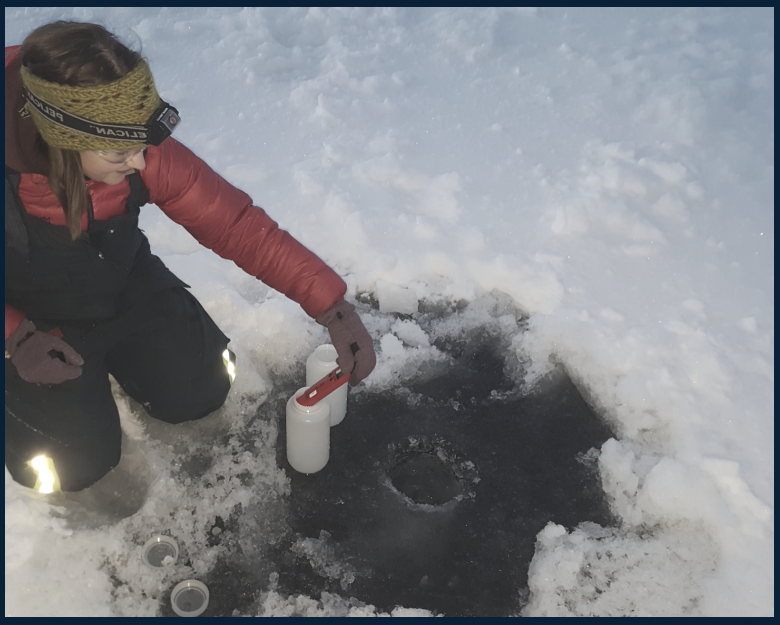
2016/2017



Alpine Ice Road Support Water Quality Sampling Summary Report

ConocoPhillips Alaska

Michael Baker INTERNATIONAL

Submitted by:
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ACRONYMS & ABBREVIATIONS

%	percent
°C	degrees Celsius
AFC	Alaska Frontier Constructors
C	conductivity
CPAI	ConocoPhillips Alaska, Inc.
DO	dissolved oxygen
ft	feet
ft/s	feet per second
µS/cm	microSiemens per centimeter
mS/cm	milliSiemens per centimeter
mg/L	milligrams per liter
ml/L	milliliters per liter
Michael Baker	Michael Baker International
NAD83	North American Datum of 1983
NE	northeast
NW	northwest
ppt	parts per thousand
S	salinity
SC	specific conductance
SU	standard units
t	temperature, in degrees Celsius
T	temperature, in degrees Kelvin
TDS	total dissolved solids
UMIAQ	UMIAQ, LLC

1.0 INTRODUCTION

The 2016/2017 Alpine Ice Road Support Water Quality Sampling Summary Report presents the results of 24 weekly water quality sampling events conducted by Michael Baker International (Michael Baker) during the 2016/2017 ice road construction season for ConocoPhillips Alaska, Inc. (CPAI). Water quality sampling requirements are set by Alaska Department of Fish and Game Fish Habitat Permits and Alaska Department of Natural Resources Temporary Water Use Authorizations.

The 2016/2017 Alpine ice road support water quality sampling locations included six locations upstream and downstream from the centerline of the Colville River ice bridge, two locations near the north side of the ASRC Minesite 2005 Cell, one location near the center of Lake M0675, one location near the center of Lake M9313, and two locations near the Northwest (NW) and Northeast (NE) corners of Nanuq Lake (referred to as Relic Site NW and Relic Site NE). The water quality sampling parameters included the following: in-situ measurements for snow depth, freeboard, ice thickness, and water depth; in-situ recordings for temperature, conductivity, dissolved oxygen (DO), salinity, and velocity; ex-situ recordings for temperature, conductivity, salinity, pH, and settleable solids; and calculations for specific conductance (SC), DO, and total dissolved solids (TDS).

Data gathered during sampling events at the Colville River was used to **1)** determine if water withdrawn from the Colville River can be used for Colville River ice bridge construction and **2)** evaluate whether the free water space beneath the ice bridge is sufficient to allow for the maintenance of fish habitat throughout the season. Data gathered during sampling events at the ASRC Minesite 2005 Cell, Lake M0675, Lake M9313, and Nanuq Lake Relic Site NW and Relic Site NE were used to evaluate if water and/or water equivalent of ice aggregate withdrawn could be used during ice road construction.

Figure 1 provides a map of the sampling locations. 3.5 contains the geographic coordinates of the sampling locations, referenced to the North American [horizontal] Datum of 1983 (NAD83).

ConocoPhillips Alaska	
Date: 05/01/2017	Project: 156665
Drawn: BTG	File: Figure 1
Checked: GCY	Scale: 1 in = 1.25 miles

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2016/2017 Alpine Ice Road Support
Water Quality Sampling Locations

FIGURE 1

(SHEET 1 of 1)

2.0 METHODS

Weekly water quality sampling began November 3, 2016 and continued through April 12, 2017. Table 1 lists the sampling event dates at each sampling location.

Table 1: Sampling Event Dates

Sampling Location	Monitoring Date																						
	Nov 2016					Dec 2016				Jan 2017				Feb 2017				Mar 2017					Apr 2017	
	3-Nov	9-Nov	16-Nov	22-Nov	30-Nov	7-Dec	14-Dec	21-Dec	28-Dec	4-Jan	11-Jan	18-Jan	25-Jan	1-Feb	8-Feb	15-Feb	22-Feb	1-Mar	8-Mar	15-Mar	22-Mar	29-Mar	5-Apr	12-Apr
Colville River Ice Bridge	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ASRC Minesite 2005 Cell							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lake M0675				✓																				
Lake M9313								✓						✓										
Nanuq Lake				✓																				

A two-person Michael Baker field crew conducted the first sampling event, prior to ice road construction. For each subsequent sampling event, with the exception of one event in December, a one-person Michael Baker field crew completed the sampling. UMIAQ, LLC (UMIAQ) provided transportation to the sampling locations and general field support. Snow machine travel was required for the first nine sampling events because tundra travel by Hägglunds was not authorized. Hägglunds were used for transportation during the remainder of the season.

Six locations at points 400, 800, and 1,200 feet upstream and downstream from the centerline of the Colville River ice bridge were marked with snow poles during the first sampling event. These locations are in the approximate thalweg of the Colville River where maximum depth has historically been observed. Sampling events at the Colville River ice bridge took place at these locations weekly. The snow poles were removed at the end of the season. All other sampling locations were established during previous ice road construction seasons and located via NAD83 coordinates provided by CPAI as sampling was required. No markers were installed at any sites other than at the Colville River.

Field sampling methods were based on United States Geological Survey (USGS 2006) and Ward and Harr (Ward and Harr 1990) methods.

Safety precautions were followed using the North Slope Water Resources 2016 Health, Safety, and Environment Plan (Michael Baker 2016a) and the 2016-2017 Winter Hydrology Projects Job Safety Analysis (Michael Baker 2016b). UMIAQ checked in with Alpine security and Michael Baker checked in with the Project Manager before and after sampling. During sampling at all locations, the field crew was equipped with arctic jacket and coveralls, head covering, safety glasses or goggles, hand and toe warmers, extra food and water, extra warm clothes, gloves, arctic mittens, snow machine helmet (when applicable), and hearing protection (when applicable). The ice augers had blade covers when not in use.

2.1 SAMPLING PARAMETERS

Water quality was investigated by drilling sample holes through the ice using either a 2-inch or 6-inch diameter auger attached to a 36 volt battery operated drill (Photo 1). In-situ and ex-situ recordings were collected using a YSI Pro1030 or YSI ProPlus water quality meter, two Hanna HI98128 handheld pH meters, a YSI ProODO meter, and a HACH FH950 electromagnetic velocity meter. The YSI Pro1030 was

used as the primary water quality meter, the YSI ProODO was used as the backup water quality meter. Table 2 lists the sampling parameters evaluated at each sampling location.

Photo 1: 6-Inch Diameter Auger with Drill

Table 2: Sampling Parameters

Sampling Location	In-Situ Measurements				In-Situ Recordings					Ex-Situ Recordings					Calculations		
	Water Depth	Ice Thickness	Snow Depth	Freeboard	Temperature	Conductivity	Dissolved Oxygen	Salinity	Velocity	Temperature	Conductivity	Salinity	pH	Settleable Solids	Specific Conductance	Dissolved Oxygen	Total Dissolved Solids
	ft	ft	ft	ft	°C	µS/cm	% saturation	ppt	ft/s	°C	µS/cm	ppt	SU	ml/L	µS/cm	mg/L	mg/L
Colville River Ice Bridge	✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	
ASRC Minesite 2005 Cell										✓			✓	✓			
Lake M0675	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓
Lake M9313	✓	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓
Nanuq Lake										✓	✓	✓			✓		✓

Notes:
1. Ice chip samples at Lake M0675 & Nanuq Lake were collected from ice auger cuttings obtained from the top two feet of ice

Instrument Calibration

The morning of each sampling event, the YSI Pro1030 and YSI ProPlus water quality meters were calibrated using 1,413 microsiemens per centimeter (µS/cm) conductivity standard, the Hanna pH meters were calibrated using two-point calibration using pH 4.01 and pH 7.00 buffer solution, and the YSI ProODO meters were checked for accuracy using tap water, as directed by the manufacturer. Approximately every four weeks, the YSI Pro1030, YSI ProPlus, and YSI ProODO water quality meters were calibrated by TTT Environmental Instruments and Supplies according to manufacturer specifications.

Instrument Accuracy

The YSI Pro1030 has a temperature accuracy of +/- 0.2 degrees Celsius (°C), a conductivity accuracy of +/- 2.0 percent (%) of the reading or 1 µS/cm, whichever is greater, and a salinity accuracy of +/- 1.0% of the reading or +/- 0.1 parts per thousand (ppt), whichever is greater. The YSI ProPlus has a temperature accuracy of +/- 0.2°C, a conductivity accuracy of +/- 0.1% of reading or 0.001 milliSiemens per centimeter (mS/cm), whichever is greater, and a salinity accuracy of +/- 1.0% of reading or +/- 0.1 ppt, whichever is greater. The YSI ProODO water quality meter has a temperature accuracy of +/- 0.2°C and a DO in percent saturation (% saturation) accuracy of 0-200%, +/- 1% reading or +/- 1%, whichever is greater. The Hanna HI98128 handheld pH meter has a temperature accuracy of +/- 0.5°C a pH accuracy of +/- 0.05. The HACH FH950 electromagnetic velocity meter has a zero stability of +/- 0.05 feet per second (ft/s) and an accuracy of +/- 2.0 % of the reading plus the meter's zero stability.

Photo 2: Data Cable Delineation

2.2 IN-SITU MEASUREMENTS

Snow depth and freeboard were measured with a survey pocket rod, ice thickness was measured with an ice pole marked in one-foot increments, and water depth was measured using the YSI Pro1030 or YSI ProPlus meter data cables marked in one-foot increments (Photo 2). Freeboard was measured from the top of ice to the water surface and water depth was measured from the water surface to the bottom of the river or lake.

2.3 IN-SITU RECORDINGS

Temperature, conductivity, and salinity were recorded using the YSI Pro1030 or the YSI ProPlus and DO was measured using the YSI ProODO meter. Temperature, salinity, conductivity, and DO were recorded from the river or lake bottom to below the ice at a maximum of two-foot intervals. The YSI Pro1030 or YSI ProPlus and YSI ProODO meter data cables were taped together to ensure measurements were recorded simultaneously and at the same water depth.

Velocities were recorded at the Colville River 1,200 feet downstream location at the same water depths where water quality parameters were recorded.

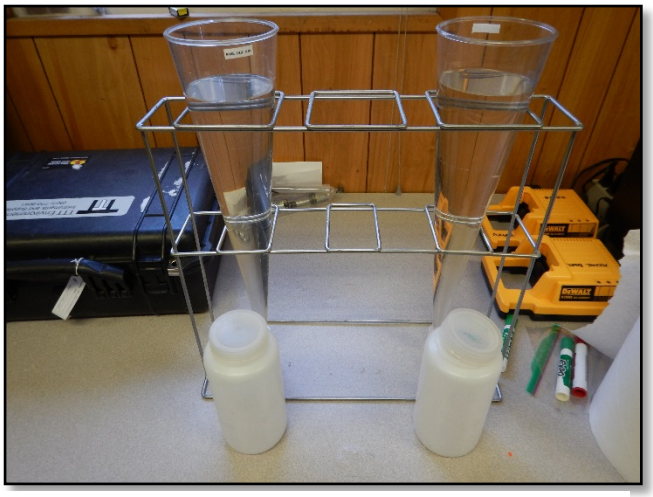

Photo 3: Volumetric Test for Settleable Solids

2.4 EX-SITU RECORDINGS

During the first four sampling events at the ASRC Minesite 2005 Cell, two one-liter bottles of water samples were collected from holes drilled in the ice on the north side of the Minesite. Once the pump house located near the north side of the Minesite operated by Alaska Frontier Constructors (AFC) was installed and operating, water samples were collected from the return hose and/or truck fill

hose. At the time of sample collection, any visual observation of oily sheen was documented. Temperature and pH were recorded within 15 minutes of sample collection and the average value of each recording was reported. Upon returning to CD1, a volumetric test for settleable solids, following the methods outlined in the Nebraska Water Environment Association lab manual, *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids* (Rice, Baird, Eaton, & Clesceri 2012), was performed on both water samples (Photo 3).

During the sampling events at Lake M0675 and at Nanuq Lake Relic Site NW and Relic Site NE, two one-liter bottles of ice aggregate were collected from ice auger cuttings obtained from the top two feet of ice and transported back to CD1. Once thawed, temperature, conductivity, and salinity were recorded using the YSI Pro1030 meter.

2.5 CALCULATIONS

Specific conductance was calculated using recorded water temperature and conductivity using the below equation. Specific conductance (referenced to 25° C) was obtained using a conversion coefficient of 0.0196 based on empirical data.

$$SC = \frac{C}{(1 + (0.0196 * (t - 25)))}$$

Where,

SC = specific conductance in μS/cm, referenced to 25°C
C = conductivity in μS/cm
t = temperature in °C

Dissolved oxygen was calculated using recorded percent saturated dissolved oxygen, temperature, and salinity using the following equation (Benson & Krause 1984):

$$DO_{mg/L} = \frac{DO_{\%\,saturation}}{100} * e^{-139.34411+\frac{1.575701*10^5}{T}-\frac{6.642308*10^7}{T^2}+\frac{1.243800*10^{10}}{T^3}-\frac{8.621949*10^{11}}{T^4}} * e^{-S*\left(0.017674-\frac{10.754}{T}+\frac{2140.7}{T^2}\right)}$$

Where,

$DO_{mg/L}$ = dissolved oxygen in milligrams per liter (mg/L)
$DO_{\%saturation}$ = dissolved oxygen in % saturation
T = temperature in Kelvins ($t_{°C}$ + 273.15)
S = salinity in ppt

Total dissolved solids were calculated using calculated specific conductance using the following equation (Rice, Baird, Eaton, & Clesceri 2012):

$$TDS = SC * 0.65$$

Where,

TDS = total dissolved solids in mg/L
SC = specific conductance in μS/cm, referenced to 25°C

3.0 RESULTS

Each sampling event was summarized in a Project Trip Report transmitted electronically to CPAI within 24 hours of data collection and are included in Attachment B. Colville River ice bridge crossing profiles, provided by ICE Design and Consult, are included in B.4.

3.1 COLVILLE RIVER ICE BRIDGE

In-situ DO saturation generally decreased over time, ranging from an average of 98.3% on November 3, 2016 to an average of 44.5% on April 12, 2017. Maximum DO saturation was 100.3% on November 3, 2016 at 800 feet (ft) downstream near the bottom of the water column. Minimum DO saturation was 35.3% on April 12, 2017 at 1,200 ft downstream near the bottom of the water column. Chart 1 presents the maximum, minimum, and average DO saturation sample results at all locations and depths during the ice bridge monitoring season.

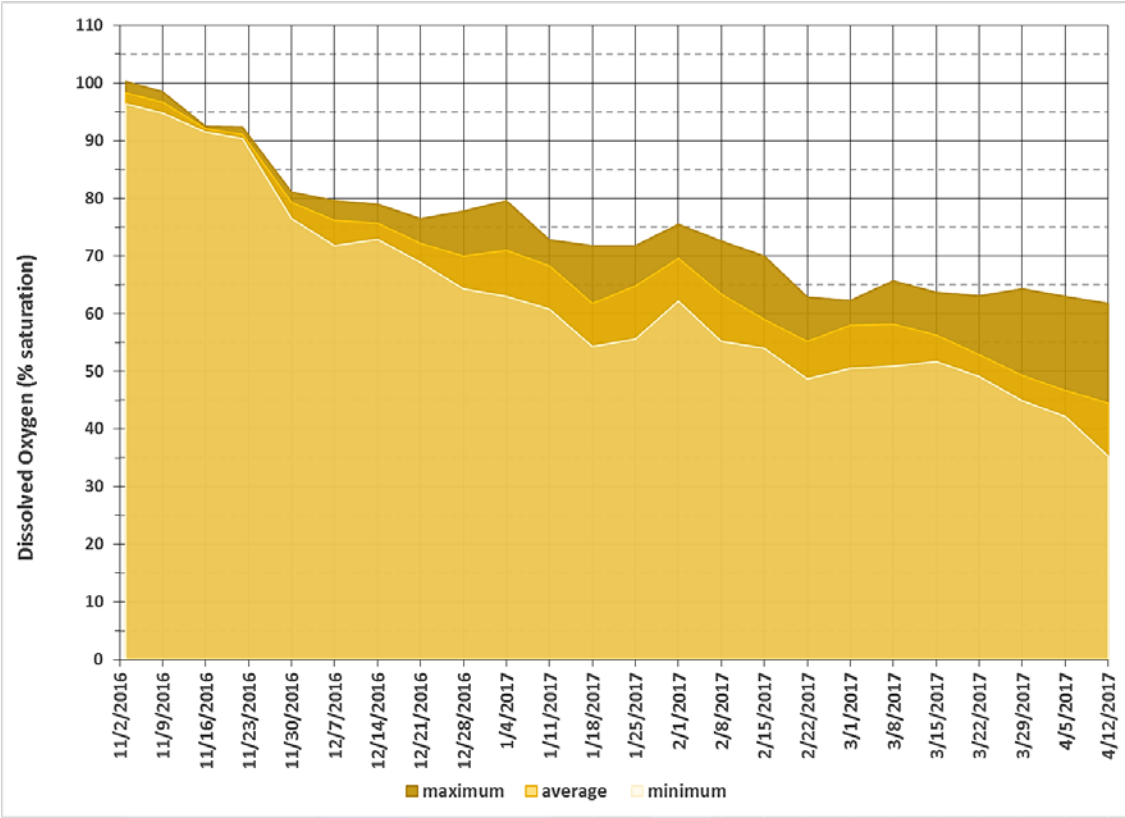

Chart 1: Weekly DO Sample Results

In-situ salinity generally increased over time, ranging from an average of 0.1 ppt on November 3, 2016 to an average of 18.1 ppt on April 12, 2017. Minimum salinity was 0.1 ppt on November 3, 2016 at all monitoring locations and was consistent throughout the water column at all sites except at 800 ft and 1,200 ft downstream of the ice bridge. At these locations, salinity levels were higher at the bottom of the water column. Maximum salinity was 23.7 ppt on April 5, 2017 at 800 ft downstream near the bottom of the water column. Chart 2 presents the maximum, minimum, and average salinity sample results at all locations and depths during the ice bridge monitoring season.

In-situ SC generally increased over time, ranging from an average of 307 µS/cm on November 3, 2016 to an average of 30,735 µS/cm on April 12, 2017. Maximum SC was 39,845 µS/cm on February 15, 2017

at 800 ft downstream near the bottom of the water column. Minimum SC was 284 µS/cm on November 3, 2016 at 800 ft downstream near the bottom of the water column. Chart 3 presents the maximum, minimum, and average SC sample results at all locations and depths during the ice bridge monitoring season. Saltwater intrusion from Harrison Bay, evidenced by higher levels of measured salinity and conductivity, was first detected at the ice bridge on November 30, 2016.

Ice thickness generally increased over time, ranging from an average of 0.9 ft on November 3, 2016 to an average of 4.9 ft on April 12, 2017. Minimum ice thickness was 0.9 ft on November 3, 2016 at 800 ft upstream, maximum ice thickness was 5.1 ft on April 12, 2017 at 400 ft downstream. Chart 4 presents the maximum, minimum, and average ice thickness results at all locations and depths during the ice bridge monitoring season.

Snow depth generally increased over time, ranging from an average of 0.0 ft on November 3, 2016 to an average of 1.0 ft on April 12, 2017. Maximum snow depth was 2.0 ft on March 1 and March 29, 2017, both at 1,200 ft downstream. Minimum snow depth was 0.0 ft on November 3, 2016 at all locations. See Chart 5 for the all sites maximum, minimum, and average snow depth results over the ice bridge monitoring season.

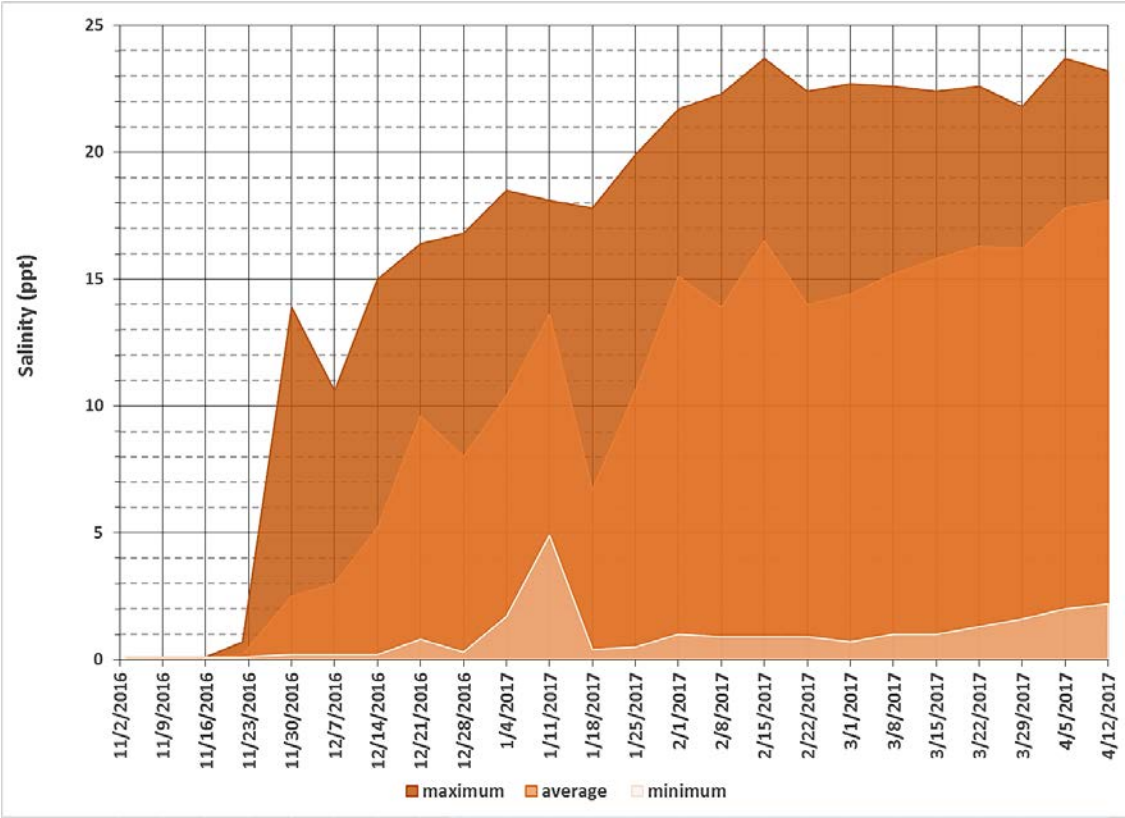

Chart 2: Weekly Salinity Sample Results

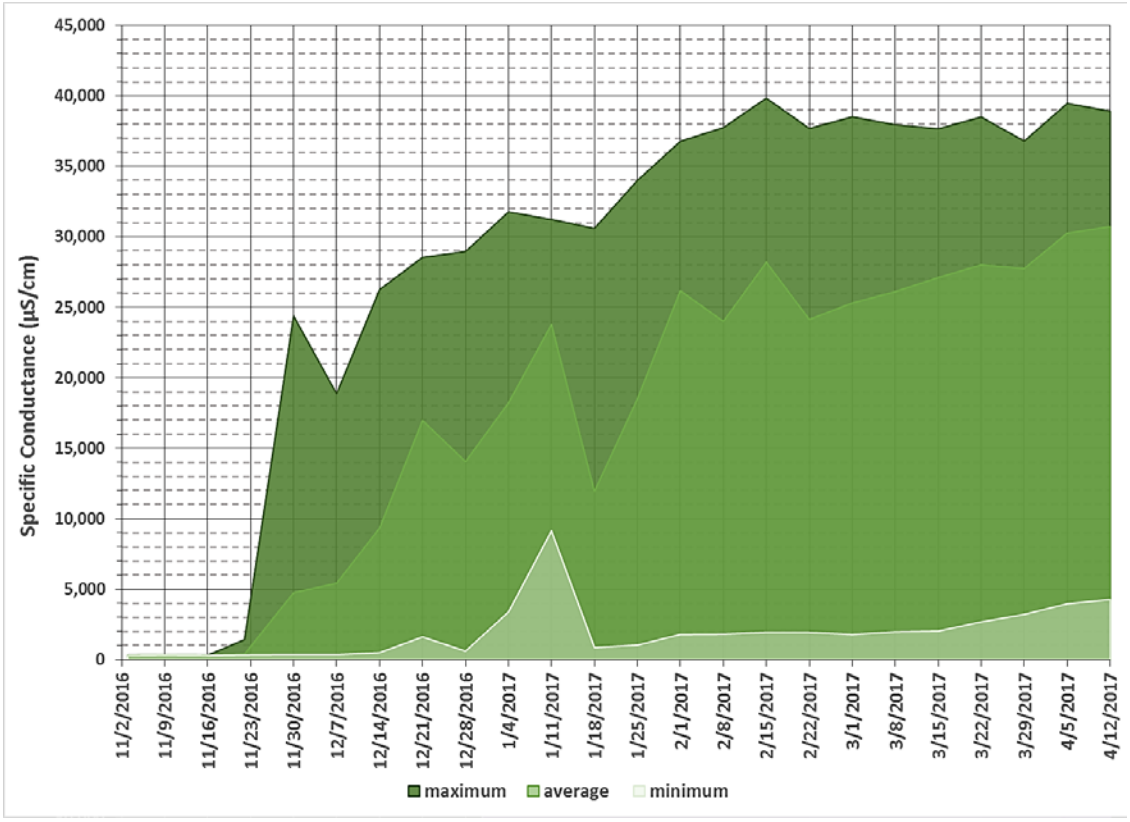

Chart 3: Weekly SC Sample Results

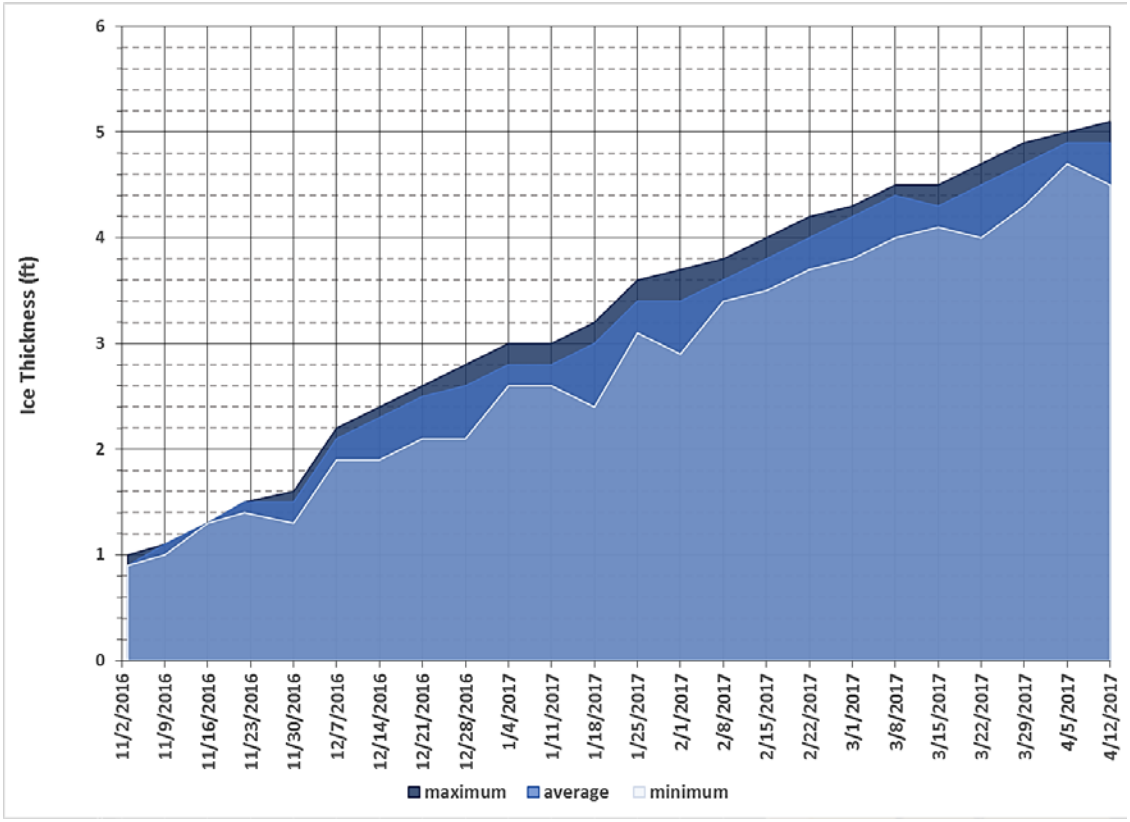

Chart 4: Weekly Ice Thickness Sample Results

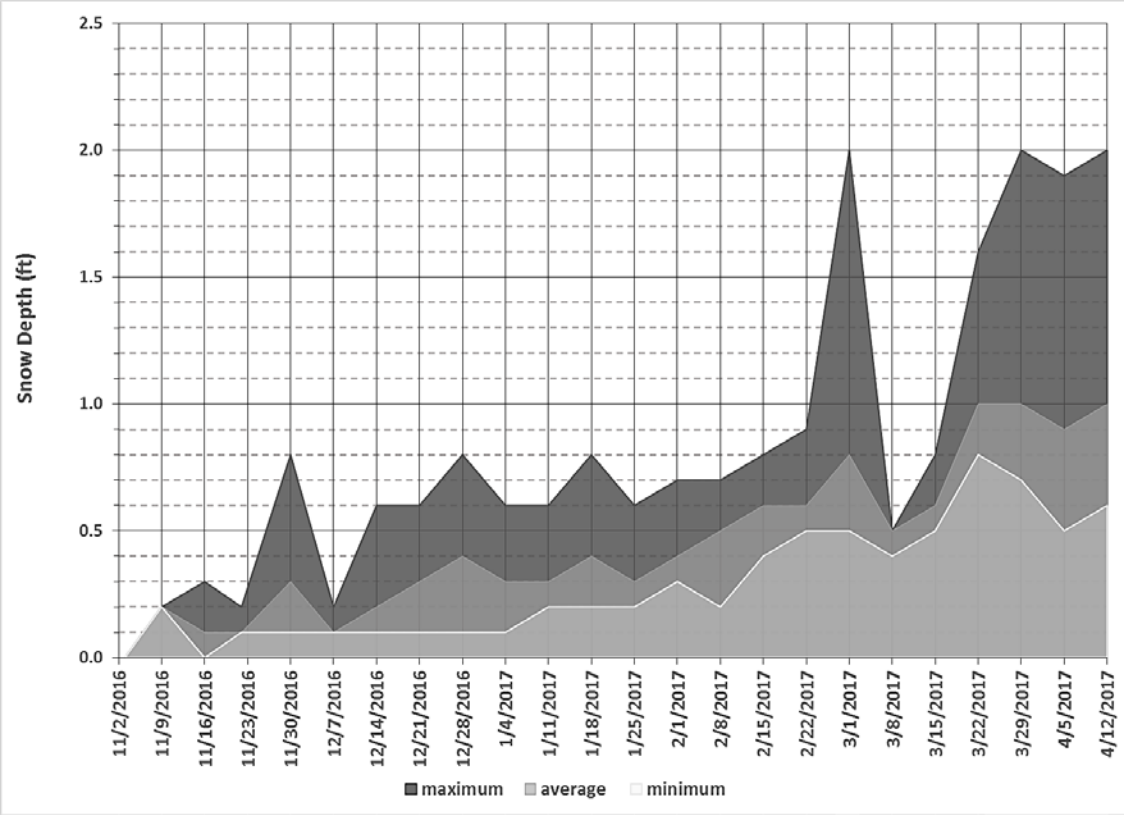

Chart 5: Weekly Snow Depth Sample Results

Velocities measured at 1,200 feet downstream from the ice bridge centerline were generally low. All measurements except for one returned velocities less than 0.5 feet per second (ft/s). Flow direction often alternated throughout the water column between upstream and downstream. Measured velocity was often less than the accuracy of the meter indicating little to no flow was present. This occurred most consistently throughout the second half of the season. Table 3 presents the weekly maximum, minimum, and average velocity results at 1,200 ft downstream during the ice bridge monitoring season.

Table 3: Weekly Velocity Results at 1,200 Feet Downstream

Sample Date	Maximum Velocity			Average Velocity			Minimum Velocity		
	Velocity (ft/s)	Flow Direction (DS/US)	Accuracy (ft/s)	Velocity (ft/s)	Flow Direction (DS/US)	Accuracy (ft/s)	Velocity (ft/s)	Flow Direction (DS/US)	Accuracy (ft/s)
11/3/2016	0.25	DS	0.06	0.17	DS	0.05	0.10	DS	0.05
11/9/2016	0.15	DS	0.05	0.12	DS	0.05	0.09	DS	0.05
11/16/2016	0.14	DS	0.05	0.11	DS	0.05	0.07	DS	0.05
11/22/2016	NOT RECORDED								
11/30/2016	0.20	US	0.05	0.04*	US	0.05	0.00*	N/A	0.05
12/7/2016	0.20	DS	0.05	0.10	DS	0.05	0.03*	DS	0.05
12/14/2016	0.21	DS	0.05	0.05*	DS	0.05	0.01*	DS	0.05
12/21/2016	0.28	DS	0.06	0.05*	DS	0.05	0.01*	US	0.05
12/28/2016	NOT RECORDED								
1/4/2017	0.23	US	0.05	0.13	US	0.05	0.03*	US	0.05
1/11/2017	0.18	DS	0.05	0.13	DS	0.05	0.05*	DS	0.05
1/18/2017	0.59	US	0.06	0.14	US	0.05	0.00*	N/A	0.05
1/25/2017	0.22	DS	0.05	0.06	DS	0.05	0.00*	N/A	0.05
2/1/2017	0.21	US	0.05	0.07	US	0.05	0.01*	US	0.05
2/8/2017	0.06*	DS	0.05	0.01*	DS	0.05	0.00*	N/A	0.05
2/15/2017	0.04*	DS	0.05	0.02*	DS	0.05	0.01*	US&DS	0.05
2/22/2017	0.05	DS	0.05	0.01*	DS	0.05	0.00*	N/A	0.05
3/1/2017	0.03*	DS	0.05	0.01*	DS	0.05	0.00*	N/A	0.05
3/8/2017	0.01*	DS	0.05	0.01*	DS	0.05	0.00*	N/A	0.05
3/15/2017	0.02*	DS	0.05	0.01*	DS	0.05	0.00*	N/A	0.05
3/22/2017	0.03*	DS	0.05	0.01*	DS	0.05	0.00*	N/A	0.05
3/29/2017	0.06	DS	0.05	0.02*	DS	0.05	0.00*	N/A	0.05
4/5/2017	0.01*	US&DS	0.05	0.00*	N/A	0.05	0.00*	N/A	0.05
4/12/2017	0.04*	DS	0.05	0.01*	DS	0.05	0.00*	N/A	0.05

Notes:

1. DS = downstream, US = upstream
2. Velocities marked with a "*" indicate the measurement was less than or equal to the accuracy of the meter

3.2 ASRC MINESITE 2005 CELL

Measured pH ranged between 6.7 and 7.5 throughout the monitoring season. No oily sheen was observed and no settleable solids were measured during any of the sampling events.

3.3 LAKE M0675

In-situ SC ranged from a minimum of 9,241 µS/cm to a maximum of 9,523 µS/cm; average in-situ SC was 9,421 µS/cm. In-situ DO saturation ranged from a minimum of 92.5% to a maximum of 98.0%; average in-situ DO saturation was 94.8%. In-situ TDS ranged from a minimum of 6,007 mg/L to a maximum of 6,190 mg/L; average in-situ TDS was 6,124 mg/L.

Thawed ice aggregate ex-situ SC ranged from a minimum of 1,881 µS/cm to a maximum of 1,892 µS/cm; average ex-situ SC was 1,887 µS/cm. Thawed ice aggregate ex-situ TDS ranged from a minimum of 1,223 mg/L to a maximum of 1,230 mg/L; average ex-situ TDS was 1,2276 mg/L.

3.4 LAKE M9313

On December 21, 2016, in-situ SC ranged from a minimum of 859 µS/cm to a maximum of 882 µS/cm; average in-situ SC was 870 µS/cm. In-situ DO saturation ranged from a minimum of 67.5% to a maximum of 87.9%; average in-situ DO saturation was 79.7%. TDS was not calculated or reported during this sampling event.

On February 1, 2017, in-situ SC ranged from a minimum of 1,033 µS/cm to a maximum of 1,055 µS/cm; average in-situ SC was 1,041 µS/cm. In-situ DO saturation ranged from a minimum of 58.7% to a maximum of 74.0%; average in-situ DO saturation was 68.9%. In-situ TDS ranged from a minimum of 671 mg/L to a maximum of 685 mg/L; average in-situ TDS was 677 mg/L.

3.5 NANUQ LAKE

At Relic Site NW, thawed ice aggregate ex-situ SC ranged from a minimum of 16.9 µS/cm to a maximum of 25.3 µS/cm; average ex-situ SC was 21.1 µS/cm. Thawed ice aggregate ex-situ TDS ranged from a minimum of 11.0 mg/L to a maximum of 16.5 mg/L; average ex-situ TDS was 13.7 mg/L.

At Relic Site NE, thawed ice aggregate ex-situ SC ranged from a minimum of 9.2 µS/cm to a maximum of 10.6 µS/cm; average ex-situ SC was 9.9 µS/cm. Thawed ice aggregate ex-situ TDS ranged from a minimum of 6.0 mg/L to a maximum of 6.9 mg/L; average ex-situ TDS was 6.4 mg/L.

4.0 REFERENCES

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Attachment A Sampling Location Coordinates

Sampling Location	Latitude	Longitude
Colville 1200U	N70.2350	W150.8341
Colville 800U	N70.2361	W150.8352
Colville 400U	N70.2371	W150.8361
Colville 400D	N70.2392	W150.8381
Colville 800D	N70.2402	W150.8391
Colville 1200D	N70.2413	W150.8401
ASRC Minesite 2005 Cell	N70.2361	W150.8049
ASRC Minesite 2005 Cell Pump House	N70.2363	W150.8058
Lake M0675	N70.4032	W151.0188
Lake M9313	N70.4221	W150.9010
Nanuq Lake Relic Site NW	N70.3274	W151.0413
Nanuq Lake Relic Site NE	N70.3267	W151.0118

Attachment B Project Trip Reports

B.1 Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 11/3/2016
MICHAEL BAKER FIELD PERSONNEL: D. Roe, B. Woelber	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: G. Diamond	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 22° F, 27 mph ENE

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Thursday, November 3 at 12:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. Prior to departure, field personnel conducted a health and safety meeting. At 6:45 PM on November 3, LCMF and Michael Baker personnel traveled to the Colville River on snow machines and began sampling at 8:00 PM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Professional 1030 meter was calibrated for conductivity and the DO meter was checked for accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC was less than 500 microsiemens per centimeter (µS/cm), ranging from a minimum of 284 µS/cm at 800 feet downstream to a maximum of 315 µS/cm at 400 feet upstream.

The DO saturation ranged between 96.4percent (%) and 100.3%, with an average of 98.3%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from a minimum of 0.10 feet per second (ft/s) at a depth of 10 feet to a maximum of 0.25 ft/s in the downstream direction at a depth of 6 feet; average velocity was 0.17 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 0.9 feet to 1.0 feet; average ice thickness was 0.9 feet. Snow depth was 0.0 feet at all locations.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, November 9, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

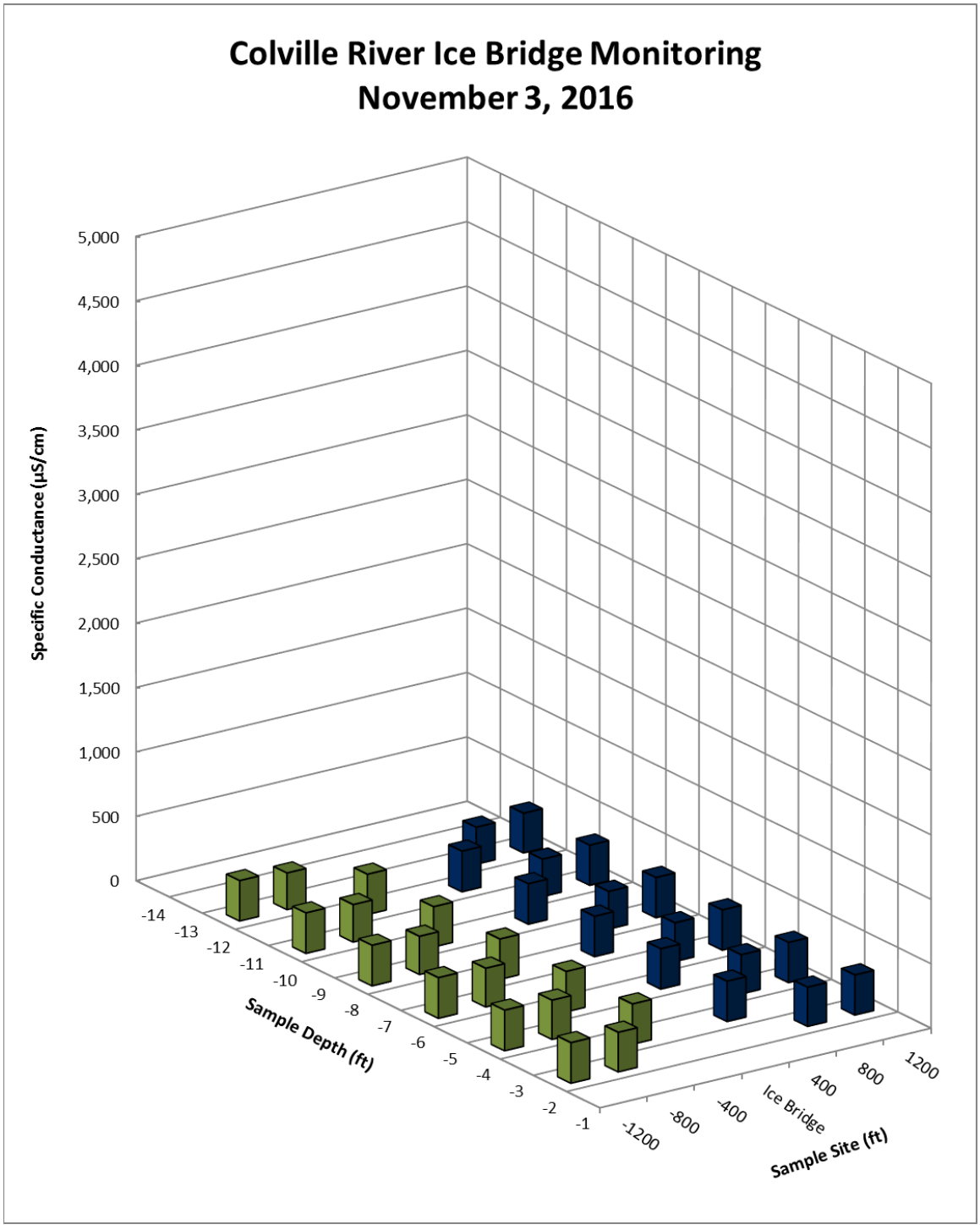
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **9:25 PM**	12.3	1.0	0.0	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	160	313	14.38	98.4	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	160	313	14.36	98.3	0.1	-
					6	-	-	-	-	-	-	-
					7	0.0	160	313	14.36	98.3	0.1	-
					8	-	-	-	-	-	-	-
					9	0.0	160	314	14.35	98.2	0.1	-
					10	-	-	-	-	-	-	-
					11	0.0	161	315	14.30	97.9	0.1	-
					12	-	-	-	-	-	-	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:10 PM**	13.4	0.9	0.0	0.1	1	-	-	-	-	-	-	-
					2	0.0	155	304	14.35	98.2	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	155	304	14.33	98.1	0.1	-
					5	-	-	-	-	-	-	-
					6	0.0	153	300	14.30	97.9	0.1	-
					7	-	-	-	-	-	-	-
					8	0.0	149	292	14.29	97.8	0.1	-
					9	-	-	-	-	-	-	-
					10	0.0	148	291	14.26	97.6	0.1	-
					11	-	-	-	-	-	-	-
					12	0.0	146	287	14.23	97.4	0.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **10:42 PM**	13.6	0.9	0.0	0.1	1	-	-	-	-	-	-	-
					2	0.0	159	311	14.32	98.0	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	159	312	14.29	97.8	0.1	-
					5	-	-	-	-	-	-	-
					6	0.0	159	312	14.27	97.7	0.1	-
					7	-	-	-	-	-	-	-
					8	0.1	160	312	14.21	97.5	0.1	-
					9	-	-	-	-	-	-	-
					10	0.2	160	312	14.11	97.1	0.1	-
					11	-	-	-	-	-	-	-
					12	0.6	161	308	13.85	96.4	0.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **9:45 PM**	12.4	1.0	0.0	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	159	313	14.42	98.7	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	160	313	14.41	98.6	0.1	-
					6	-	-	-	-	-	-	-
					7	0.0	160	313	14.38	98.4	0.1	-
					8	-	-	-	-	-	-	-
					9	0.1	160	312	14.32	98.3	0.1	-
					10	-	-	-	-	-	-	-
					11	0.1	160	312	14.31	98.2	0.1	-
					12	-	-	-	-	-	-	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:10 PM**	13.1	0.9	0.0	0.1	1	-	-	-	-	-	-	-
					2	0.0	156	307	14.48	99.1	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	155	304	14.46	99.0	0.1	-
					5	-	-	-	-	-	-	-
					6	0.0	153	300	14.45	98.9	0.1	-
					7	-	-	-	-	-	-	-
					8	0.0	151	296	14.44	98.8	0.1	-
					9	-	-	-	-	-	-	-
					10	0.0	148	291	14.42	98.7	0.1	-
					11	-	-	-	-	-	-	-
					12	0.0	145	284	14.65	100.3	0.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **10:20 PM**	12.9	0.9	0.0	0.1	1	-	-	-	-	-	-	-
					2	0.0	161	315	14.49	99.2	0.1	0.12
					3	-	-	-	-	-	-	-
					4	0.0	161	315	14.45	98.9	0.1	0.14
					5	-	-	-	-	-	-	-
					6	0.0	161	315	14.44	98.8	0.1	0.25
					7	-	-	-	-	-	-	-
					8	0.0	161	315	14.42	98.7	0.1	0.21
					9	-	-	-	-	-	-	-
					10	0.1	161	314	14.37	98.6	0.1	0.10
					11	-	-	-	-	-	-	-
					12	0.1	160	313	14.39	98.8	0.1	0.18
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 11/9/2016
MICHAEL BAKER FIELD PERSONNEL: B. Woelber	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: T. Bass	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 20°F, 0-5 knots

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, November 8 at 12:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on November 9, Mr. Woelber attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel traveled to the Colville River on snow machines and began sampling at 12:05 PM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Professional 1030 meter was calibrated for conductivity and the DO meter was checked for accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC was less than 500 microsiemens per centimeter (µS/cm) ranging from a minimum of 319 µS/cm at 800 and 1,200 feet upstream to a maximum of 324 µS/cm at 400 feet downstream.

The DO saturation ranged between 94.8 percent (%) and 98.5%, with an average of 96.7%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from a minimum of 0.09 feet per second (ft/s) in the downstream direction at a depth of 3 feet to a maximum of 0.15 ft/s in the downstream direction at a depth of 5 feet; average velocity was 0.12 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 1.0 feet to 1.1 feet; average ice thickness was 1.1 feet. Snow depth was 0.2 feet at all sampling locations.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, November 16, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

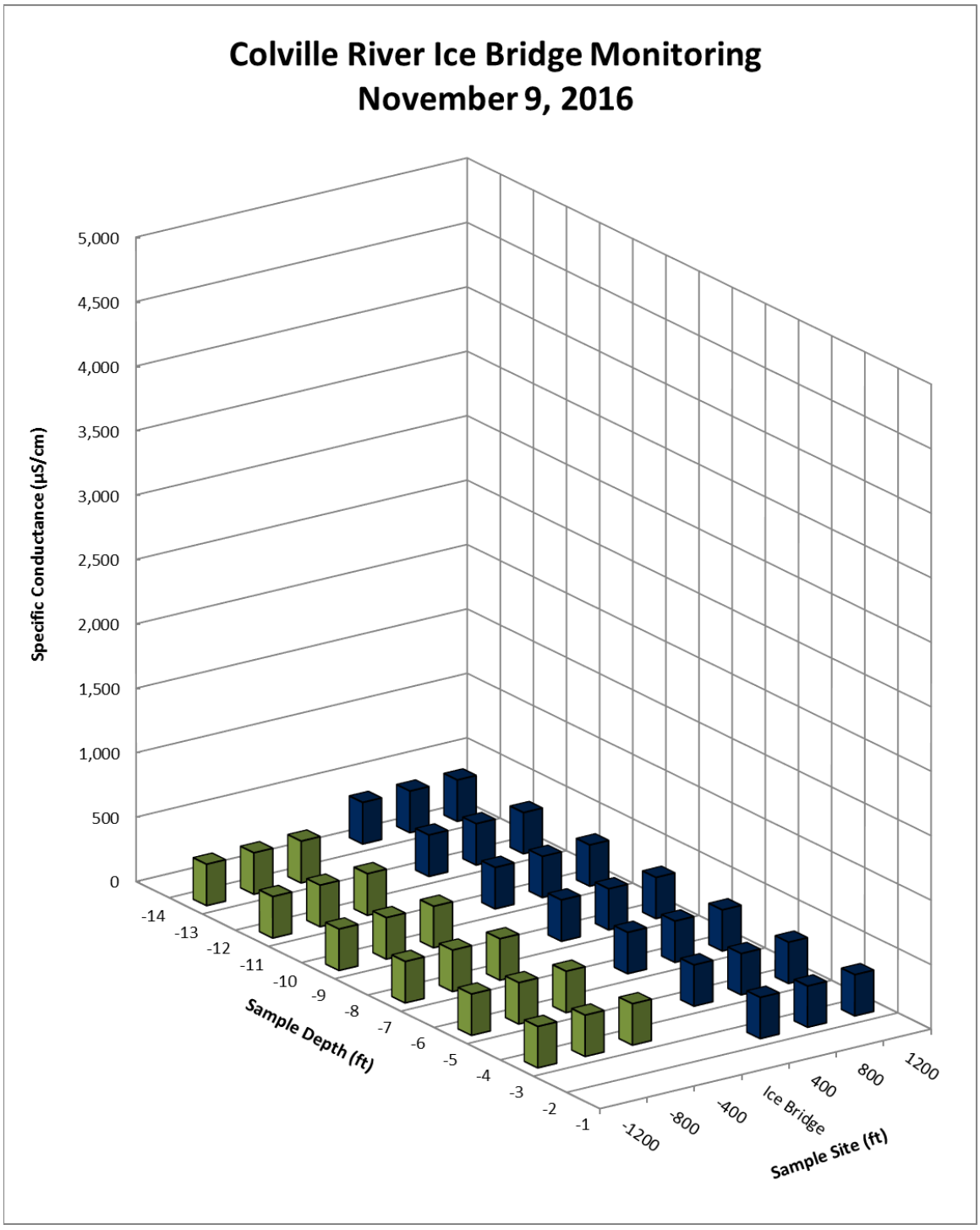
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **1:00 PM**	14.5	1.1	0.2	0.1	1	-	-	-	-	-	-	-
					2	0.0	163	320	14.11	96.6	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	163	320	14.10	96.5	0.1	-
					5	-	-	-	-	-	-	-
					6	0.0	164	321	14.08	96.4	0.1	-
					7	-	-	-	-	-	-	-
					8	0.0	164	321	14.06	96.2	0.1	-
					9	-	-	-	-	-	-	-
					10	0.0	164	321	14.11	96.6	0.1	-
					11	-	-	-	-	-	-	-
					12	0.1	165	322	14.10	96.8	0.1	-
					13	-	-	-	-	-	-	-
					14	0.1	165	323	14.09	96.7	0.1	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **12:45 PM**	14.7	1.0	0.2	0.1	1	-	-	-	-	-	-	-
					2	0.0	163	320	14.07	96.3	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	163	320	14.06	96.2	0.1	-
					5	-	-	-	-	-	-	-
					6	0.0	163	320	14.04	96.1	0.1	-
					7	-	-	-	-	-	-	-
					8	0.1	163	319	14.02	96.2	0.1	-
					9	-	-	-	-	-	-	-
					10	0.1	163	319	14.03	96.3	0.1	-
					11	-	-	-	-	-	-	-
					12	0.1	165	321	14.06	96.5	0.1	-
					13	-	-	-	-	-	-	-
					14	0.2	166	323	14.03	96.6	0.1	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **12:05 PM**	14.9	1.1	0.2	0.1	1	-	-	-	-	-	-	-
					2	0.0	163	320	13.97	95.6	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	163	320	13.94	95.4	0.1	-
					5	-	-	-	-	-	-	-
					6	0.1	163	319	13.87	95.2	0.1	-
					7	-	-	-	-	-	-	-
					8	0.1	163	319	13.86	95.1	0.1	-
					9	-	-	-	-	-	-	-
					10	0.1	164	320	13.86	95.1	0.1	-
					11	-	-	-	-	-	-	-
					12	0.2	164	319	13.82	95.1	0.1	-
					13	-	-	-	-	-	-	-
					14	0.3	166	321	13.73	94.8	0.1	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **1:15 PM**	13.7	1.0	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	164	321	14.25	97.5	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	164	321	14.23	97.4	0.1	-
					6	-	-	-	-	-	-	-
					7	0.0	164	322	14.19	97.1	0.1	-
					8	-	-	-	-	-	-	-
					9	0.0	164	322	14.20	97.2	0.1	-
					10	-	-	-	-	-	-	-
					11	0.0	165	323	14.27	97.7	0.1	-
					12	-	-	-	-	-	-	-
					13	0.1	166	324	14.25	97.8	0.1	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **1:30 PM**	14.3	1.0	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	164	321	14.23	97.4	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	164	321	14.20	97.2	0.1	-
					6	-	-	-	-	-	-	-
					7	0.0	164	322	14.14	96.8	0.1	-
					8	-	-	-	-	-	-	-
					9	0.0	164	322	14.19	97.1	0.1	-
					10	-	-	-	-	-	-	-
					11	0.0	164	322	14.32	98.0	0.1	-
					12	-	-	-	-	-	-	-
					13	0.1	165	322	14.31	98.2	0.1	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **1:45 PM**	14.4	1.1	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	164	321	14.27	97.7	0.1	0.09
					4	-	-	-	-	-	-	-
					5	0.0	164	321	14.20	97.2	0.1	0.15
					6	-	-	-	-	-	-	-
					7	0.0	164	322	14.14	96.8	0.1	0.13
					8	-	-	-	-	-	-	-
					9	0.0	164	322	14.16	96.9	0.1	0.13
					10	-	-	-	-	-	-	-
					11	0.0	164	322	14.32	98.0	0.1	0.14
					12	-	-	-	-	-	-	-
					13	0.1	164	321	14.35	98.5	0.1	0.10
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 11/16/2016
MICHAEL BAKER FIELD PERSONNEL: B. Brooks	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -7°F to 20°F, wind 5 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, November 15 at 5:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, November 16, Mr. Brooks attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River on snow machines and began sampling at 11:15 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the DO meter was checked for accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC was less than 500 microsiemens per centimeter (µS/cm), ranging from a minimum of 292 µS/cm at 800 feet upstream to a maximum of 319 µS/cm at 1,200 feet downstream.

The DO saturation ranged between 91.5 percent (%) and 92.5%, with an average of 92.1%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from a minimum of 0.07 feet per second (ft/s) in the downstream direction at a depth of 5 feet to a maximum of 0.14 ft/s in the downstream direction at a depth of 7 feet; average velocity was 0.11 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness was measured to be 1.3 feet at all sampling locations. Snow depth ranged from 0.0 feet to 0.3 feet; average snow depth was 0.1 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, November 22, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

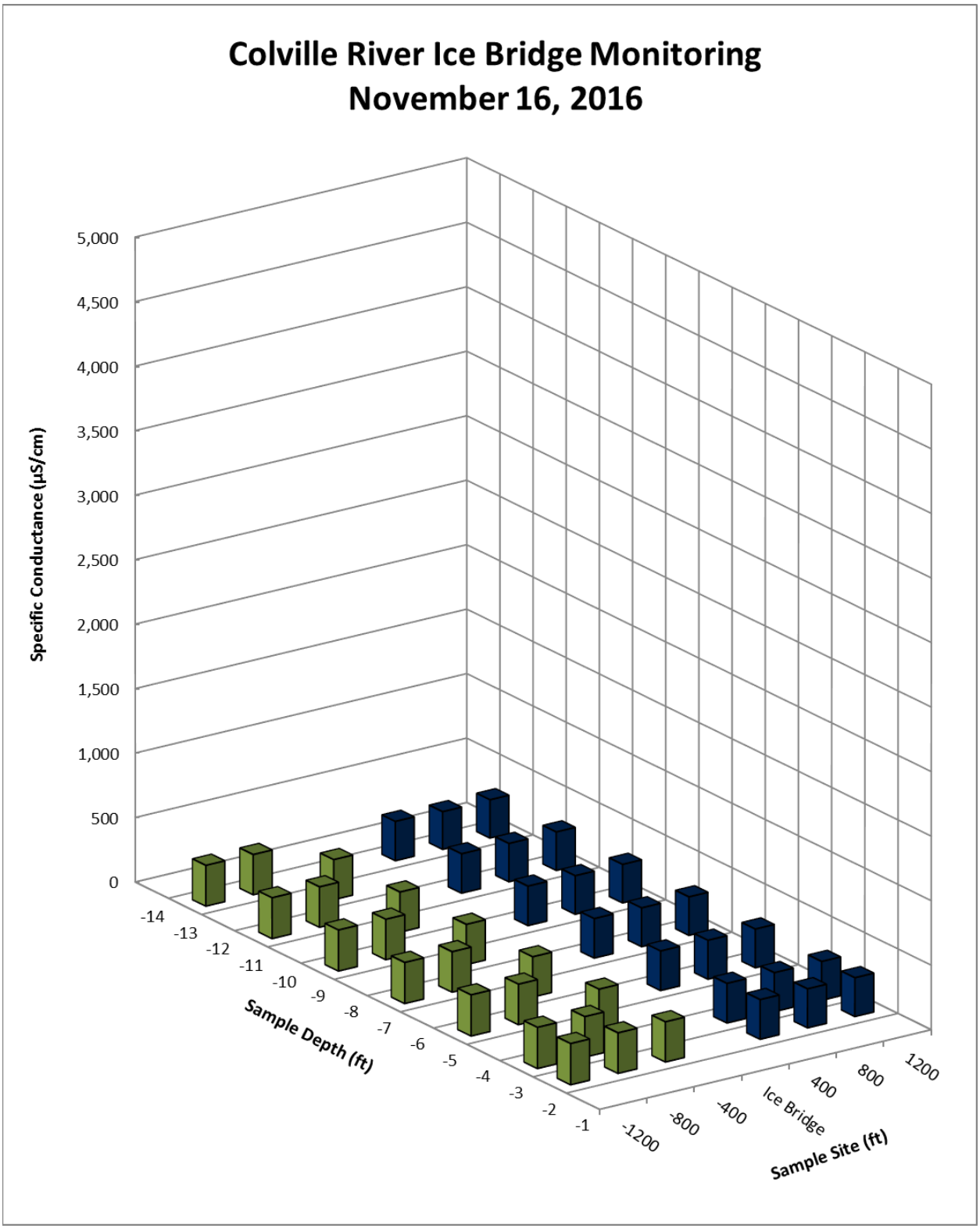
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **12:18 PM**	14.0	1.3	0.3	0.0	1	-	-	-	-	-	-	-
					2	0.0	157	307	13.49	92.3	0.1	-
					3	0.0	157	307	13.49	92.3	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	156	307	13.47	92.2	0.1	-
					6	-	-	-	-	-	-	-
					7	0.0	156	306	13.47	92.2	0.1	-
					8	-	-	-	-	-	-	-
					9	0.0	156	306	13.47	92.2	0.1	-
					10	-	-	-	-	-	-	-
					11	0.0	156	305	13.49	92.3	0.1	-
					12	-	-	-	-	-	-	-
					13	0.0	156	305	13.49	92.3	0.1	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **11:35 AM**	13.9	1.3	0.0	0.1	1	-	-	-	-	-	-	-
					2	0.0	154	303	13.47	92.2	0.1	-
					3	0.0	154	302	13.47	92.2	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	154	302	13.46	92.1	0.1	-
					6	-	-	-	-	-	-	-
					7	0.0	154	301	13.46	92.1	0.1	-
					8	-	-	-	-	-	-	-
					9	0.0	152	299	13.46	92.1	0.1	-
					10	-	-	-	-	-	-	-
					11	0.0	152	297	13.46	92.1	0.1	-
					12	-	-	-	-	-	-	-
					13	0.0	149	292	13.47	92.2	0.1	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **11:15 AM**	14.2	1.3	0.1	0.1	1	-	-	-	-	-	-	-
					2	0.0	153	301	13.41	91.8	0.1	-
					3	0.0	153	301	13.40	91.7	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	153	300	13.40	91.7	0.1	-
					6	-	-	-	-	-	-	-
					7	0.1	153	298	13.35	91.6	0.1	-
					8	-	-	-	-	-	-	-
					9	0.1	153	298	13.35	91.6	0.1	-
					10	-	-	-	-	-	-	-
					11	0.1	153	298	13.33	91.5	0.1	-
					12	-	-	-	-	-	-	-
					13	0.3	153	297	13.28	91.7	0.1	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **12:30 PM**	12.9	1.3	0.0	0.1	1	-	-	-	-	-	-	-
					2	0.0	159	312	13.50	92.4	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	160	313	13.49	92.3	0.1	-
					5	-	-	-	-	-	-	-
					6	0.0	159	312	13.47	92.2	0.1	-
					7	-	-	-	-	-	-	-
					8	0.0	159	312	13.47	92.2	0.1	-
					9	-	-	-	-	-	-	-
					10	0.0	159	311	13.47	92.2	0.1	-
					11	-	-	-	-	-	-	-
					12	0.0	158	310	13.50	92.4	0.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **12:45 PM**	13.6	1.3	0.0	0.2	1	-	-	-	-	-	-	-
					2	0.0	160	314	13.50	92.4	0.1	-
					3	0.0	160	314	13.49	92.3	0.1	-
					4	-	-	-	-	-	-	-
					5	0.0	160	314	13.47	92.2	0.1	-
					6	-	-	-	-	-	-	-
					7	0.0	160	314	13.47	92.2	0.1	-
					8	-	-	-	-	-	-	-
					9	0.0	160	314	13.46	92.1	0.1	-
					10	-	-	-	-	-	-	-
					11	0.0	160	313	13.46	92.1	0.1	-
					12	-	-	-	-	-	-	-
					13	0.1	160	312	13.43	92.2	0.1	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **1:05 PM**	13.6	1.3	0.3	0.0	1	-	-	-	-	-	-	-
					2	0.0	163	319	13.51	92.5	0.1	-
					3	0.0	163	319	13.51	92.5	0.1	0.10
					4	-	-	-	-	-	-	-
					5	0.0	163	319	13.50	92.4	0.1	0.07
					6	-	-	-	-	-	-	-
					7	0.0	162	318	13.49	92.3	0.1	0.14
					8	-	-	-	-	-	-	-
					9	0.0	162	318	13.49	92.3	0.1	0.10
					10	-	-	-	-	-	-	-
					11	0.1	162	317	13.45	92.3	0.1	0.12
					12	-	-	-	-	-	-	-
					13	0.1	162	316	13.42	92.1	0.1	0.13
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 11/22/2016
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: M. Rourick	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 10°F, wind 10 mph, freezing fog, overcast

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Monday, November 21 at 11:45 AM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Tuesday, November 22, Ms. Gillenwater attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River on snow machines and began sampling the Colville River at 3:04 PM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 334 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 1,423 µS/cm at 1,200 feet downstream.

The DO saturation ranged between 90.4 percent (%) and 92.4%, with an average of 91.1%.

Velocity measurements at 1,200 feet downstream of the ice bridge centerline could not be obtained due to inclement weather.

Ice thickness ranged between 1.4 feet and 1.5 feet; average ice thickness was 1.5 feet. Snow depth ranged from 0.1 feet to 0.2 feet; average snow depth was 0.1 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, November 30, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

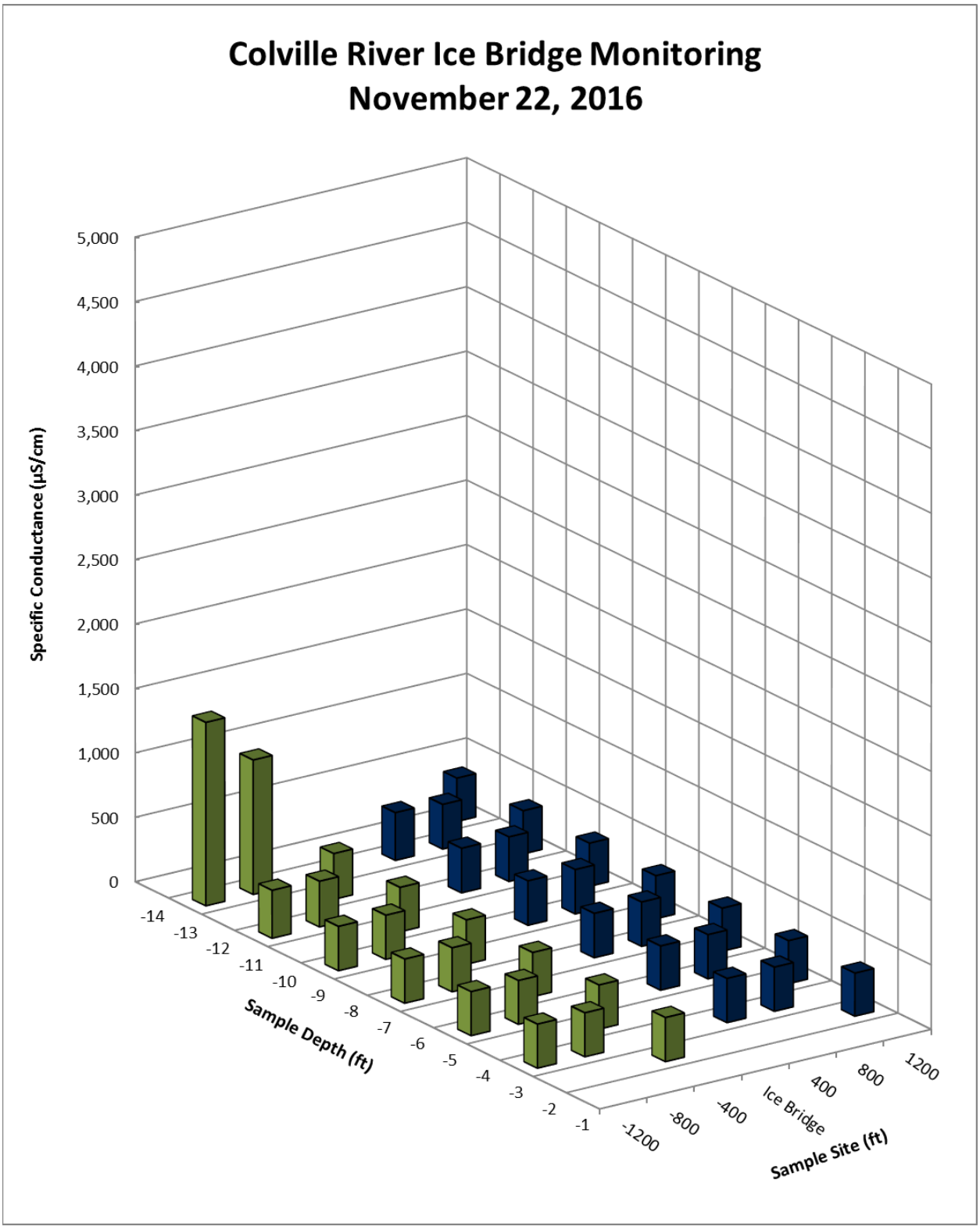
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **3:43 PM**	14.5	1.5	0.1	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	175	343	13.34	91.4	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	175	343	13.33	91.3	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	175	344	13.32	91.2	0.2	-
					8	-	-	-	-	-	-	-
					9	0.1	176	345	13.26	91.1	0.2	-
					10	-	-	-	-	-	-	-
					11	0.1	177	346	13.23	90.9	0.2	-
					12	-	-	-	-	-	-	-
					13	0.2	190	370	13.12	90.4	0.2	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **3:22 PM**	14.6	1.5	0.1	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	175	342	13.30	91.1	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	175	343	13.30	91.1	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	175	344	13.29	91.0	0.2	-
					8	-	-	-	-	-	-	-
					9	0.1	176	344	13.28	91.2	0.2	-
					10	-	-	-	-	-	-	-
					11	0.1	177	346	13.32	91.5	0.2	-
					12	-	-	-	-	-	-	-
					13	0.1	177	346	13.21	90.7	0.2	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **3:04 PM**	14.7	1.4	0.1	0.1	1	-	-	-	-	-	-	-
					2	0.0	170	334	13.28	90.9	0.1	-
					3	-	-	-	-	-	-	-
					4	0.0	170	334	13.28	90.9	0.1	-
					5	-	-	-	-	-	-	-
					6	0.0	170	334	13.30	91.0	0.1	-
					7	-	-	-	-	-	-	-
					8	0.1	171	334	13.25	91.0	0.2	-
					9	-	-	-	-	-	-	-
					10	0.1	171	335	13.28	91.2	0.2	-
					11	-	-	-	-	-	-	-
					12	0.1	172	335	13.34	91.6	0.2	-
					13	-	-	-	-	-	-	-
					14	0.2	173	336	13.41	92.4	0.2	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **4:00 PM**	13.7	1.5	0.1	0.1	1	-	-	-	-	-	-	-
					2	0.0	174	342	13.30	91.1	0.2	-
					3	-	-	-	-	-	-	-
					4	0.0	175	343	13.30	91.1	0.2	-
					5	-	-	-	-	-	-	-
					6	0.0	175	343	13.29	91.0	0.2	-
					7	-	-	-	-	-	-	-
					8	0.0	175	344	13.29	91.0	0.2	-
					9	-	-	-	-	-	-	-
					10	0.1	176	344	13.23	90.9	0.2	-
					11	-	-	-	-	-	-	-
					12	0.1	182	355	13.23	90.9	0.2	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **4:20 PM**	14.5	1.5	0.1	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	174	341	13.29	91.0	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	173	340	13.29	91.0	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	174	341	13.27	90.9	0.2	-
					8	-	-	-	-	-	-	-
					9	0.1	175	342	13.23	90.9	0.2	-
					10	-	-	-	-	-	-	-
					11	0.1	181	354	13.26	91.1	0.2	-
					12	-	-	-	-	-	-	-
					13	0.2	536	1043	13.27	91.6	0.5	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **4:38 PM**	14.3	1.5	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	174	341	13.36	91.5	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	174	341	13.36	91.5	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	175	342	13.34	91.4	0.2	-
					8	-	-	-	-	-	-	-
					9	0.1	176	344	13.29	91.3	0.2	-
					10	-	-	-	-	-	-	-
					11	0.1	190	372	13.29	91.3	0.2	-
					12	-	-	-	-	-	-	-
					13	0.3	734	1423	13.14	91.1	0.7	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 11/30/2016
MICHAEL BAKER FIELD PERSONNEL: B. Woelber	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: L. Hathaway	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -20 TO -15°F, 0-5 knot winds

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, November 29 at 5:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, November 30, Mr. Woelber attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River on snow machines and began sampling at 11:55 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 365 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 24,393 µS/cm at 800 feet downstream. SC near the river bottom exceeded 4,000 µS/cm at all sampling locations.

The DO saturation ranged between 76.5 percent (%) and 81.1%, with an average of 79.3%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 9 feet to a maximum of 0.20 ft/s in the upstream direction at a depth of 11 feet; average velocity was 0.04 ft/s in the upstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 1.3 feet to 1.6 feet; average ice thickness was 1.5 feet. Snow depth ranged from 0.1 feet to 0.8 feet; average snow thickness was 0.3 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, December 7, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

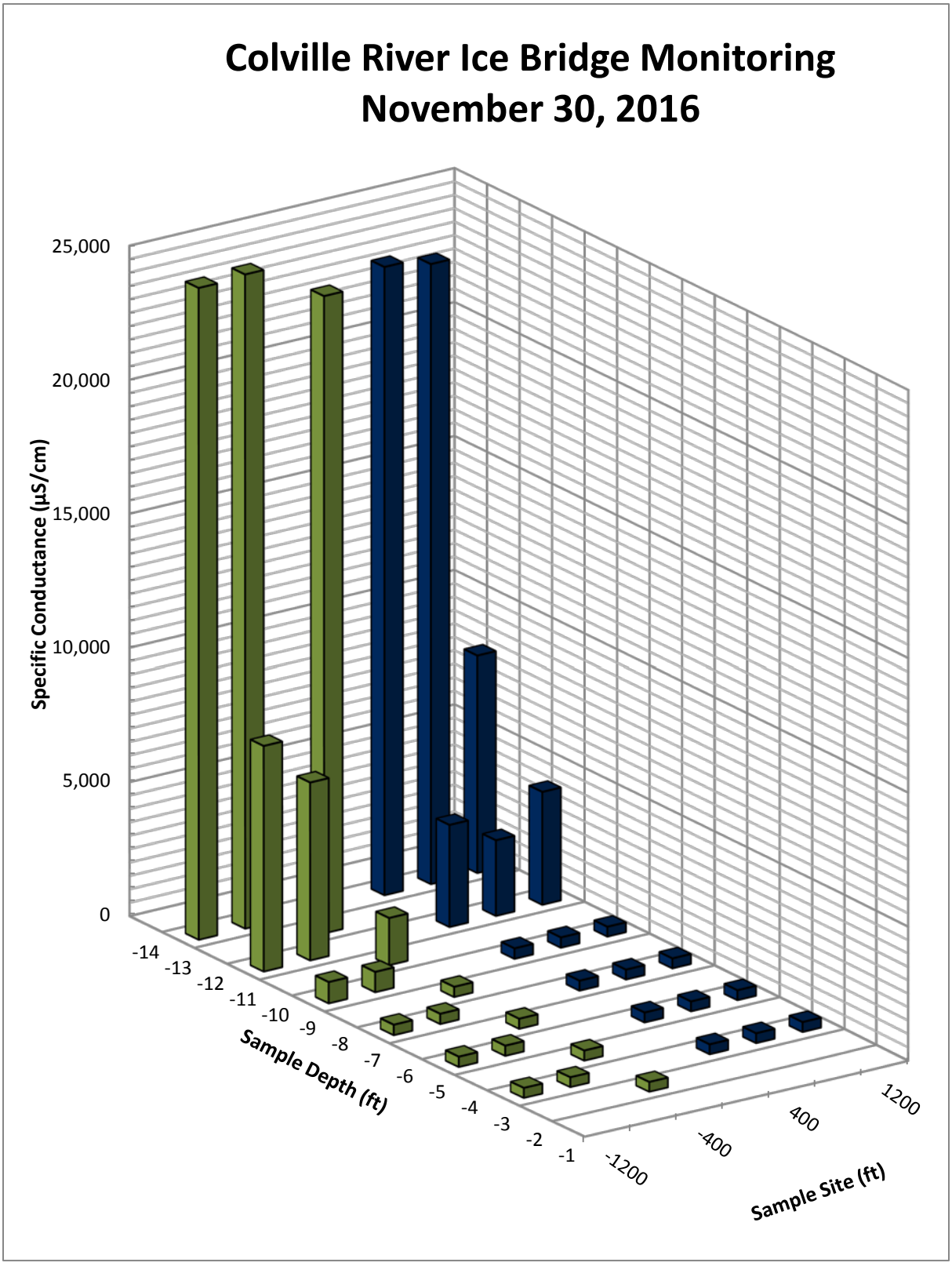
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **12:35 PM**	13.8	1.6	0.2	0.0	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	188	369	11.65	79.8	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	188	369	11.65	79.8	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	189	370	11.67	79.9	0.2	-
					8	-	-	-	-	-	-	-
					9	0.0	199	390	11.71	80.2	0.2	-
					10	-	-	-	-	-	-	-
					11	0.2	1958	3810	11.43	79.7	1.9	-
					12	-	-	-	-	-	-	-
					13	0.4	12133	23430	10.20	77.4	13.3	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **12:15 PM**	13.8	1.5	0.5	0.0	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	187	367	11.62	79.6	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	187	367	11.62	79.6	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	188	368	11.64	79.7	0.2	-
					8	-	-	-	-	-	-	-
					9	0.0	196	383	11.67	79.9	0.2	-
					10	-	-	-	-	-	-	-
					11	0.1	1445	2822	11.39	78.9	1.4	-
					12	-	-	-	-	-	-	-
					13	0.3	11929	23124	10.29	77.8	13.1	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **11:55 AM**	14.1	1.5	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	188	369	11.59	79.4	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	189	370	11.59	79.4	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	189	371	11.59	79.4	0.2	-
					8	-	-	-	-	-	-	-
					9	0.0	186	365	11.64	79.7	0.2	-
					10	-	-	-	-	-	-	-
					11	0.2	2165	4213	11.19	78.1	2.1	-
					12	-	-	-	-	-	-	-
					13	0.3	4178	8099	10.88	77.3	4.3	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **1:10 PM**	12.9	1.5	0.1	0.1	1	-	-	-	-	-	-	-
					2	0.0	191	375	11.67	79.9	0.2	-
					3	-	-	-	-	-	-	-
					4	0.0	192	375	11.67	79.9	0.2	-
					5	-	-	-	-	-	-	-
					6	0.0	191	375	11.67	79.9	0.2	-
					7	-	-	-	-	-	-	-
					8	0.0	193	379	11.68	80.0	0.2	-
					9	-	-	-	-	-	-	-
					10	0.1	901	1760	11.76	81.1	0.8	-
					11	-	-	-	-	-	-	-
					12	0.3	12259	23763	10.65	80.7	13.5	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **1:30 PM**	13.5	1.6	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	193	378	11.65	79.8	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	193	379	11.65	79.8	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	195	382	11.64	79.7	0.2	-
					8	-	-	-	-	-	-	-
					9	0.0	387	758	11.56	79.3	0.4	-
					10	-	-	-	-	-	-	-
					11	0.2	3412	6639	11.05	77.9	3.5	-
					12	-	-	-	-	-	-	-
					13	0.2	12536	24393	10.40	78.8	13.9	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **1:45 PM**	13.6	1.3	0.8	0.0	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	196	383	11.65	79.8	0.2	0.05
					4	-	-	-	-	-	-	-
					5	0.0	196	384	11.67	79.9	0.2	0.08
					6	-	-	-	-	-	-	-
					7	0.0	198	389	11.68	80.0	0.2	0.01
					8	-	-	-	-	-	-	-
					9	0.0	405	795	11.61	79.6	0.4	0.00
					10	-	-	-	-	-	-	-
					11	0.3	4343	8419	10.76	76.5	4.4	-0.20
					12	-	-	-	-	-	-	-
					13	0.4	12585	24303	10.26	78.2	13.9	-0.15
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 12/7/2016
MICHAEL BAKER FIELD PERSONNEL: Brett Woelber, Jen Gillenwater	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -15 to -5°F, 0-5 knot winds

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 6 at 9:15 AM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, December 7, Mr. Woelber and Ms. Gillenwater attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River on snow machines and began sampling at 10:48 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 353 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 18,873 µS/cm at 800 feet upstream. SC near the river bottom exceeded 4,000 µS/cm at all sampling locations.

The DO saturation ranged between 71.8 percent (%) and 79.6%; average DO was 76.2%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from a minimum of 0.03 feet per second (ft/s) in the downstream direction at a depth of 8 feet to a maximum of 0.20 ft/s in the downstream direction at a depth of 12 feet; average velocity was 0.10 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 1.9 feet to 2.2 feet; average ice thickness was 2.1 feet. Snow depth ranged from 0.1 feet to 0.2 feet; average snow depth was 0.1 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, December 14, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

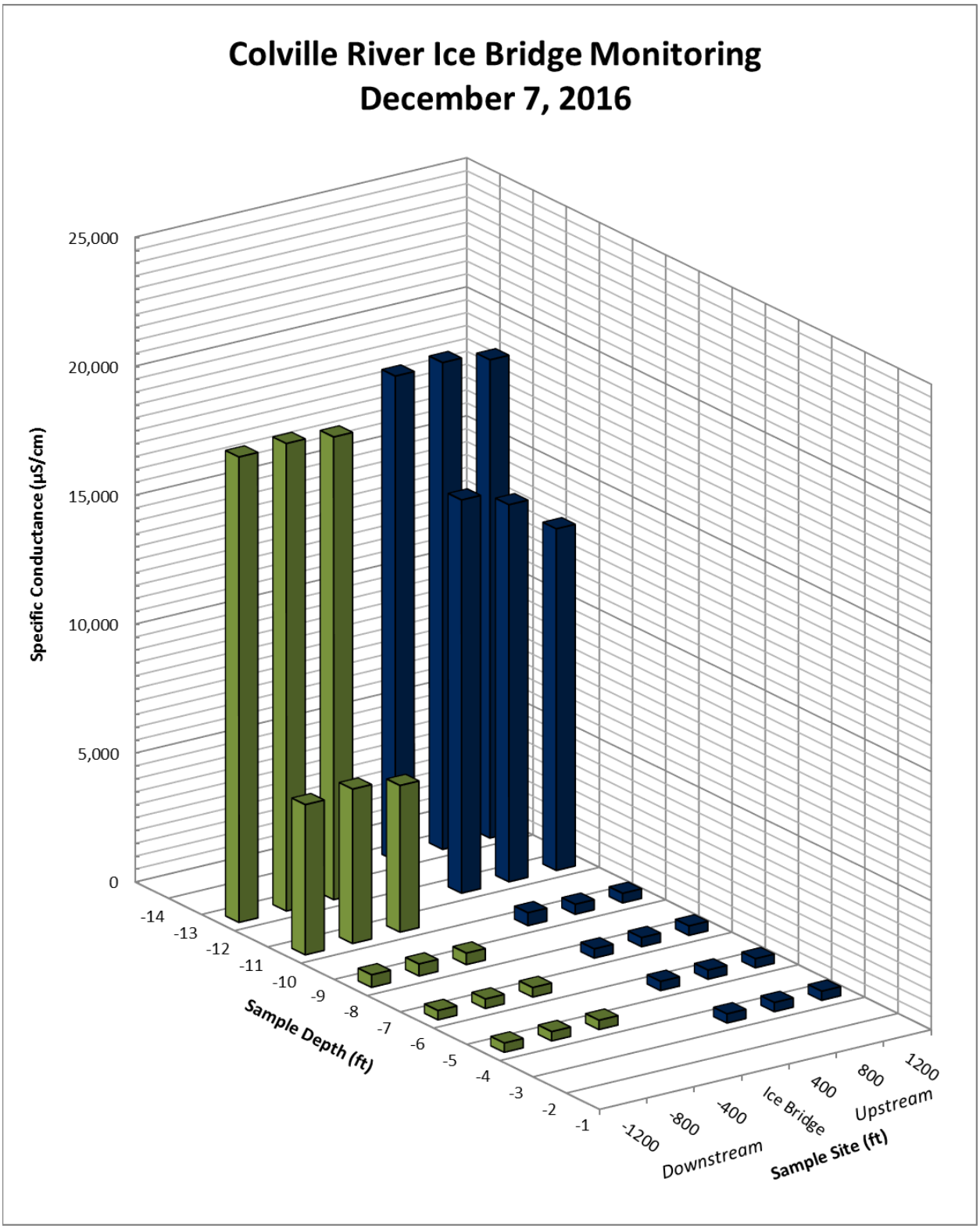
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturatio	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **11:19 AM**	13.1	1.9	0.1	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	181	355	11.23	76.9	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	181	355	11.20	76.7	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	182	356	11.15	76.4	0.2	-
					8	-	-	-	-	-	-	-
					9	0.1	255	499	10.91	75.0	0.3	-
					10	-	-	-	-	-	-	-
					11	0.4	7893	15242	10.08	73.9	8.4	-
					12	-	-	-	-	-	-	-
					13	0.5	9766	18788	9.90	73.9	10.5	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **11:06 AM**	13.2	2.2	0.1	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	181	354	11.21	76.8	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	180	353	11.20	76.7	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	180	354	11.17	76.5	0.2	-
					8	-	-	-	-	-	-	-
					9	0.1	198	387	10.97	75.4	0.3	-
					10	-	-	-	-	-	-	-
					11	0.4	7570	14618	10.09	73.8	8.0	-
					12	-	-	-	-	-	-	-
					13	0.5	9810	18873	10.03	74.9	10.6	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **10:48 AM**	13.5	2.1	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	180	353	11.17	76.5	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	181	354	11.10	76.0	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	186	365	11.02	75.5	0.2	-
					8	-	-	-	-	-	-	-
					9	0.1	190	370	11.01	75.6	0.2	-
					10	-	-	-	-	-	-	-
					11	0.5	6885	13245	10.13	73.9	7.2	-
					12	-	-	-	-	-	-	-
					13	0.7	9710	18540	9.92	74.4	10.4	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturatio	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **11:33 AM**	12.1	2.0	0.1	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	184	360	11.27	77.2	0.2	-
					5	-	-	-	-	-	-	-
					6	0.1	188	368	11.11	76.3	0.2	-
					7	-	-	-	-	-	-	-
					8	0.2	229	445	11.12	76.6	0.2	-
					9	-	-	-	-	-	-	-
					10	0.4	2943	5683	11.12	78.5	2.9	-
					11	-	-	-	-	-	-	-
					12	0.8	9428	17935	9.72	72.9	10.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **11:55 AM**	13.0	2.0	0.1	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	183	359	11.42	78.2	0.2	-
					5	-	-	-	-	-	-	-
					6	0.0	186	365	11.53	79.0	0.2	-
					7	-	-	-	-	-	-	-
					8	0.1	237	464	11.30	77.6	0.2	-
					9	-	-	-	-	-	-	-
					10	0.2	3075	5983	11.06	77.6	2.8	-
					11	-	-	-	-	-	-	-
					12	0.6	9455	18121	9.62	71.8	10.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **12:26 PM**	13.0	2.1	0.1	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	183	358	11.49	78.7	0.2	0.09
					5	-	-	-	-	-	-	-
					6	0.0	183	358	11.51	78.8	0.2	0.10
					7	-	-	-	-	-	-	-
					8	0.1	248	484	11.50	79.0	0.2	0.03
					9	-	-	-	-	-	-	-
					10	0.3	3003	5821	11.30	79.6	3.0	0.09
					11	-	-	-	-	-	-	-
					12	0.7	9447	18038	9.89	74.0	10.1	0.20
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 12/14/2016
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: C. Ziemet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 10°F, wind 10 mph, freezing fog, overcast

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 13 at 5:30 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, December 14, Ms. Runa attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel traveled to the Colville River on snow machines and began sampling the Colville River at 1:20 PM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 499 microsiemens per centimeter (µS/cm) at 400 feet upstream to a maximum of 26,255 µS/cm at 800 feet downstream.

The DO saturation ranged between 72.9 percent (%) and 79.0%, with an average of 75.7%.

Velocity measurements at 1,200 feet downstream of the ice bridge centerline ranged from 0.21 feet per second (ft/s) at 5 feet of depth to -0.08 ft/s (flow moving upstream) at 9 feet of depth; average velocity was 0.05 ft/s.

Ice thickness ranged between 1.9 feet and 2.4 feet; average ice thickness was 2.3 feet. Snow depth ranged from 0.1 feet to 0.6 feet; average snow depth was 0.2 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, December 21, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

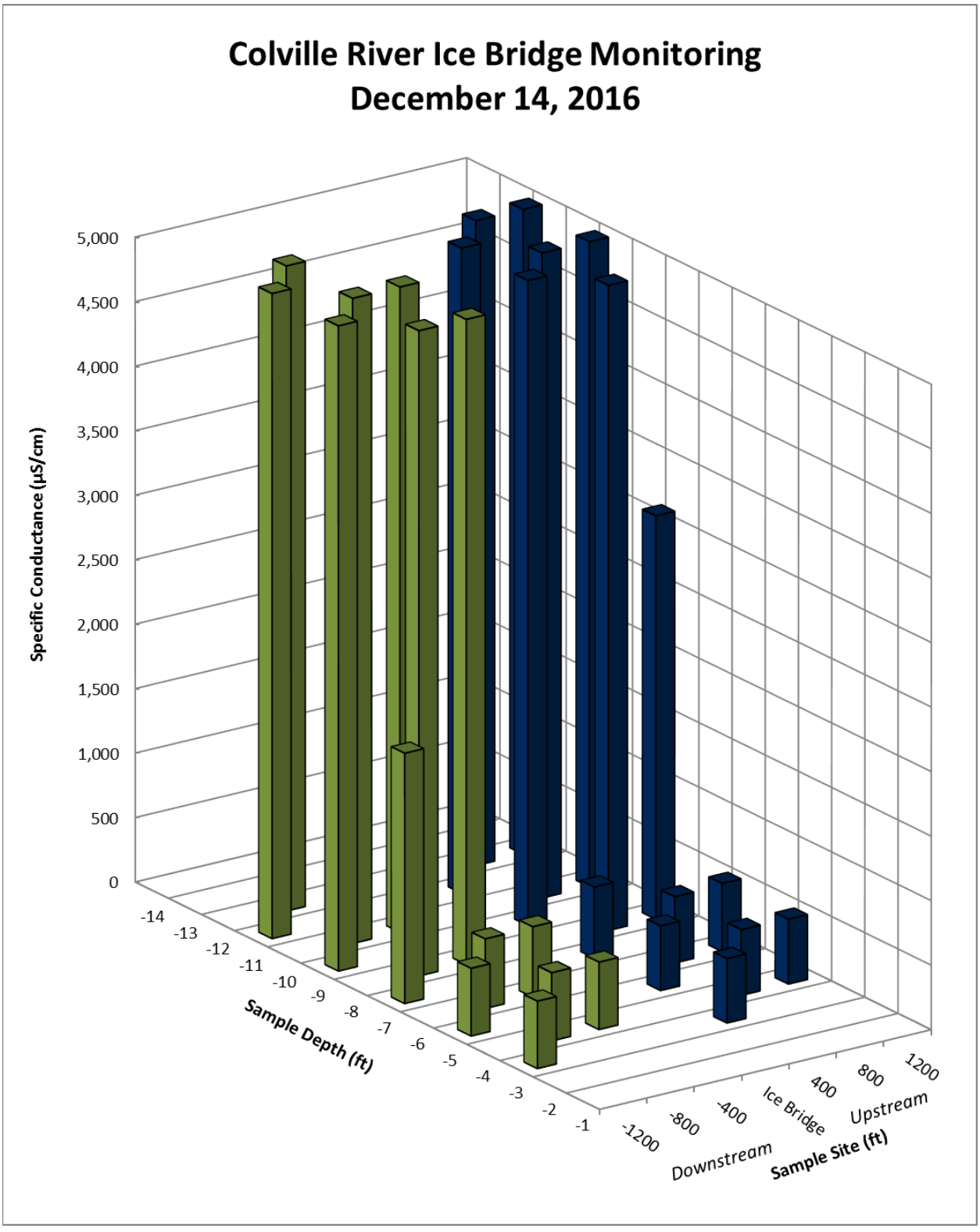
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **1:55 PM**	13.1	1.9	0.6	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	255	499	11.21	76.8	0.2	-
					4	-	-	-	-	-	-	-
					5	0.0	255	501	11.20	76.7	0.2	-
					6	-	-	-	-	-	-	-
					7	0.0	281	551	11.06	75.8	0.3	-
					8	-	-	-	-	-	-	-
					9	0.5	8904	17130	9.83	72.9	9.6	-
					10	-	-	-	-	-	-	-
					11	0.5	11698	22505	9.98	75.6	12.6	-
					12	-	-	-	-	-	-	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **1:35 PM**	14.1	2.4	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	260	511	11.08	75.9	0.2	-
					5	-	-	-	-	-	-	-
					6	0.0	262	513	11.05	75.7	0.2	-
					7	-	-	-	-	-	-	-
					8	0.3	3063	5937	10.47	73.9	3.3	-
					9	-	-	-	-	-	-	-
					10	0.5	10275	19767	9.93	74.5	11.3	-
					11	-	-	-	-	-	-	-
					12	0.5	13476	25925	9.90	76.1	14.7	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **1:20 PM**	13.7	2.3	0.1	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	256	503	11.23	76.9	0.2	-
					5	-	-	-	-	-	-	-
					6	0.0	269	528	11.18	76.6	0.2	-
					7	-	-	-	-	-	-	-
					8	0.3	1613	3127	10.80	75.4	1.7	-
					9	-	-	-	-	-	-	-
					10	0.5	11613	22341	10.08	75.8	11.6	-
					11	-	-	-	-	-	-	-
					12	0.5	11736	22578	10.13	76.8	12.8	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **3:10 PM**	13.1	2.4	0.1	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	266	522	11.21	76.8	0.2	-
					5	-	-	-	-	-	-	-
					6	0.0	278	545	11.17	76.5	0.2	-
					7	-	-	-	-	-	-	-
					8	0.3	3149	6104	10.62	74.9	3.2	-
					9	-	-	-	-	-	-	-
					10	0.5	9136	17576	10.00	74.3	9.8	-
					11	-	-	-	-	-	-	-
					12	0.5	No data, see note 10		10.97	76.3	-	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **3:25 PM**	13.7	2.4	0.1	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	270	528	11.21	76.8	0.2	-
					5	-	-	-	-	-	-	-
					6	0.0	275	539	10.99	75.3	0.2	-
					7	-	-	-	-	-	-	-
					8	0.3	6036	11700	10.29	74.2	6.4	-
					9	-	-	-	-	-	-	-
					10	0.5	10305	19825	9.83	73.7	11.2	-
					11	-	-	-	-	-	-	-
					12	0.4	13596	26255	10.29	79.0	15.0	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **3:55 PM**	12.4	2.3	0.1	0.0	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	266	522	11.21	76.8	0.2	0.11
					4	-	-	-	-	-	-	-
					5	0.0	268	525	11.18	76.6	0.2	0.21
					6	-	-	-	-	-	-	-
					7	0.2	997	1940	10.81	74.8	0.9	0.01
					8	-	-	-	-	-	-	-
					9	0.4	8540	16492	9.96	73.4	9.1	-0.08
					10	-	-	-	-	-	-	-
					11	0.4	12790	24699	9.99	76.2	14.1	0.02
					12	-	-	-	-	-	-	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.
(10) Conductivity, specific conductance, and salinity were omitted after data analysis indicated measured conductivity value was erroneous



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 12/21/2016
MICHAEL BAKER FIELD PERSONNEL: B. Woelber	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: C. Ziemet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -18 to -8°F, wind 0-5 knots

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 20 at 5:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, December 21, Mr. Woelber attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River on snow machines and began sampling at 10:45 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,616 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 28,543 µS/cm at 1,200 feet downstream.

The DO saturation ranged between 68.9 percent (%) and 76.5%; average DO was 72.2%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from a minimum of 0.01 feet per second (ft/s) in the upstream direction at depths of 13 feet, 9 feet and 7 feet to a maximum of 0.28 ft/s in the downstream direction at a depth of 5 feet; average velocity was 0.05 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 2.1 feet to 2.6 feet; average ice thickness was 2.5 feet. Snow depth ranged from 0.1 feet to 0.6 feet; average snow depth was 0.3 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, December 28, 2016.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

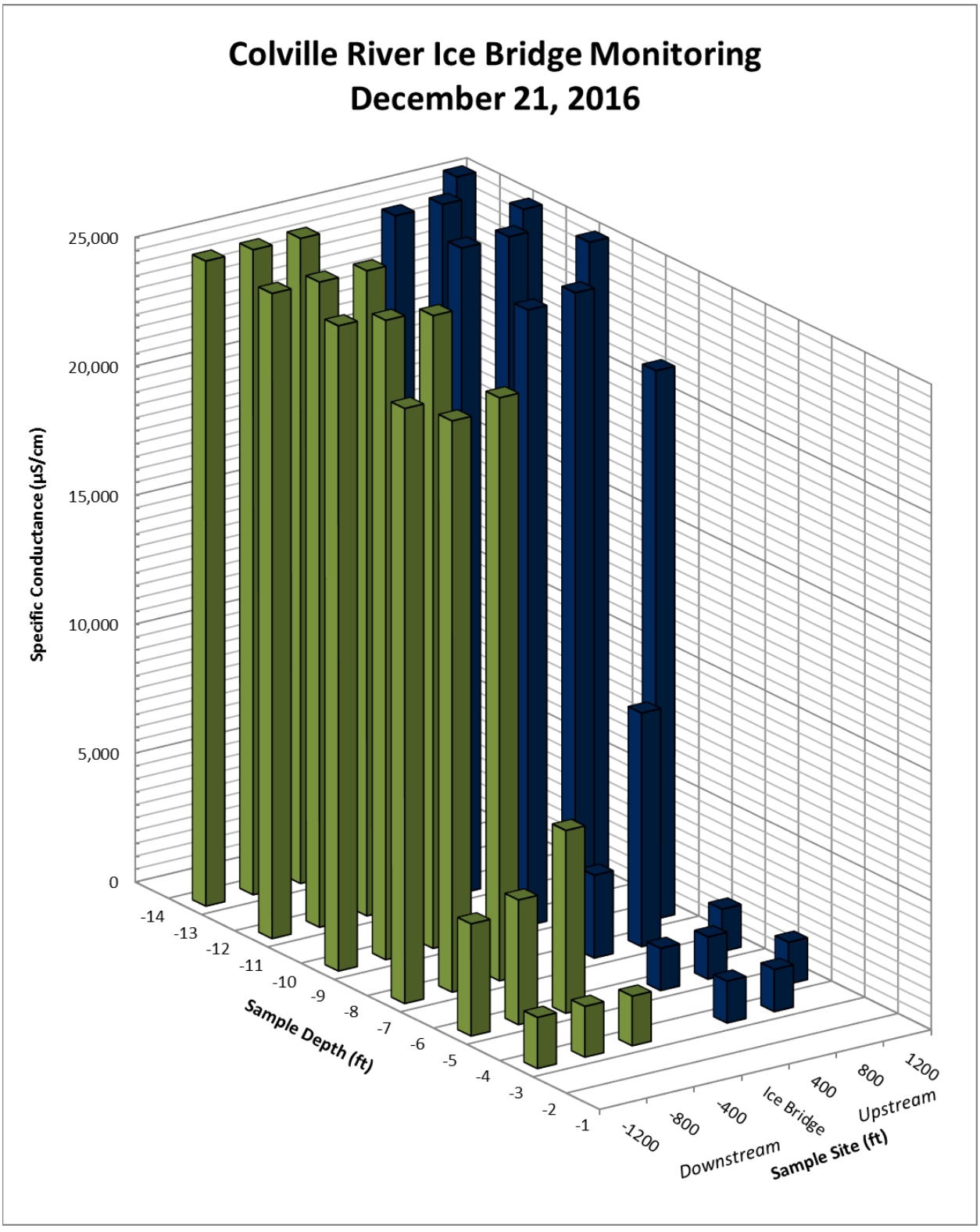
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **11:15 AM**	13.4	2.1	0.6	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	827	1622	10.29	70.8	0.8	-
					4	-	-	-	-	-	-	-
					5	0.0	832	1631	10.24	70.4	0.8	-
					6	-	-	-	-	-	-	-
					7	0.1	1642	3207	9.99	69.3	1.6	-
					8	-	-	-	-	-	-	-
					9	0.4	12355	23859	9.32	70.9	13.6	-
					10	-	-	-	-	-	-	-
					11	0.4	13873	26790	9.54	73.5	15.4	-
					12	-	-	-	-	-	-	-
					13	0.4	14366	27742	9.73	75.3	16.1	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **11:00 AM**	13.9	2.5	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	834	1635	10.28	70.7	0.8	-
					4	-	-	-	-	-	-	-
					5	0.0	835	1637	10.22	70.3	0.8	-
					6	-	-	-	-	-	-	-
					7	0.2	4653	9054	9.71	68.9	4.5	-
					8	-	-	-	-	-	-	-
					9	0.4	12472	24085	9.36	71.2	13.7	-
					10	-	-	-	-	-	-	-
					11	0.4	13775	26601	9.53	73.3	15.3	-
					12	-	-	-	-	-	-	-
					13	0.4	14395	27798	9.24	71.5	16.1	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **10:45 AM**	14.2	2.6	0.2	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	824	1616	10.29	70.8	0.8	-
					5	-	-	-	-	-	-	-
					6	0.0	838	1643	10.24	70.4	0.8	-
					7	-	-	-	-	-	-	-
					8	0.1	10880	21252	9.46	70.5	11.9	-
					9	-	-	-	-	-	-	-
					10	0.4	12933	24975	9.55	73.0	14.3	-
					11	-	-	-	-	-	-	-
					12	0.4	13824	26696	9.71	74.7	15.3	-
					13	-	-	-	-	-	-	-
					14	0.4	14398	27804	9.82	76.0	16.1	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **11:30 AM**	13.1	2.6	0.2	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	980	1922	10.33	71.1	0.9	-
					4	-	-	-	-	-	-	-
					5	0.1	3626	7083	10.04	70.7	3.7	-
					6	-	-	-	-	-	-	-
					7	0.4	11697	22588	9.36	70.9	13.0	-
					8	-	-	-	-	-	-	-
					9	0.4	12696	24517	9.57	73.0	14.0	-
					10	-	-	-	-	-	-	-
					11	0.4	13970	26977	9.65	74.4	15.5	-
					12	-	-	-	-	-	-	-
					13	0.2	14380	27981	9.74	75.0	16.1	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **11:50 AM**	13.6	2.6	0.1	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	1002	1965	10.35	71.3	1.0	-
					4	-	-	-	-	-	-	-
					5	0.1	2473	4830	10.16	70.9	2.5	-
					6	-	-	-	-	-	-	-
					7	0.3	11418	22133	9.46	71.2	12.5	-
					8	-	-	-	-	-	-	-
					9	0.3	12780	24773	9.65	73.5	14.2	-
					10	-	-	-	-	-	-	-
					11	0.2	14030	27300	9.71	74.5	15.7	-
					12	-	-	-	-	-	-	-
					13	0.2	14293	27812	9.93	76.5	16.2	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **12:15 PM**	13.9	2.5	0.4	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	1009	1978	10.34	71.2	1.0	0.08
					4	-	-	-	-	-	-	-
					5	0.0	2215	4343	10.19	70.8	2.2	0.28
					6	-	-	-	-	-	-	-
					7	0.4	11938	23053	9.42	71.3	12.9	-0.01
					8	-	-	-	-	-	-	-
					9	0.2	13385	26045	9.68	73.9	14.9	-0.01
					10	-	-	-	-	-	-	-
					11	0.0	13983	27418	9.20	70.3	15.8	-0.03
					12	-	-	-	-	-	-	-
					13	-0.3	14389	28543	9.99	76.0	16.4	-0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 12/28/2016
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** A. Smith
LCMF FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -35 to -20°F, wind 0-15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 27 at 5:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, December 28, Ms. Gillenwater attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River on snow machines and began sampling at 11:28 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 610 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 28,959 µS/cm at 1,200 feet downstream.

The DO saturation ranged between 64.3 percent (%) and 77.8%; average DO was 70.0%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline could not be obtained due to inclement weather.

Ice thickness ranged between 2.1 feet to 2.8 feet; average ice thickness was 2.6 feet. Snow depth ranged from 0.1 feet to 0.8 feet; average snow depth was 0.4 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, January 4, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

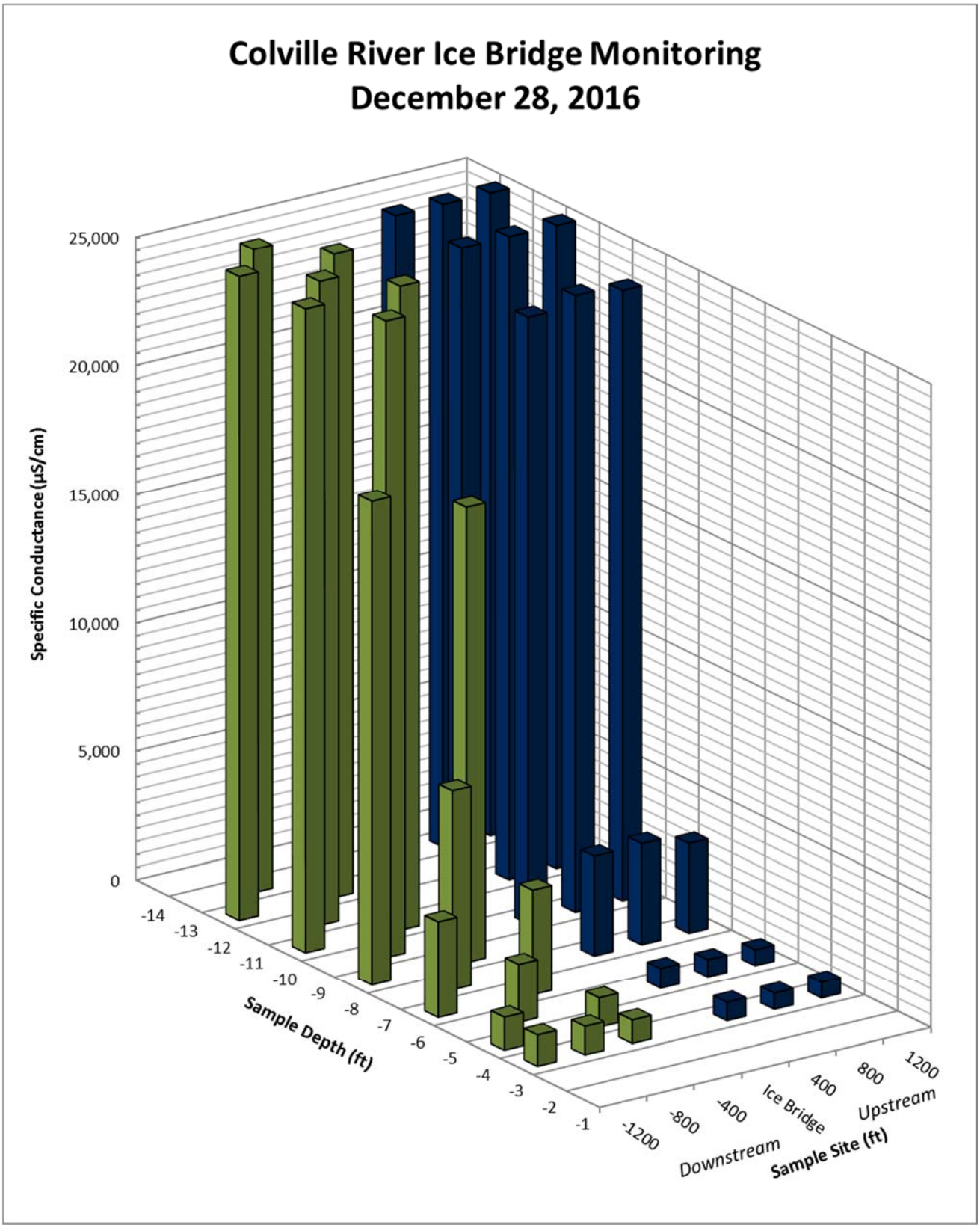
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **1:07 PM**	13.8	2.4	0.6	0.7	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	365	715	9.38	64.3	0.3	-
					4	-	-	-	-	-	-	-
					5	0.0	392	769	9.42	64.6	0.4	-
					6	-	-	-	-	-	-	-
					7	0.2	1988	3868	9.50	66.2	1.9	-
					8	-	-	-	-	-	-	-
					9	0.4	12194	23548	9.34	70.9	13.4	-
					10	-	-	-	-	-	-	-
					11	0.4	14377	27763	9.40	72.7	16.0	-
					12	-	-	-	-	-	-	-
					13	0.4	14996	28959	9.37	72.9	16.8	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **11:43 AM**	14.1	2.6	0.4	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	320	627	9.75	66.8	0.3	-
					4	-	-	-	-	-	-	-
					5	0.0	343	673	9.80	67.2	0.3	-
					6	-	-	-	-	-	-	-
					7	0.1	2006	3918	9.90	68.8	1.9	-
					8	-	-	-	-	-	-	-
					9	0.4	12402	23949	9.59	72.9	13.6	-
					10	-	-	-	-	-	-	-
					11	0.5	14594	28076	9.66	75.0	16.2	-
					12	-	-	-	-	-	-	-
					13	0.5	14962	28784	9.67	75.3	16.6	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **11:28 AM**	14.1	2.8	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	311	610	9.80	67.2	0.3	-
					4	-	-	-	-	-	-	-
					5	0.0	318	623	9.91	67.9	0.3	-
					6	-	-	-	-	-	-	-
					7	0.1	1784	3485	9.95	69.1	1.8	-
					8	-	-	-	-	-	-	-
					9	0.4	12278	23710	9.86	75.0	13.6	-
					10	-	-	-	-	-	-	-
					11	0.5	14463	27824	9.91	76.9	16.1	-
					12	-	-	-	-	-	-	-
					13	0.5	14715	28309	10.01	77.8	16.4	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **2:20 PM**	13.4	2.8	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	463	908	9.61	65.9	0.4	-
					4	0.0	579	1135	9.66	66.3	0.5	-
					5	-	-	-	-	-	-	-
					6	0.1	2080	4063	9.68	67.4	2.1	-
					7	-	-	-	-	-	-	-
					8	0.3	9122	17682	9.50	70.2	9.9	-
					9	-	-	-	-	-	-	-
					10	0.5	13944	26826	9.52	73.6	15.5	-
					11	-	-	-	-	-	-	-
					12	0.6	14516	27821	9.58	74.5	16.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **2:50 PM**	13.8	2.7	0.1	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	563	1104	9.59	65.8	0.5	-
					4	-	-	-	-	-	-	-
					5	0.1	1153	2252	9.64	66.6	1.1	-
					6	-	-	-	-	-	-	-
					7	0.2	3967	7719	9.80	69.4	4.1	-
					8	-	-	-	-	-	-	-
					9	0.4	12801	24720	9.42	71.9	14.2	-
					10	-	-	-	-	-	-	-
					11	0.5	14339	27586	9.32	72.2	15.9	-
					12	-	-	-	-	-	-	-
					13	0.5	14450	27799	9.35	72.5	16.0	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **3:11 PM**	12.7	2.1	0.8	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	0.0	617	1210	9.58	65.8	0.6	-
					4	0.0	646	1267	9.65	66.3	0.6	-
					5	-	-	-	-	-	-	-
					6	0.1	1903	3717	9.71	67.5	1.9	-
					7	-	-	-	-	-	-	-
					8	0.4	9735	18799	9.43	70.2	10.5	-
					9	-	-	-	-	-	-	-
					10	0.5	14123	27170	9.23	71.4	15.6	-
					11	-	-	-	-	-	-	-
					12	0.5	14633	28151	9.29	72.2	16.4	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 1/4/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 10 to 16°F, wind 10-20 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 3 at 5:30 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, January 4, Ms. Runa attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:50 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 3,386 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 31,775 µS/cm at 800 feet downstream.

The DO saturation ranged between 63.0 percent (%) and 79.6%; average DO was 71.0%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from -0.03 feet per second (ft/s) to -0.23 ft/s. Average velocity was -0.13 ft/s. Negative velocities indicate flow moving in an upstream direction.

Ice thickness ranged between 2.6 feet to 3.0 feet; average ice thickness was 2.8 feet. Snow depth ranged from 0.1 feet to 0.6 feet; average snow depth was 0.3 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, January 11, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

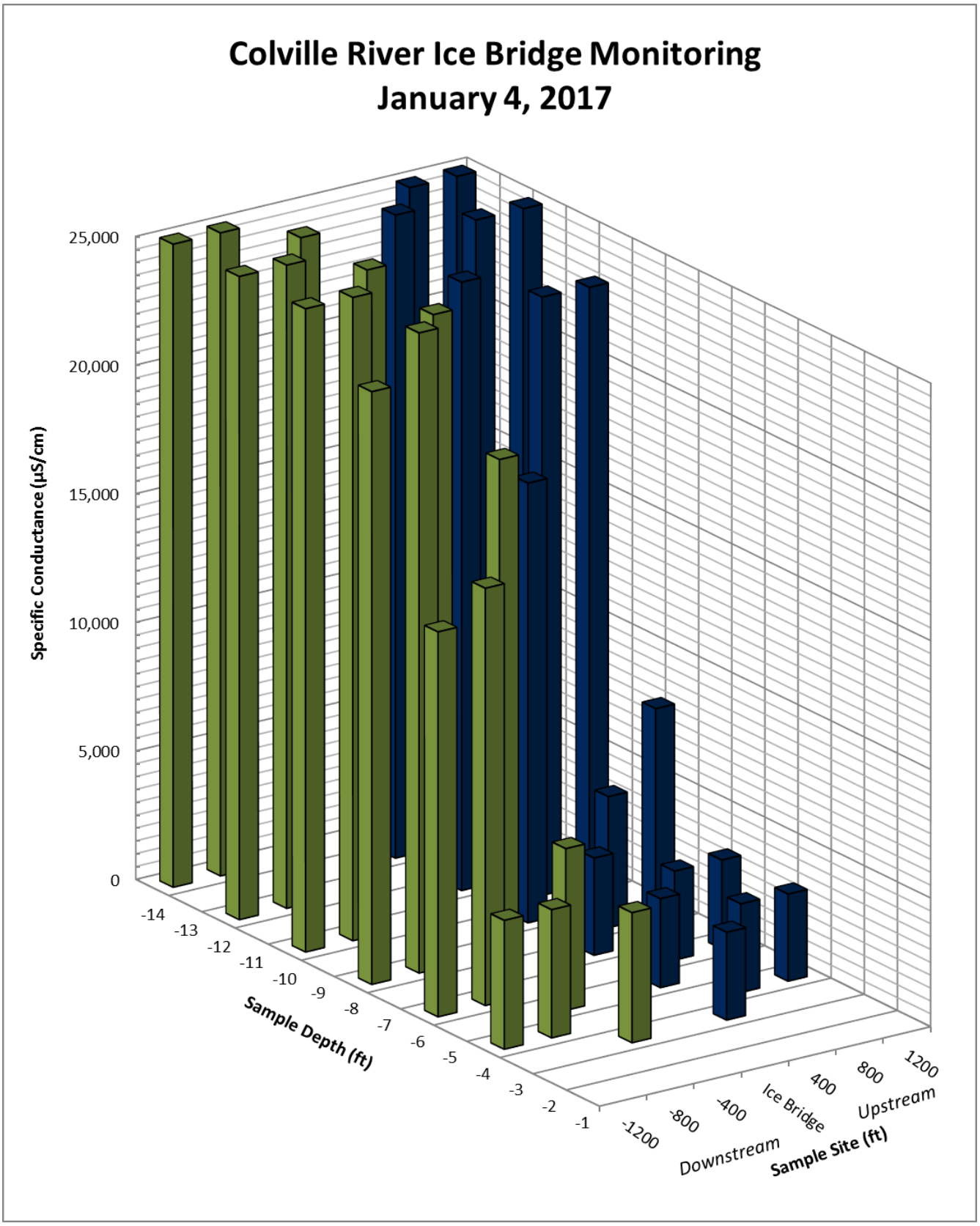
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:20 AM**	14.6	2.6	0.6	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-0.1	1732	3409	9.27	64.0	1.7	-
					4	-	-	-	-	-	-	-
					5	-0.1	1755	3454	9.13	63.0	1.7	-
					6	-	-	-	-	-	-	-
					7	-0.1	1920	3779	9.43	65.2	1.9	-
					8	-	-	-	-	-	-	-
					9	0.1	8750	17091	9.57	70.2	9.6	-
					10	-	-	-	-	-	-	-
					11	0.2	12153	23648	9.58	72.4	13.5	-
					12	-	-	-	-	-	-	-
					13	-0.1	15665	30834	9.88	76.2	17.5	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **10:05 AM**	15.1	2.6	0.4	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	1751	3447	9.20	63.5	1.7	-
					5	-	-	-	-	-	-	-
					6	-0.1	1758	3460	9.26	63.9	1.7	-
					7	-	-	-	-	-	-	-
					8	-0.1	2589	5096	9.64	67.0	2.7	-
					9	-	-	-	-	-	-	-
					10	0.2	11953	23258	9.56	72.1	13.2	-
					11	-	-	-	-	-	-	-
					12	0.2	13026	25346	9.75	74.2	14.5	-
					13	-	-	-	-	-	-	-
					14	0.1	15611	30493	10.01	77.7	17.7	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:50 AM**	15.1	2.9	0.4	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	1720	3386	9.21	63.6	1.7	-
					5	-	-	-	-	-	-	-
					6	-0.1	1753	3451	9.30	64.2	1.7	-
					7	-	-	-	-	-	-	-
					8	0.0	4119	8076	9.51	67.0	4.2	-
					9	-	-	-	-	-	-	-
					10	0.2	11921	23196	9.55	72.0	13.2	-
					11	-	-	-	-	-	-	-
					12	0.3	12951	25105	9.65	73.6	14.4	-
					13	-	-	-	-	-	-	-
					14	0.6	14470	27733	9.65	75.0	16.0	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:40 AM**	13.9	2.8	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-0.1	2568	5055	9.33	64.8	2.6	-
					4	-	-	-	-	-	-	-
					5	0.0	3205	6284	9.39	65.7	3.3	-
					6	-	-	-	-	-	-	-
					7	0.1	10314	20146	9.53	70.7	11.3	-
					8	-	-	-	-	-	-	-
					9	0.1	12553	24519	9.64	73.0	14.1	-
					10	-	-	-	-	-	-	-
					11	0.1	16018	31288	9.80	76.3	18.2	-
					12	-	-	-	-	-	-	-
					13	0.1	16253	31747	9.95	77.7	18.5	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:55 AM**	14.6	3.0	0.1	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2531	4982	9.48	65.9	2.7	-
					5	-	-	-	-	-	-	-
					6	0.0	8269	16214	9.52	69.3	8.9	-
					7	-	-	-	-	-	-	-
					8	0.1	12736	24877	9.64	72.9	13.9	-
					9	-	-	-	-	-	-	-
					10	0.1	13750	26858	9.88	75.6	15.6	-
					11	-	-	-	-	-	-	-
					12	0.1	16188	31620	9.79	76.4	18.4	-
					13	-	-	-	-	-	-	-
					14	0.0	16205	31775	9.95	77.4	18.4	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:15 AM**	14.6	2.7	0.4	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2544	5007	9.55	66.3	2.6	-0.16
					5	-	-	-	-	-	-	-
					6	0.0	7629	14959	9.72	70.4	8.2	-0.23
					7	-	-	-	-	-	-	-
					8	0.1	11792	23033	9.82	73.8	13.1	-0.16
					9	-	-	-	-	-	-	-
					10	0.1	15487	30250	9.95	77.1	17.5	-0.03
					11	-	-	-	-	-	-	-
					12	0.1	16024	31299	10.08	78.5	18.2	-0.08
					13	-	-	-	-	-	-	-
					14	0.3	16385	31761	10.14	79.6	18.5	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 1/11/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: T. Bass	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 10 - 20°F, wind 0-15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 10 at 5:30 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, January 11, Ms. Gillenwater attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:14 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 9,135 microsiemens per centimeter (µS/cm) at 400 feet upstream to a maximum of 31,234 µS/cm at 400 feet downstream.

The DO saturation ranged between 60.8 percent (%) and 72.8%; average DO was 68.3%.

Velocities measured at 1,200 feet downstream of the ice bridge centerline ranged from a minimum of 0.05 feet per second (ft/s) in the downstream direction at a depth of 10 feet to a maximum of 0.18 ft/s in the downstream direction at a depth of 6 feet; average velocity was 0.13 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 2.6 feet to 3.0 feet; average ice thickness was 2.8 feet. Snow depth ranged from 0.2 feet to 0.6 feet; average snow depth was 0.3 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, January 18, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

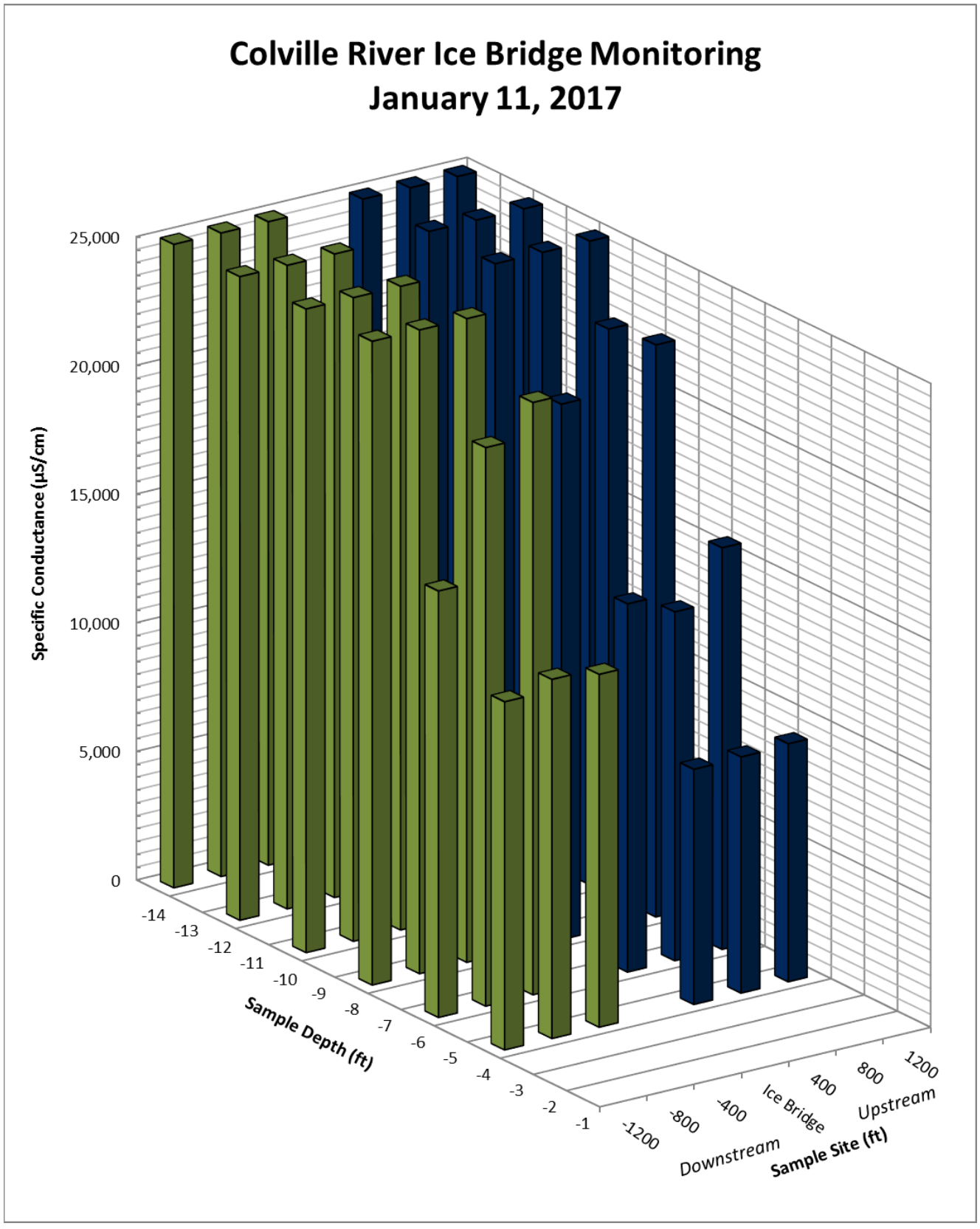
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **9:44 AM**	15.4	2.7	0.3	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	4641	9135	8.71	61.5	4.9	-
					5	-	-	-	-	-	-	-
					6	-0.1	7265	14300	8.82	63.5	7.8	-
					7	-	-	-	-	-	-	-
					8	0.1	10649	20800	8.97	66.8	11.8	-
					9	-	-	-	-	-	-	-
					10	0.1	13781	26918	8.97	68.6	15.5	-
					11	-	-	-	-	-	-	-
					12	0.2	15058	29300	9.06	70.2	17.1	-
					13	-	-	-	-	-	-	-
					14	0.3	15619	30276	9.10	71.0	17.7	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:30 AM**	15.6	2.7	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	4661	9174	8.73	61.6	4.9	-
					5	-	-	-	-	-	-	-
					6	0.0	6911	13551	8.99	64.8	7.5	-
					7	-	-	-	-	-	-	-
					8	0.2	11964	23280	9.05	68.3	13.3	-
					9	-	-	-	-	-	-	-
					10	0.2	13677	26613	9.09	69.6	15.4	-
					11	-	-	-	-	-	-	-
					12	0.3	15052	29177	9.18	71.3	17.0	-
					13	-	-	-	-	-	-	-
					14	0.4	15387	29714	9.28	72.5	17.4	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:14 AM**	15.6	3.0	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	4697	9245	8.61	60.8	4.9	-
					5	-	-	-	-	-	-	-
					6	-0.1	7925	15599	8.85	64.1	8.6	-
					7	-	-	-	-	-	-	-
					8	0.0	11334	22224	8.94	66.8	12.6	-
					9	-	-	-	-	-	-	-
					10	0.1	13602	26568	9.01	68.8	15.3	-
					11	-	-	-	-	-	-	-
					12	0.2	15093	29368	9.02	69.9	17.1	-
					13	-	-	-	-	-	-	-
					14	0.3	15217	29497	9.02	70.2	17.3	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:03 AM**	14.7	2.9	0.3	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.2	6934	13701	8.89	63.7	7.4	-
					5	-	-	-	-	-	-	-
					6	0.0	11731	23002	9.05	67.8	13.0	-
					7	-	-	-	-	-	-	-
					8	0.1	14210	27756	9.17	70.3	16.0	-
					9	-	-	-	-	-	-	-
					10	0.1	15403	30086	9.25	71.7	17.5	-
					11	-	-	-	-	-	-	-
					12	0.2	15722	30592	9.24	72.0	17.8	-
					13	-	-	-	-	-	-	-
					14	0.3	16113	31234	9.30	72.8	18.1	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:18 AM**	15.1	3.0	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.2	7058	13946	8.85	63.5	7.6	-
					5	-	-	-	-	-	-	-
					6	-0.1	11019	21689	9.05	67.2	12.1	-
					7	-	-	-	-	-	-	-
					8	0.0	14294	28027	9.16	70.1	16.1	-
					9	-	-	-	-	-	-	-
					10	0.1	15352	29987	9.15	70.9	17.4	-
					11	-	-	-	-	-	-	-
					12	0.1	15594	30459	9.16	71.1	17.7	-
					13	-	-	-	-	-	-	-
					14	0.4	15745	30405	9.09	71.2	17.9	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **10:32 AM**	15.0	2.6	0.6	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.2	6841	13518	8.83	63.2	7.3	0.07
					5	-	-	-	-	-	-	-
					6	-0.1	8413	16560	9.27	67.4	9.2	0.18
					7	-	-	-	-	-	-	-
					8	0.0	14891	29198	9.17	70.6	16.9	0.15
					9	-	-	-	-	-	-	-
					10	0.1	15409	30098	9.12	70.7	17.5	0.05
					11	-	-	-	-	-	-	-
					12	0.1	15656	30581	9.14	71.0	17.8	0.17
					13	-	-	-	-	-	-	-
					14	0.2	15770	30686	9.17	71.5	17.9	0.13

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 1/18/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Bass	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -18 to -30°F, wind 0-15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 17 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, January 18, Ms. Gillenwater attended UMIAQ's daily health and safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:11 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 868 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 30,604 µS/cm at 1,200 feet downstream.

The DO saturation ranged between 54.3 percent (%) and 71.8%; average DO was 61.8%.

Velocities were measured at 1,200 feet downstream of the ice bridge centerline. Direction of flow was upstream toward the bottom of the water column and downstream toward the top of the water column. Velocities ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 8 feet to a maximum of 0.59 ft/s in the upstream direction at a depth of 10 feet; average velocity was 0.14 ft/s in the upstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 2.4 feet to 3.2 feet; average ice thickness was 3.0 feet. Snow depth ranged from 0.2 feet to 0.8 feet; average snow depth was 0.4 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, January 25, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

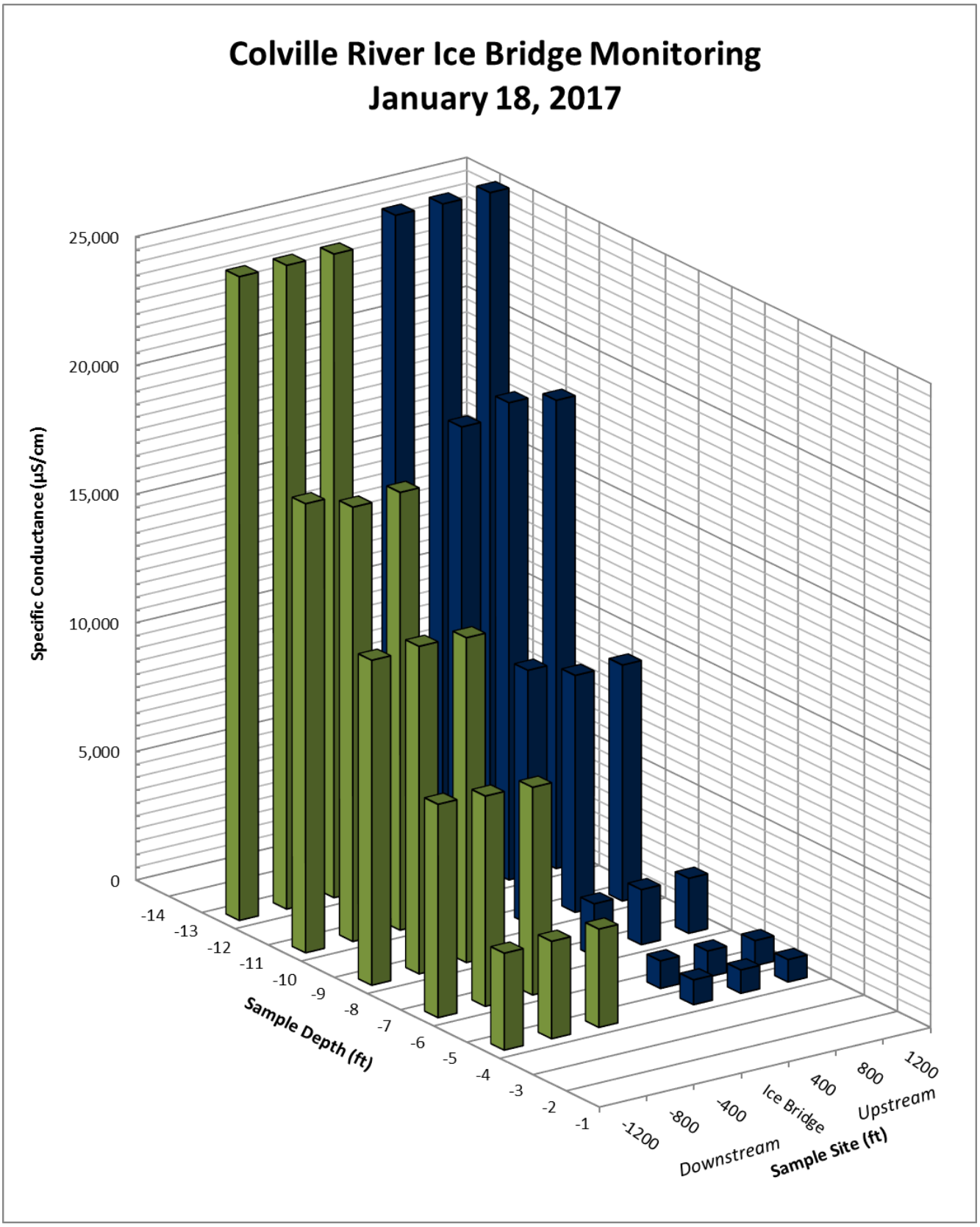
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **9:39 AM**	13.8	3.1	0.3	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	490	961	7.91	54.3	0.5	-
					5	0.0	546	1071	7.94	54.5	0.5	-
					6	-	-	-	-	-	-	-
					7	0.0	1033	2025	8.12	55.9	1.0	-
					8	-	-	-	-	-	-	-
					9	0.0	5018	9839	8.49	60.2	5.2	-
					10	-	-	-	-	-	-	-
					11	-0.1	9162	18034	8.87	65.0	10.2	-
					12	-	-	-	-	-	-	-
					13	0.1	14322	27975	8.85	68.0	16.2	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:27 AM**	14.0	2.9	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	462	906	8.11	55.6	0.4	-
					5	0.0	516	1012	8.07	55.4	0.5	-
					6	-	-	-	-	-	-	-
					7	0.1	1093	2135	8.26	57.1	1.1	-
					8	-	-	-	-	-	-	-
					9	0.0	4692	9200	8.75	61.9	4.9	-
					10	-	-	-	-	-	-	-
					11	0.0	9453	18535	8.85	65.1	10.4	-
					12	-	-	-	-	-	-	-
					13	0.2	14437	28092	9.13	70.4	16.3	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:11 AM**	14.1	3.2	0.3	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	443	868	8.16	56.0	0.4	-
					5	0.0	497	975	8.16	56.0	0.5	-
					6	-	-	-	-	-	-	-
					7	0.0	1089	2135	8.31	57.3	1.1	-
					8	-	-	-	-	-	-	-
					9	0.1	4691	9163	8.78	62.3	4.9	-
					10	-	-	-	-	-	-	-
					11	0.1	9313	18191	8.96	66.0	10.2	-
					12	-	-	-	-	-	-	-
					13	0.1	14107	27555	9.25	70.9	15.9	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **9:55 AM**	12.9	3.2	0.3	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	1946	3816	8.33	57.8	2.0	-
					5	-	-	-	-	-	-	-
					6	0.0	4112	8063	8.40	59.2	4.2	-
					7	-	-	-	-	-	-	-
					8	0.1	6457	12612	8.70	62.6	6.9	-
					9	-	-	-	-	-	-	-
					10	0.1	8703	16999	8.71	63.8	9.4	-
					11	-	-	-	-	-	-	-
					12	0.4	15443	29822	9.04	70.6	17.4	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:10 AM**	13.5	3.0	0.2	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	1928	3780	8.40	58.2	1.9	-
					5	-	-	-	-	-	-	-
					6	0.0	4163	8163	8.47	59.7	4.3	-
					7	-	-	-	-	-	-	-
					8	0.1	6511	12718	8.71	62.7	6.9	-
					9	-	-	-	-	-	-	-
					10	0.1	8635	16867	8.78	64.3	9.4	-
					11	-	-	-	-	-	-	-
					12	0.5	15583	29979	9.00	70.6	17.6	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **10:23 AM**	13.6	2.4	0.8	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.0	1918	3761	8.38	58.1	1.9	0.16
					5	-	-	-	-	-	-	-
					6	0.0	4225	8284	8.52	60.1	4.4	0.06
					7	-	-	-	-	-	-	-
					8	0.0	6435	12618	8.80	63.1	6.8	0.00
					9	-	-	-	-	-	-	-
					10	0.0	8894	17439	8.99	65.8	9.7	-0.59
					11	-	-	-	-	-	-	-
					12	0.2	15728	30604	9.22	71.8	17.8	-0.34
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 1/25/2017
MICHAEL BAKER FIELD PERSONNEL: G. Yager	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -20°F, wind 0-5mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 24 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, January 25, Mr. Yager attended UMIAQ's daily health and safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:51 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,035 microsiemens per centimeter (µS/cm) at 800 feet upstream to a maximum of 34,005 µS/cm at 800 feet downstream.

The DO saturation ranged between 55.6 percent (%) and 71.8%; average DO was 64.8%.

Velocities were measured at 1,200 feet downstream of the ice bridge centerline. Velocities ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 9 feet to a maximum of 0.22 ft/s in the downstream direction at a depth of 5 feet; average velocity was 0.06 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 3.1 feet to 3.6 feet; average ice thickness was 3.4 feet. Snow depth ranged from 0.2 feet to 0.6 feet; average snow depth was 0.3 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, February 1, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

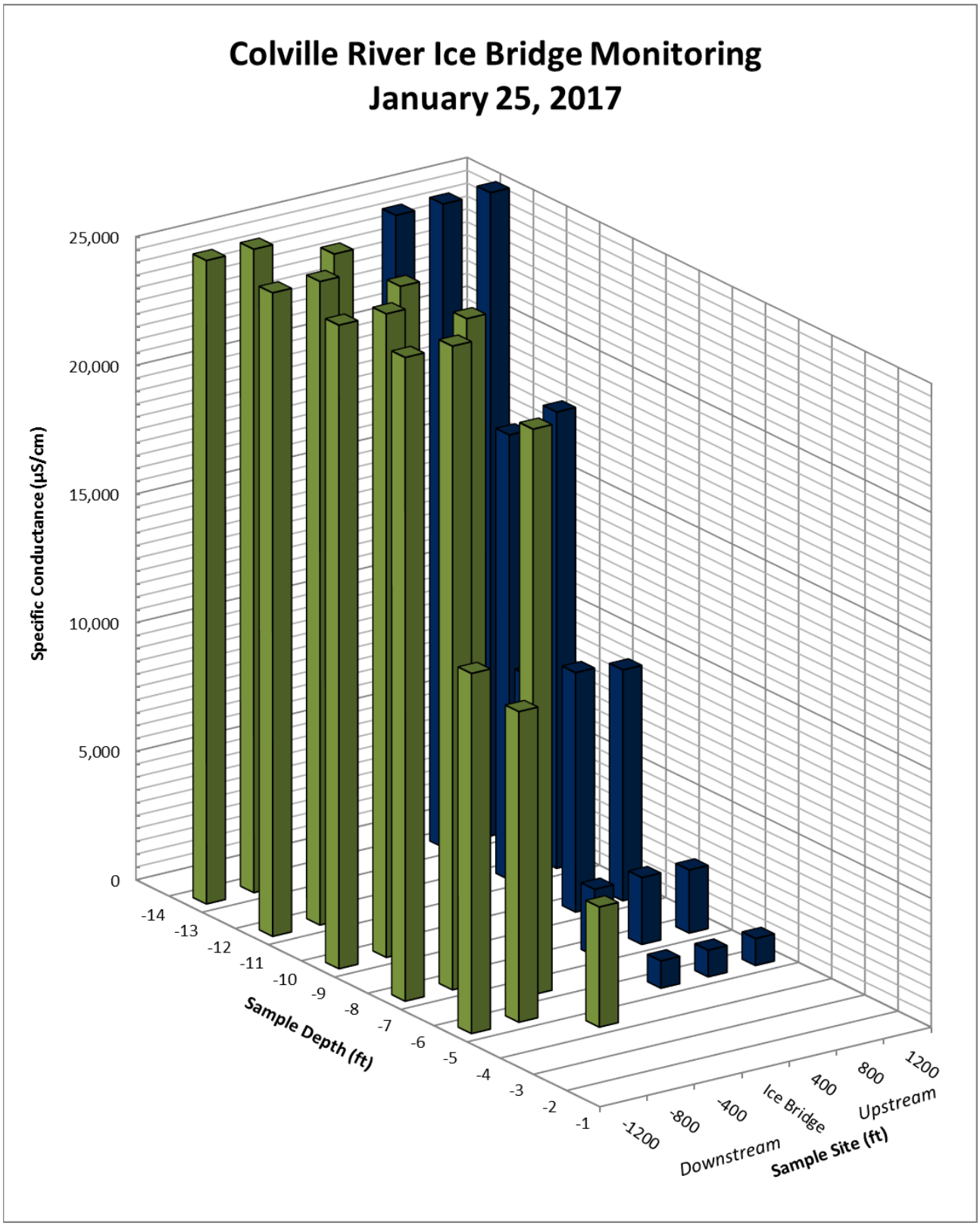
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:25 AM**	14.0	3.1	0.6	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	540	1059	8.22	56.4	0.5	-
					6	-	-	-	-	-	-	-
					7	0.1	1322	2582	8.09	56.0	1.3	-
					8	-	-	-	-	-	-	-
					9	0.1	4930	9630	8.39	59.6	5.1	-
					10	-	-	-	-	-	-	-
					11	0.2	8846	17213	8.79	64.6	9.5	-
					12	-	-	-	-	-	-	-
					13	0.2	15685	30520	9.23	71.8	17.7	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **10:05 AM**	14.4	3.2	0.3	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	528	1035	8.39	57.9	1.3	-
					6	-	-	-	-	-	-	-
					7	0.0	1324	2596	8.06	55.6	1.3	-
					8	-	-	-	-	-	-	-
					9	0.2	4781	9303	8.34	59.4	5.0	-
					10	-	-	-	-	-	-	-
					11	0.2	8883	17285	8.70	64.0	9.6	-
					12	-	-	-	-	-	-	-
					13	0.2	15341	29851	9.08	70.5	17.3	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:51 AM**	14.4	3.4	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	534	1047	8.86	60.8	0.5	-
					6	-	-	-	-	-	-	-
					7	0.0	1250	2451	8.08	55.7	1.2	-
					8	-	-	-	-	-	-	-
					9	0.1	4592	8969	8.46	60.0	4.8	-
					10	-	-	-	-	-	-	-
					11	0.2	9115	17736	8.74	64.4	9.9	-
					12	-	-	-	-	-	-	-
					13	0.2	15136	29452	9.04	70.1	17.1	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:45 AM**	13.5	3.5	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2370	4665	8.81	61.1	2.4	-
					5	-	-	-	-	-	-	-
					6	0.0	11203	21967	8.82	65.8	12.4	-
					7	-	-	-	-	-	-	-
					8	0.0	13795	27049	8.95	68.2	15.5	-
					9	-	-	-	-	-	-	-
					10	0.0	14903	29222	9.08	69.9	16.9	-
					11	-	-	-	-	-	-	-
					12	0.2	16245	31610	9.08	71.0	18.4	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **11:05 AM**	14.0	3.6	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	6153	12065	8.77	62.8	6.5	-
					6	-	-	-	-	-	-	-
					7	-0.1	12745	25087	8.93	67.3	14.3	-
					8	-	-	-	-	-	-	-
					9	0.0	14285	28010	9.14	70.0	16.2	-
					10	-	-	-	-	-	-	-
					11	0.0	15332	30063	9.17	70.8	17.4	-
					12	-	-	-	-	-	-	-
					13	0.2	17476	34005	9.08	71.8	19.9	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:25 AM**	13.8	3.4	0.3	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	7133	13986	8.57	61.8	7.6	0.22
					6	-	-	-	-	-	-	-
					7	0.0	12845	25186	8.83	66.8	14.4	0.09
					8	-	-	-	-	-	-	-
					9	-0.1	14406	28356	9.09	69.5	16.3	0.00
					10	-	-	-	-	-	-	-
					11	0.0	15233	29869	9.11	70.3	17.3	0.01
					12	-	-	-	-	-	-	-
					13	0.1	17069	33340	9.03	71.0	19.5	-0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 2/1/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 0°F, wind 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 31 at 5:00 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 1, Ms. Runa attended UMIAQ's daily health and safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:45 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,791 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 36,781 µS/cm at 1,200 feet downstream.

The DO saturation ranged between 62.2 percent (%) and 75.5%; average DO was 69.6%.

Velocities were measured at 1,200 feet downstream of the ice bridge centerline. Velocities ranged from a minimum of 0.01 feet per second (ft/s) in the upstream direction at a depth of 6 feet to a maximum of 0.21 ft/s in the upstream direction at a depth of 8 feet; average velocity was 0.07 ft/s in the upstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 2.9 feet to 3.7 feet; average ice thickness was 3.4 feet. Snow depth ranged from 0.3 feet to 0.7 feet; average snow depth was 0.4 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, February 8, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:30 AM**	15.2	3.4	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	3015	5935	9.20	64.2	3.2	-
					5	-	-	-	-	-	-	-
					6	-0.2	12648	24992	8.95	67.3	14.3	-
					7	-	-	-	-	-	-	-
					8	-0.2	15330	30292	9.04	69.3	17.1	-
					9	-	-	-	-	-	-	-
					10	-0.1	17956	35344	8.97	70.7	20.6	-
					11	-	-	-	-	-	-	-
					12	-0.1	18182	35789	8.99	71.0	21.0	-
					13	-	-	-	-	-	-	-
					14	-0.1	18190	35804	9.11	72.0	21.0	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **10:15 AM**	15.6	3.4	0.3	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2733	5379	9.25	64.3	2.7	-
					5	-	-	-	-	-	-	-
					6	-0.3	11182	22181	9.04	66.9	12.5	-
					7	-	-	-	-	-	-	-
					8	-0.1	15423	30358	9.09	70.0	17.3	-
					9	-	-	-	-	-	-	-
					10	-0.1	17739	34917	9.01	70.5	19.6	-
					11	-	-	-	-	-	-	-
					12	-0.1	17823	35082	9.01	71.0	20.6	-
					13	-	-	-	-	-	-	-
					14	-0.1	17874	35182	9.08	71.5	20.6	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:45 AM**	15.6	3.6	0.3	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	910	1791	9.06	62.2	1.0	-
					5	-	-	-	-	-	-	-
					6	-0.2	11067	21868	9.04	67.0	12.3	-
					7	-	-	-	-	-	-	-
					8	-0.1	15059	29641	9.04	69.5	17.1	-
					9	-	-	-	-	-	-	-
					10	0.0	17202	33729	8.97	70.5	19.8	-
					11	-	-	-	-	-	-	-
					12	0.0	17501	34316	9.07	71.4	20.1	-
					13	-	-	-	-	-	-	-
					14	0.1	17844	34854	9.16	72.4	20.3	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:50 AM**	14.6	3.7	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2889	5687	9.73	67.8	3.0	-
					5	-	-	-	-	-	-	-
					6	-0.2	8543	16881	9.26	67.2	9.3	-
					7	-	-	-	-	-	-	-
					8	-0.3	9625	19093	9.36	68.4	10.7	-
					9	-	-	-	-	-	-	-
					10	-0.1	18250	35922	9.18	72.6	21.1	-
					11	-	-	-	-	-	-	-
					12	-0.1	18421	36259	9.32	73.8	21.3	-
					13	-	-	-	-	-	-	-
					14	0.0	18508	36290	9.47	75.2	21.4	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **11:10 AM**	15.1	3.6	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2424	4771	9.40	65.4	2.8	-
					5	-	-	-	-	-	-	-
					6	-0.2	7842	15496	9.28	67.0	8.5	-
					7	-	-	-	-	-	-	-
					8	-0.3	11097	22013	9.13	67.4	12.1	-
					9	-	-	-	-	-	-	-
					10	-0.1	18152	35729	9.10	71.9	21.0	-
					11	-	-	-	-	-	-	-
					12	-0.1	18484	36383	9.15	72.5	21.4	-
					13	-	-	-	-	-	-	-
					14	-0.1	18518	36450	9.40	74.5	21.5	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:30 AM**	15.1	2.9	0.7	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2220	4370	9.44	65.4	2.3	0.05
					5	-	-	-	-	-	-	-
					6	-0.2	8554	16902	9.20	66.8	9.4	-0.01
					7	-	-	-	-	-	-	-
					8	-0.3	12230	24260	9.23	69.0	13.9	-0.21
					9	-	-	-	-	-	-	-
					10	-0.1	17955	35342	9.02	71.2	20.8	-0.13
					11	-	-	-	-	-	-	-
					12	-0.1	18481	36377	9.13	72.2	21.2	-0.08
					13	-	-	-	-	-	-	-
					14	-0.1	18686	36781	9.51	75.5	21.7	-0.02

Notes:

(1) All sample location coordinates referenced to NAD83 datum.

(2) Freeboard is the distance from the top of ice to the water surface.

(3) Sample depth is measured from the water surface.

(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.

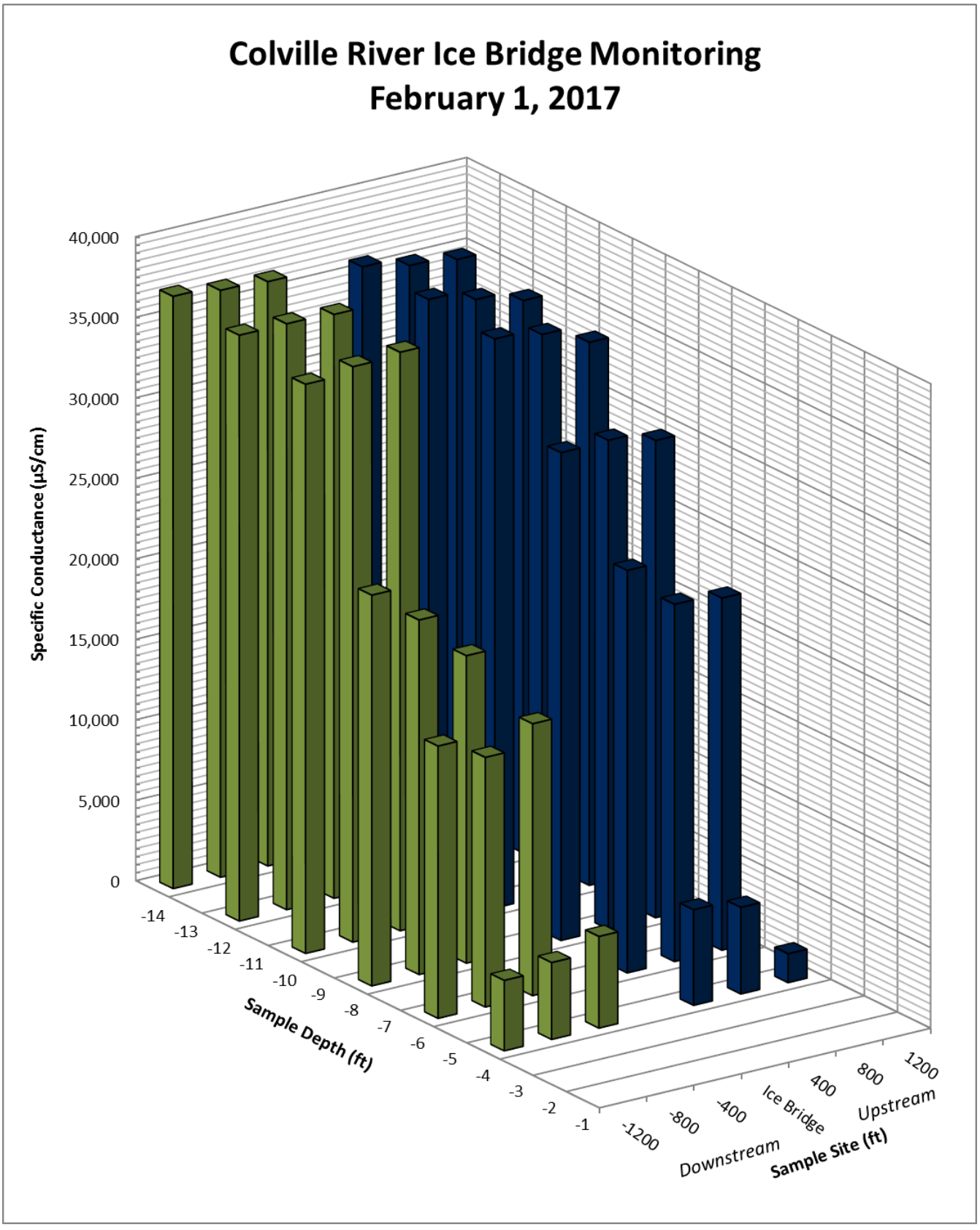
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.

(6) Dissolved oxygen was measured using a YSI ProODO meter.

(7) Time shown indicates the start of the measurement.

(8) Temperature measurements have an accuracy of +/- 0.2°C

(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 2/8/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -9 to -16°F, wind 20 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 7 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 8, Ms. Runa attended UMIAQ's daily health and safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 10:05 AM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by measuring water velocity 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,814 microsiemens per centimeter (µS/cm) at 400 feet upstream to a maximum of 37,753 µS/cm at 800 feet downstream.

The DO saturation ranged between 55.2 percent (%) and 72.6%; average DO was 63.4%.

Velocities were measured at 1,200 feet downstream of the ice bridge centerline. Velocities ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 5 feet to a maximum of 0.06 ft/s in the downstream direction at a depth of 9 feet; average velocity was 0.01 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 3.4 feet to 3.8 feet; average ice thickness was 3.6 feet. Snow depth ranged from 0.2 feet to 0.7 feet; average snow depth was 0.5 feet.

Water quality parameters upstream and downstream of the Colville River Ice Bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, February 15, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

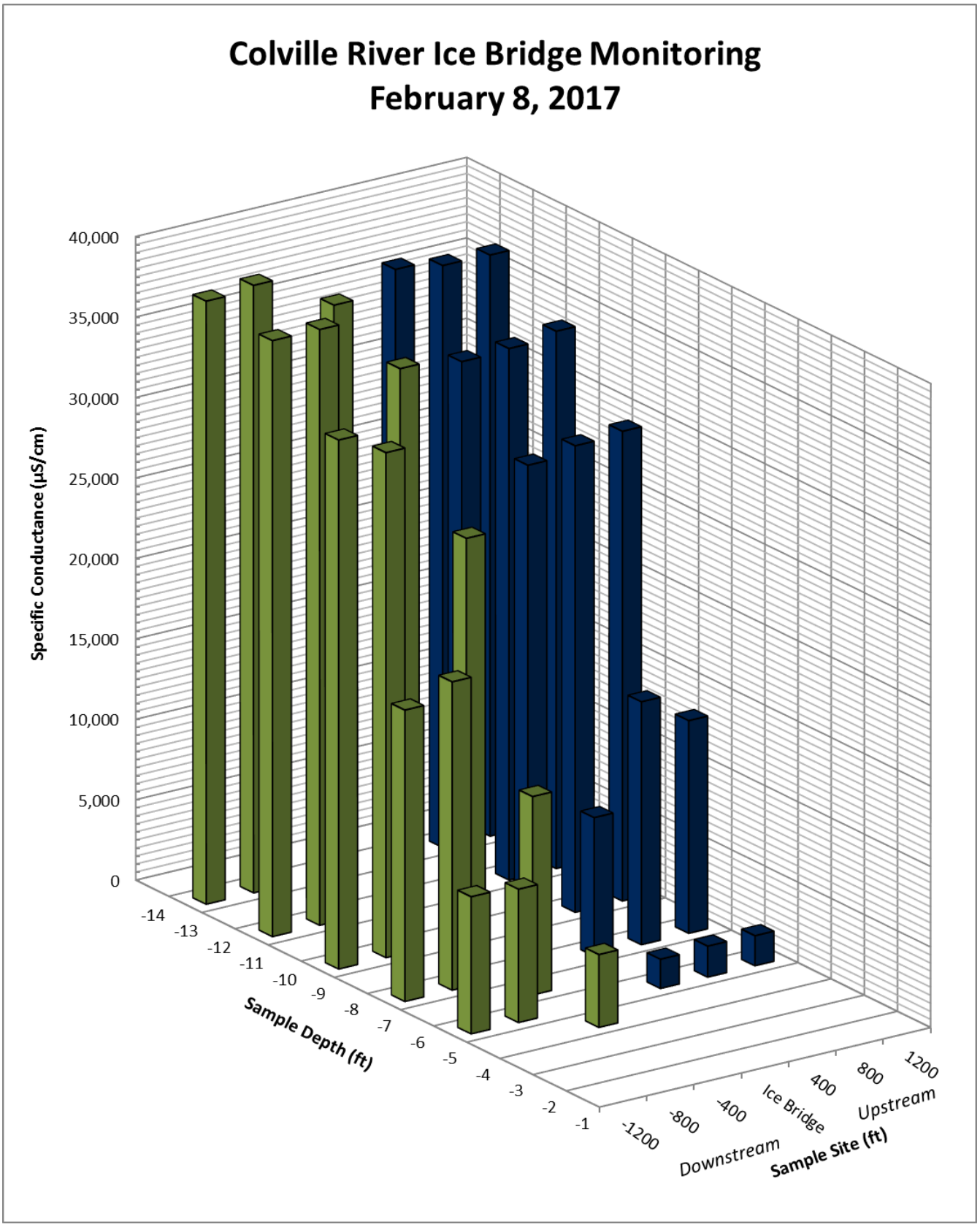
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:40 AM**	14.2	3.4	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	925	1814	8.18	56.3	0.9	-
					6	-	-	-	-	-	-	-
					7	0.0	4386	8600	8.47	59.6	4.0	-
					8	-	-	-	-	-	-	-
					9	0.1	14583	28485	8.37	64.4	16.5	-
					10	-	-	-	-	-	-	-
					11	0.2	16914	32912	8.50	66.9	19.3	-
					12	-	-	-	-	-	-	-
					13	0.2	18829	36638	9.08	72.6	21.6	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **10:20 AM**	14.5	3.6	0.7	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	980	1922	8.02	55.2	0.9	-
					6	-	-	-	-	-	-	-
					7	0.0	7698	15094	8.31	60.1	7.9	-
					8	-	-	-	-	-	-	-
					9	0.0	14786	28992	8.30	63.8	16.7	-
					10	-	-	-	-	-	-	-
					11	0.1	16906	33022	8.24	64.7	19.3	-
					12	-	-	-	-	-	-	-
					13	-0.1	18378	36174	8.54	67.6	21.3	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **10:05 AM**	14.6	3.7	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	951	1865	8.09	55.7	1.0	-
					6	-	-	-	-	-	-	-
					7	0.0	6742	13220	8.48	61.1	7.4	-
					8	-	-	-	-	-	-	-
					9	0.1	14944	29190	8.45	65.2	16.9	-
					10	-	-	-	-	-	-	-
					11	0.2	17164	33398	8.46	66.7	19.6	-
					12	-	-	-	-	-	-	-
					13	0.3	18635	36123	8.50	68.1	21.4	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **11:00 AM**	13.5	3.7	0.2	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-0.1	2298	4523	8.66	60.0	2.3	-
					5	-	-	-	-	-	-	-
					6	0.0	6286	12325	8.36	59.9	6.7	-
					7	-	-	-	-	-	-	-
					8	1.0	13958	26356	8.33	65.3	15.6	-
					9	-	-	-	-	-	-	-
					10	0.3	17998	34888	8.26	66.1	21.3	-
					11	-	-	-	-	-	-	-
					12	0.4	19069	36824	8.22	66.2	21.8	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **11:25 AM**	14.1	3.8	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	4224	8282	8.15	57.5	4.5	-
					6	-	-	-	-	-	-	-
					7	0.0	9767	19151	8.28	61.1	10.9	-
					8	-	-	-	-	-	-	-
					9	0.0	16003	31378	8.21	63.8	18.2	-
					10	-	-	-	-	-	-	-
					11	0.2	19024	37017	8.29	66.4	21.8	-
					12	-	-	-	-	-	-	-
					13	0.3	19476	37753	8.51	68.6	22.3	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:45 AM**	14.1	3.5	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	4344	8518	8.08	57.0	4.5	0.00
					6	-	-	-	-	-	-	-
					7	0.0	9232	18102	8.30	60.9	10.1	0.04
					8	-	-	-	-	-	-	-
					9	0.1	16826	32866	8.22	64.5	19.2	0.06
					10	-	-	-	-	-	-	-
					11	0.1	18958	37030	8.41	67.2	21.8	-0.03
					12	-	-	-	-	-	-	-
					13	0.2	19260	37477	8.60	69.0	22.1	-0.03
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 2/15/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -14 to -20°F, wind 0 to 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 14 at 5:00 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 15, Ms. Gillenwater attended UMIAQ's daily health and safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:32 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,945 microsiemens per centimeter (µS/cm) at 1,200 feet upstream to a maximum of 39,845 µS/cm at 800 feet downstream.

DO saturation ranged between 54.0 percent (%) and 70.0%; average DO was 59.0%.

Velocities ranged from a minimum of 0.01 feet per second (ft/s) in the upstream direction at a depth of 13 feet to a maximum of 0.04 ft/s in the downstream direction at a depth of 5 feet; average velocity was 0.02 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 3.5 feet to 4.0 feet; average ice thickness was 3.8 feet. Snow depth ranged from 0.4 feet to 0.8 feet; average snow depth was 0.6 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, February 22, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

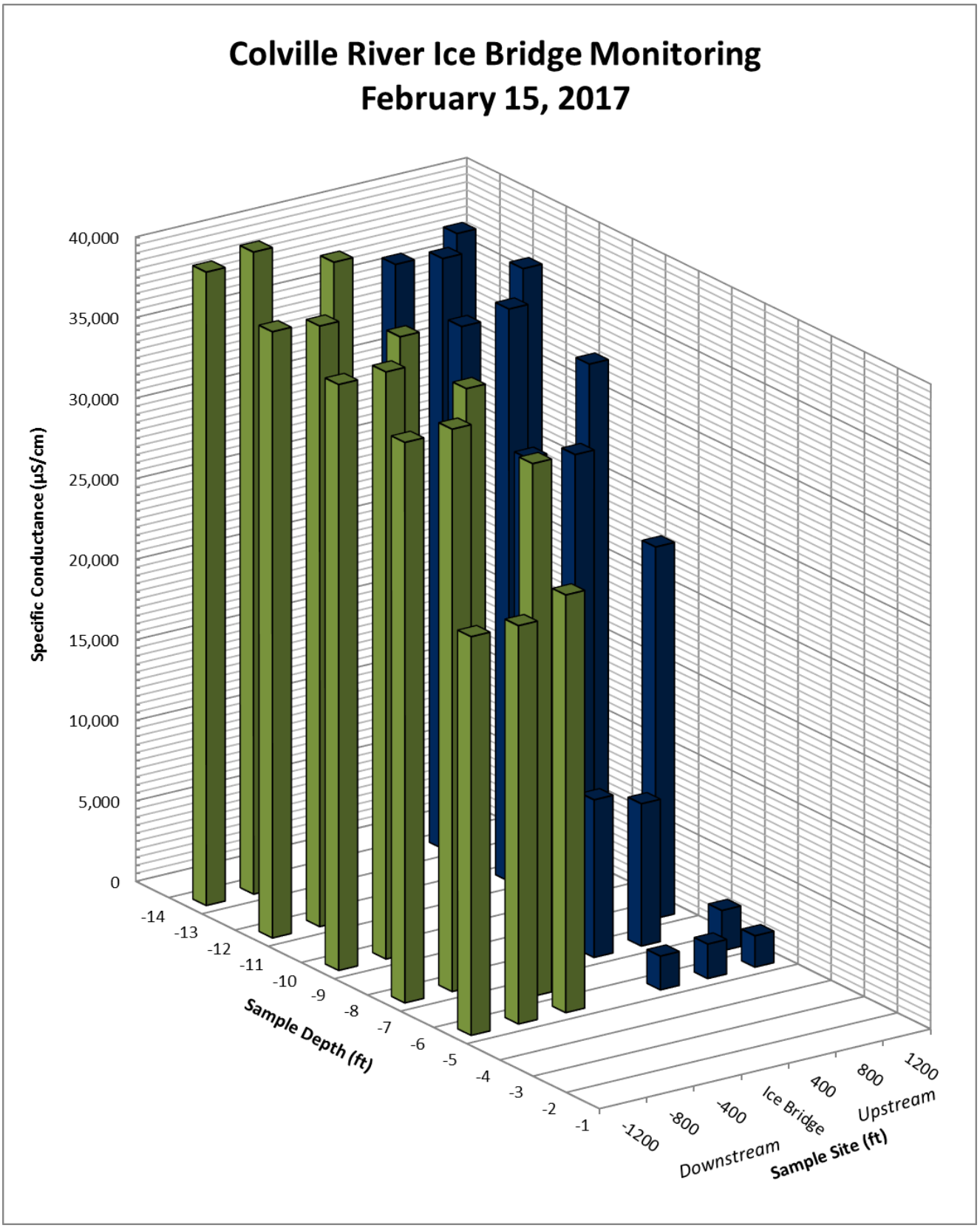
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:04 AM**	14.3	3.5	0.7	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1067	2092	8.04	55.4	1.0	-
					6	-	-	-	-	-	-	-
					7	0.0	4987	9778	7.68	54.5	5.3	-
					8	-	-	-	-	-	-	-
					9	0.1	14824	28955	7.60	58.6	16.7	-
					10	-	-	-	-	-	-	-
					11	0.1	17983	35126	7.70	61.0	20.7	-
					12	-	-	-	-	-	-	-
					13	0.1	18928	36972	7.56	60.4	21.8	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:51 AM**	14.4	3.6	0.8	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1089	2135	7.93	54.6	1.0	-
					6	-	-	-	-	-	-	-
					7	0.0	4503	8829	7.67	54.2	4.7	-
					8	-	-	-	-	-	-	-
					9	0.2	14640	28487	7.44	57.4	16.5	-
					10	-	-	-	-	-	-	-
					11	0.0	18109	35508	7.74	61.3	21.0	-
					12	-	-	-	-	-	-	-
					13	0.2	18827	36634	7.66	61.3	21.7	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:32 AM**	14.7	4.0	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	992	1945	7.98	54.9	0.9	-
					6	0.0	1278	2506	7.82	54.0	1.3	-
					7	-	-	-	-	-	-	-
					8	0.1	11803	23055	7.83	58.9	13.3	-
					9	-	-	-	-	-	-	-
					10	0.1	16583	32391	8.00	62.6	18.9	-
					11	-	-	-	-	-	-	-
					12	0.1	18588	36308	8.22	65.5	21.4	-
					13	-	-	-	-	-	-	-
					14	0.3	18818	36477	8.73	70.0	21.6	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:19 AM**	13.3	3.9	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.1	13163	25909	7.60	57.5	14.8	-
					6	-0.1	16790	33049	7.61	59.3	19.1	-
					7	-	-	-	-	-	-	-
					8	-0.1	18133	35692	7.58	59.9	21.0	-
					9	-	-	-	-	-	-	-
					10	0.1	18890	36897	7.46	59.6	21.8	-
					11	-	-	-	-	-	-	-
					12	0.3	20386	39517	7.37	59.9	23.5	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:37 AM**	14.0	4.0	0.4	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.1	12553	24709	7.68	57.8	14.1	-
					6	-	-	-	-	-	-	-
					7	-0.1	17723	34885	7.60	59.8	20.5	-
					8	-	-	-	-	-	-	-
					9	-0.1	18506	36426	7.54	59.7	21.4	-
					10	-	-	-	-	-	-	-
					11	0.1	19078	37265	7.43	59.5	22.1	-
					12	-	-	-	-	-	-	-
					13	0.0	20321	39845	7.61	61.4	23.7	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **10:53 AM**	13.8	3.5	0.7	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.1	12563	24728	7.70	58.0	14.1	0.04
					6	-	-	-	-	-	-	-
					7	-0.1	17663	34767	7.59	59.7	20.4	0.01
					8	-	-	-	-	-	-	-
					9	-0.1	18467	36350	7.52	59.6	21.4	0.03
					10	-	-	-	-	-	-	-
					11	0.0	19183	37614	7.29	58.3	22.3	0.03
					12	-	-	-	-	-	-	-
					13	0.1	20123	39306	6.84	55.2	23.2	-0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 2/22/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -38°F, wind 0 to 10 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 21 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 22, Ms. Runa attended UMIAQ's daily health and safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:45 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,937 microsiemens per centimeter (µS/cm) at 800 feet upstream to a maximum of 37,697 µS/cm at 1,200 feet downstream.

DO saturation ranged between 48.7 percent (%) and 62.9%; average DO was 55.2%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at depths of 9 and 7 feet to a maximum of 0.05 ft/s in the downstream direction at a depth of 5 feet; average velocity was 0.01 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 3.7 feet to 4.2 feet; average ice thickness was 4.0 feet. Snow depth ranged from 0.5 feet to 0.9 feet; average snow depth was 0.6 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, March 1, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

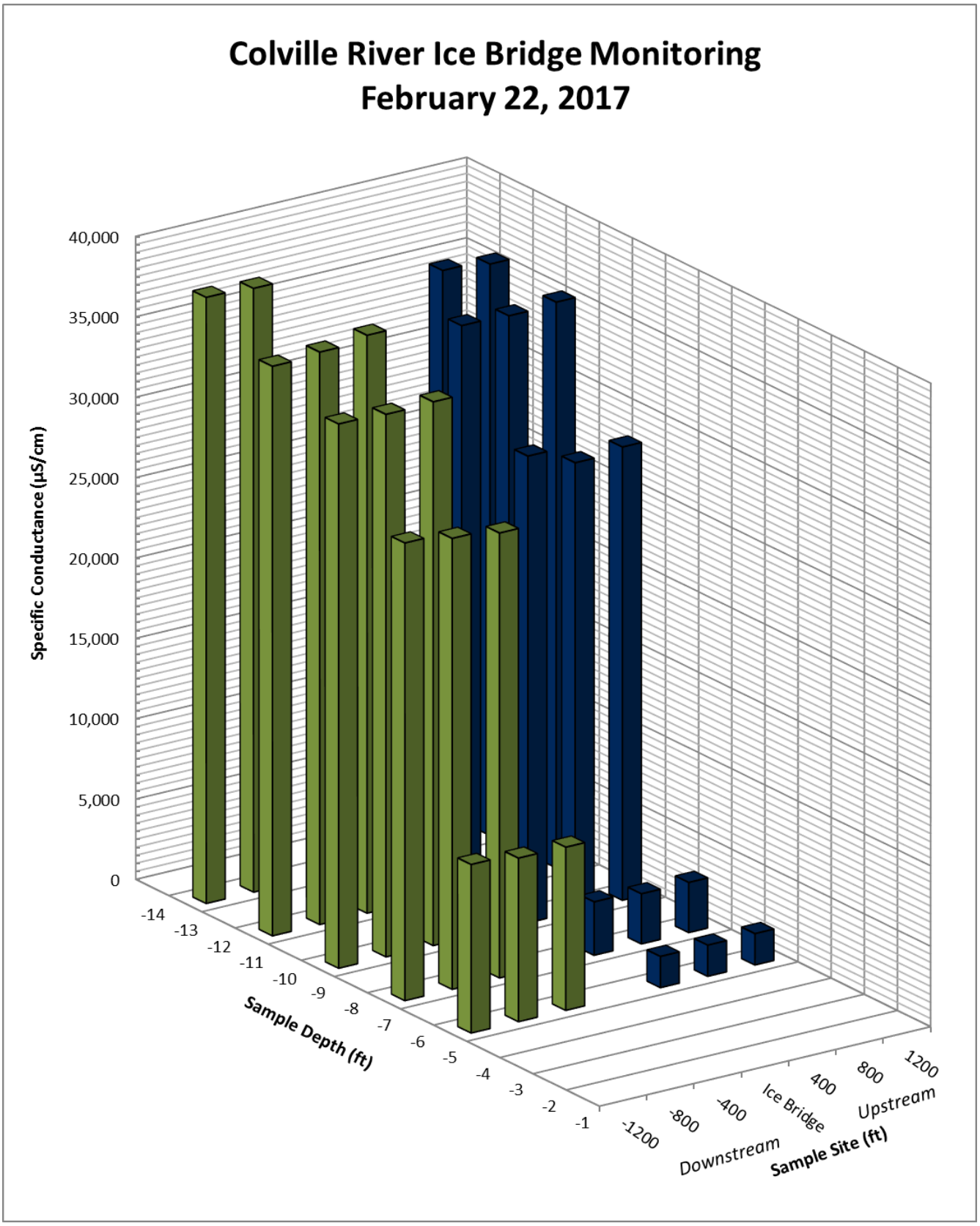
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:20 AM**	12.9	3.7	0.8	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	990	1941	7.95	54.7	0.9	-
					6	-	-	-	-	-	-	-
					7	0.2	1707	3322	7.27	50.6	1.7	-
					8	-	-	-	-	-	-	-
					9	0.2	14920	29032	7.31	56.5	16.8	-
					10	-	-	-	-	-	-	-
					11	0.7	18401	35135	7.16	57.7	20.8	-
					12	-	-	-	-	-	-	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **10:05 AM**	13.8	4.0	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	988	1937	7.83	53.9	0.9	-
					6	-	-	-	-	-	-	-
					7	0.1	1596	3117	7.02	48.7	1.6	-
					8	-	-	-	-	-	-	-
					9	0.1	14291	27914	7.37	56.5	16.0	-
					10	-	-	-	-	-	-	-
					11	0.3	18078	35043	7.27	57.9	20.6	-
					12	-	-	-	-	-	-	-
					13	0.5	18637	35854	7.14	57.4	21.2	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:45 AM**	14.4	4.1	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	994	1949	7.74	53.3	0.9	-
					6	-	-	-	-	-	-	-
					7	0.1	1596	3117	7.22	50.1	1.6	-
					8	-	-	-	-	-	-	-
					9	0.2	14488	28191	7.69	59.2	16.2	-
					10	-	-	-	-	-	-	-
					11	0.3	18155	35192	7.70	61.3	20.6	-
					12	-	-	-	-	-	-	-
					13	0.6	18548	35549	7.81	62.9	21.0	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:40 AM**	13.1	4.2	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5174	10145	7.46	53.0	5.4	-
					6	-	-	-	-	-	-	-
					7	0.1	14164	27666	7.27	55.8	16.0	-
					8	-	-	-	-	-	-	-
					9	0.1	17311	33813	7.25	57.1	19.8	-
					10	-	-	-	-	-	-	-
					11	0.3	18541	35941	6.97	55.7	21.2	-
					12	-	-	-	-	-	-	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:55 AM**	13.8	4.2	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5187	10171	7.32	52.0	5.4	-
					6	-	-	-	-	-	-	-
					7	0.0	14298	28035	7.18	55.0	16.2	-
					8	-	-	-	-	-	-	-
					9	0.0	17206	33737	7.10	55.8	19.8	-
					10	-	-	-	-	-	-	-
					11	0.3	18365	35599	6.72	53.7	21.0	-
					12	-	-	-	-	-	-	-
					13	0.7	19667	37553	6.72	54.8	22.4	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:15 AM**	13.8	3.7	0.9	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5344	10478	7.33	52.2	5.7	0.05
					6	-	-	-	-	-	-	-
					7	0.0	14512	28455	7.25	55.6	16.4	0.00
					8	-	-	-	-	-	-	-
					9	0.2	17392	33842	7.08	55.9	19.8	0.00
					10	-	-	-	-	-	-	-
					11	0.3	18273	35421	6.54	52.2	20.9	0.02
					12	-	-	-	-	-	-	-
					13	0.4	19521	37697	6.88	55.6	22.4	-0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 3/1/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -25 to -12°F, wind 15 to 25 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 28 at 5:45 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 1, Ms. Gillenwater attended UMIAQ's daily health and safety meeting. After sampling at the ASRC Minesite 2005 Cell, UMIAQ and Michael Baker personnel traveled to the Colville River via Hägglund tracked vehicle and began sampling at 3:04 PM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 and YSI ProPlus meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI Pro1030 and YSI ProPlus meters were calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,792 microsiemens per centimeter (µS/cm) at 400 feet upstream to a maximum of 38,516 µS/cm at 1,200 feet downstream.

DO saturation ranged between 50.5 percent (%) and 62.3%; average DO was 58.0%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 9 feet to a maximum of 0.03 ft/s in the downstream direction at depths of 11 and 5 feet; average velocity was 0.01 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 3.8 feet to 4.3 feet; average ice thickness was 4.2 feet. Snow depth ranged from 0.5 feet to 2.0 feet; average snow depth was 0.8 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, March 8, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

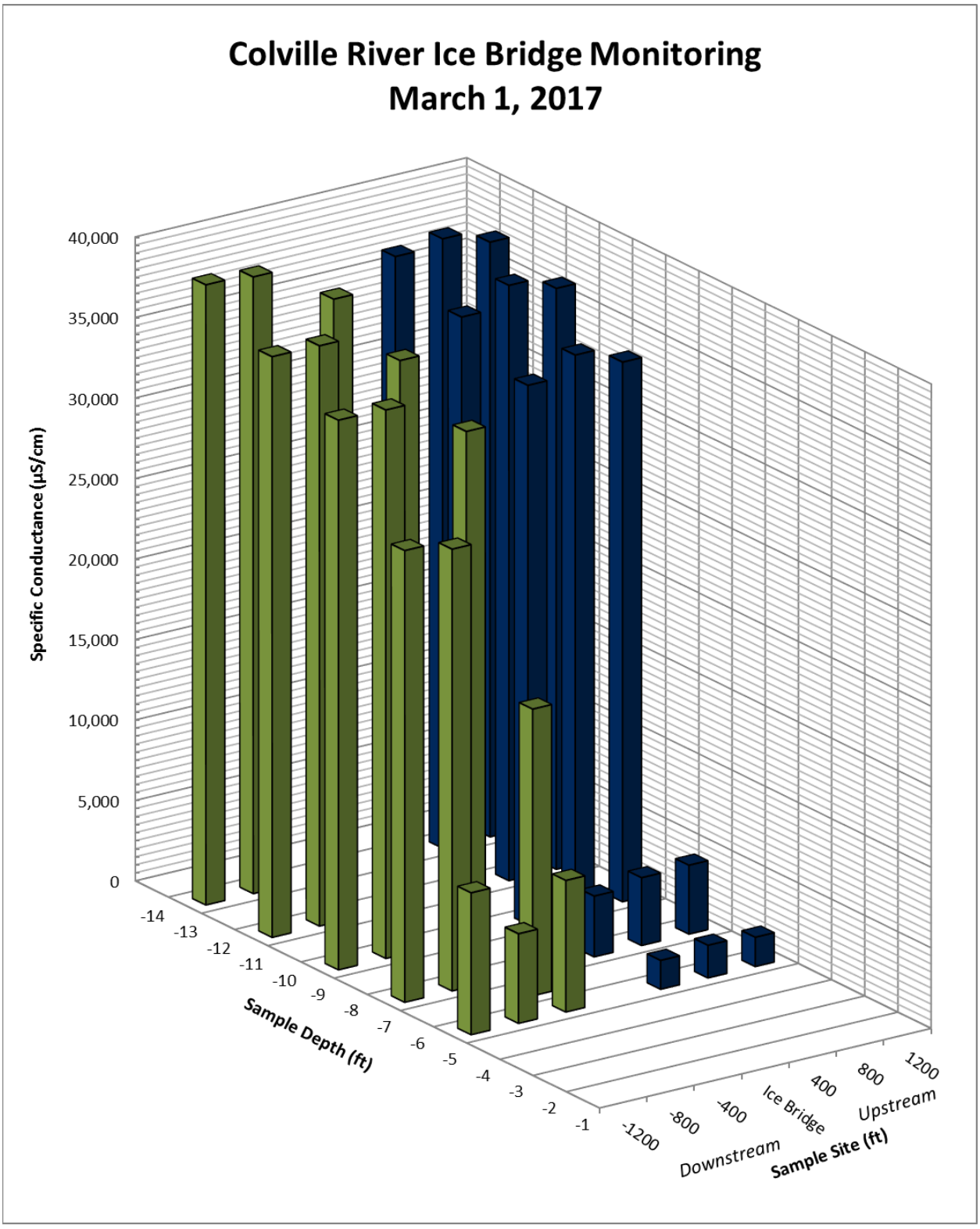
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **3:50 PM**	13.8	3.8	0.7	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	914	1792	8.59	59.1	0.9	-
					6	-	-	-	-	-	-	-
					7	0.0	1924	3773	7.59	52.6	1.9	-
					8	-	-	-	-	-	-	-
					9	-0.1	17009	33480	7.80	61.0	19.6	-
					10	-	-	-	-	-	-	-
					11	0.0	18213	35712	7.61	60.3	21.0	-
					12	-	-	-	-	-	-	-
					13	0.0	19105	37461	6.91	55.2	22.1	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **3:26 PM**	14.0	4.2	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1033	2025	8.57	59.0	0.9	-
					6	-	-	-	-	-	-	-
					7	0.1	2155	4209	7.26	50.5	2.1	-
					8	-	-	-	-	-	-	-
					9	0.0	17675	34657	7.37	58.1	20.3	-
					10	-	-	-	-	-	-	-
					11	0.1	18930	36976	7.14	57.0	21.8	-
					12	-	-	-	-	-	-	-
					13	0.2	19457	37860	7.01	56.4	22.4	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **3:04 PM**	14.1	4.2	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	928	1820	8.18	56.2	0.7	-
					6	-	-	-	-	-	-	-
					7	0.1	2191	4280	7.29	50.6	1.7	-
					8	-	-	-	-	-	-	-
					9	0.2	17225	33517	8.03	61.6	15.6	-
					10	-	-	-	-	-	-	-
					11	0.2	18546	36087	7.79	60.7	17.9	-
					12	-	-	-	-	-	-	-
					13	0.4	19134	36950	7.08	56.7	21.1	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **4:24 PM**	12.9	4.3	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	4166	8169	7.85	55.3	4.3	-
					6	0.0	9079	17802	7.78	57.1	10.0	-
					7	-	-	-	-	-	-	-
					8	0.0	16844	33027	7.79	61.0	19.3	-
					9	-	-	-	-	-	-	-
					10	0.0	18065	35422	7.67	60.7	20.9	-
					11	-	-	-	-	-	-	-
					12	0.2	19130	37224	7.38	59.3	22.2	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **4:53 PM**	13.4	4.3	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.1	2826	5563	8.08	56.2	2.8	-
					6	-	-	-	-	-	-	-
					7	0.0	13989	27429	7.80	59.6	15.8	-
					8	-	-	-	-	-	-	-
					9	0.1	17437	34059	7.75	61.1	20.0	-
					10	-	-	-	-	-	-	-
					11	0.1	18449	36036	7.47	59.4	21.2	-
					12	-	-	-	-	-	-	-
					13	0.2	19685	38304	7.73	62.3	22.7	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **5:20 PM**	13.5	4.2	2.0	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	4493	8810	8.11	57.3	4.6	0.03
					6	-	-	-	-	-	-	-
					7	0.1	14358	28045	7.97	61.2	16.1	0.01
					8	-	-	-	-	-	-	-
					9	0.1	17473	34130	7.83	61.6	19.7	0.00
					10	-	-	-	-	-	-	-
					11	0.1	18463	36063	7.52	59.6	20.6	0.03
					12	-	-	-	-	-	-	-
					13	0.2	19794	38516	6.81	54.5	21.6	-0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 3/8/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Bass	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -15 to -8°F, wind 15 to 20 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 7 at 5:45 PM and coordinated with UMIAQ to schedule transportation support. At 9:15 AM on Wednesday, March 8, Ms. Gillenwater and Mr. Bass conducted a toolbox safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 10:51 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI ProPlus meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI ProPlus meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 1,973 microsiemens per centimeter (µS/cm) at 800 feet downstream to a maximum of 37,958 µS/cm at 1,200 feet downstream.

DO saturation ranged between 50.9 percent (%) and 65.7%; average DO was 58.2%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at depths of 9 and 11 feet to a maximum of 0.01 ft/s at depths of 5, 7, and 13 feet in the downstream direction; average velocity was 0.01 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 4.0 feet to 4.5 feet; average ice thickness was 4.4 feet. Snow depth ranged from 0.4 feet to 0.5 feet; average snow depth was 0.5 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, March 15, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

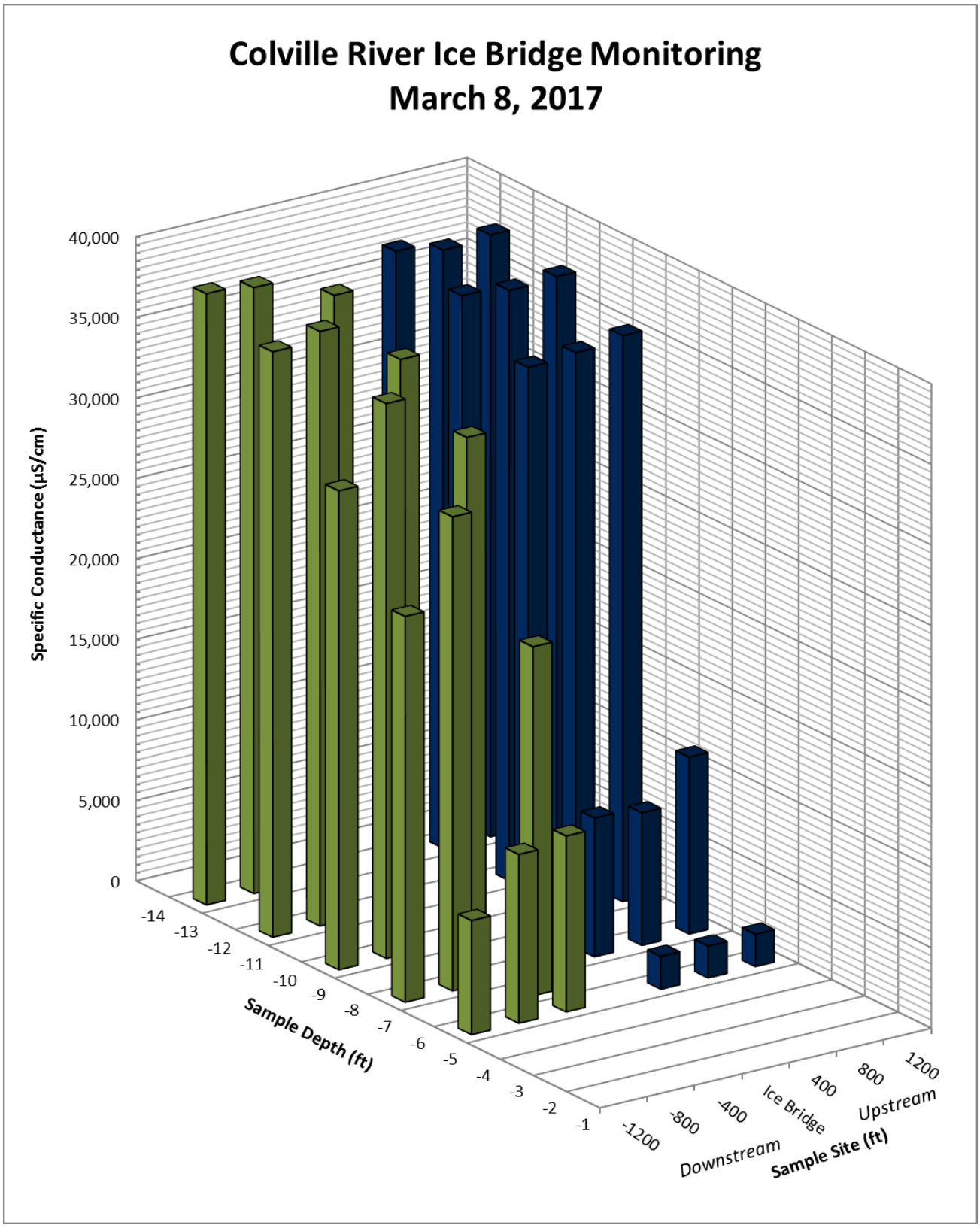
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **11:29 AM**	13.8	4.3	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1041	2041	8.86	61.0	1.0	-
					6	-	-	-	-	-	-	-
					7	0.1	4413	8620	7.18	50.9	4.8	-
					8	-	-	-	-	-	-	-
					9	0.1	17707	34587	7.34	58.0	20.3	-
					10	-	-	-	-	-	-	-
					11	0.2	19032	37033	7.14	57.2	21.9	-
					12	-	-	-	-	-	-	-
					13	0.4	19562	37776	6.81	55.1	22.4	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **11:11 AM**	14.1	4.0	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1006	1973	9.22	63.5	1.0	-
					6	-	-	-	-	-	-	-
					7	0.2	4231	8233	7.25	51.4	4.4	-
					8	-	-	-	-	-	-	-
					9	0.2	17884	34799	7.47	59.3	20.5	-
					10	-	-	-	-	-	-	-
					11	0.4	18986	36664	7.32	58.9	21.6	-
					12	-	-	-	-	-	-	-
					13	1.0	19676	37153	7.36	60.4	22.2	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **10:51 AM**	14.1	4.3	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1019	1998	8.93	61.5	1.0	-
					6	-	-	-	-	-	-	-
					7	0.2	5645	10984	7.51	53.8	5.9	-
					8	-	-	-	-	-	-	-
					9	0.2	18067	35155	7.88	62.6	20.7	-
					10	-	-	-	-	-	-	-
					11	0.4	19058	36803	7.82	63.0	21.8	-
					12	-	-	-	-	-	-	-
					13	0.6	19512	37397	8.09	65.7	22.2	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **11:47 AM**	13.0	4.5	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5568	10918	8.07	57.5	5.8	-
					6	0.1	11091	21664	7.36	55.0	12.3	-
					7	-	-	-	-	-	-	-
					8	0.2	16778	32647	7.53	59.2	19.1	-
					9	-	-	-	-	-	-	-
					10	0.4	18371	35476	7.41	59.3	20.9	-
					11	-	-	-	-	-	-	-
					12	0.8	19690	37456	7.41	60.5	22.2	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **12:04 PM**	13.8	4.5	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5347	10484	7.68	54.6	5.6	-
					6	-	-	-	-	-	-	-
					7	0.1	15066	29428	7.35	56.8	17.0	-
					8	-	-	-	-	-	-	-
					9	0.2	17704	34449	7.41	58.7	20.3	-
					10	-	-	-	-	-	-	-
					11	0.3	19044	36916	7.28	58.5	21.8	-
					12	-	-	-	-	-	-	-
					13	0.6	19635	37632	7.12	57.9	22.4	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **12:22 PM**	13.9	4.5	0.4	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	3611	7080	8.23	57.8	3.7	0.01
					6	-	-	-	-	-	-	-
					7	0.1	12261	23949	7.53	56.8	13.6	0.01
					8	-	-	-	-	-	-	-
					9	0.1	15225	29739	7.47	57.8	17.2	0.00
					10	-	-	-	-	-	-	-
					11	0.3	18754	36353	7.28	58.3	21.5	0.00
					12	-	-	-	-	-	-	-
					13	0.4	19656	37958	6.83	55.3	22.6	0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 3/15/2017
MICHAEL BAKER FIELD PERSONNEL: G. Yager	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -20°F, wind 10 to 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 14 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 15, Mr. Yager attended the UMIAQ morning toolbox safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:30 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI ProPlus meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI ProPlus meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 2,031 microsiemens per centimeter (µS/cm) at 800 feet upstream to a maximum of 37,675 µS/cm at 1,200 feet downstream.

DO saturation ranged between 51.7 percent (%) and 63.7%; average DO was 56.3%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 11 feet to a maximum of 0.02 ft/s at a depth of 5 feet in the downstream direction; average velocity was 0.01 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 4.1 feet to 4.5 feet; average ice thickness was 4.3 feet. Snow depth ranged from 0.5 feet to 0.8 feet; average snow depth was 0.6 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, March 22, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

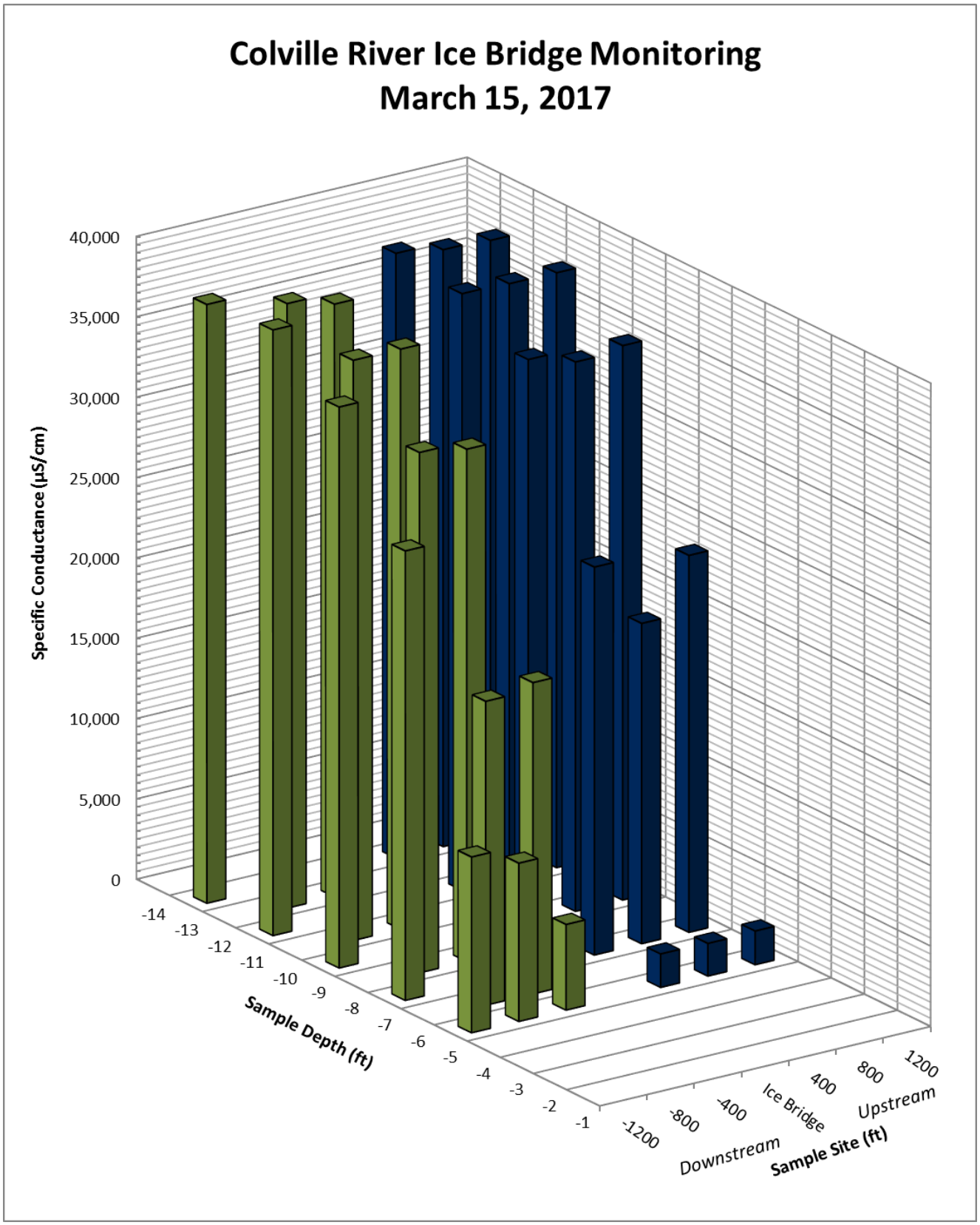
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:20 AM**	13.7	4.3	0.8	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1061	2080	9.25	63.7	1.0	-
					6	-	-	-	-	-	-	-
					7	0.2	12403	24134	6.86	51.9	13.7	-
					8	-	-	-	-	-	-	-
					9	0.2	18003	35031	7.11	56.5	20.7	-
					10	-	-	-	-	-	-	-
					11	0.4	19222	37120	6.94	55.9	22.0	-
					12	-	-	-	-	-	-	-
					13	0.7	19703	37621	6.85	55.8	22.3	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:58 AM**	14.0	4.1	0.6	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1036	2031	9.10	62.7	1.0	-
					6	-	-	-	-	-	-	-
					7	0.2	10240	19925	7.07	52.5	11.0	-
					8	-	-	-	-	-	-	-
					9	0.4	17698	34177	7.73	61.5	20.1	-
					10	-	-	-	-	-	-	-
					11	0.4	19179	37037	7.22	58.2	21.9	-
					12	-	-	-	-	-	-	-
					13	0.8	19526	37144	7.07	57.7	22.2	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:30 AM**	14.2	4.5	0.6	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1070	2098	8.99	61.9	1.0	-
					6	-	-	-	-	-	-	-
					7	0.1	12006	23451	7.00	52.7	13.3	-
					8	-	-	-	-	-	-	-
					9	0.2	17726	34492	6.98	55.3	20.2	-
					10	-	-	-	-	-	-	-
					11	0.7	19385	37014	6.36	51.7	22.0	-
					12	-	-	-	-	-	-	-
					13	0.8	19461	37021	6.53	53.3	22.2	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **11:15 AM**	12.9	4.5	0.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.5	2664	5326	8.82	60.6	2.7	-
					6	0.2	9950	19361	7.24	53.7	10.9	-
					7	-	-	-	-	-	-	-
					8	0.4	16502	31867	7.29	57.4	18.6	-
					9	-	-	-	-	-	-	-
					10	0.6	18825	36080	7.02	56.6	21.3	-
					11	-	-	-	-	-	-	-
					12	1.6	19960	36870	6.49	54.0	22.0	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **11:45 AM**	13.4	4.5	0.5	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5020	9843	7.89	56.0	5.2	-
					6	0.2	9715	18904	7.19	53.2	10.5	-
					7	-	-	-	-	-	-	-
					8	0.5	16823	32364	7.26	57.5	19.0	-
					9	-	-	-	-	-	-	-
					10	0.8	18972	36090	7.01	56.9	21.4	-
					11	-	-	-	-	-	-	-
					12	1.2	20063	37605	6.70	55.3	22.4	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **12:10 PM**	14.3	4.1	0.8	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5575	10931	7.80	55.6	5.9	0.02
					6	-	-	-	-	-	-	-
					7	0.3	14420	27952	7.36	56.8	16.1	0.01
					8	-	-	-	-	-	-	-
					9	0.5	18136	34890	7.03	56.2	20.3	0.01
					10	-	-	-	-	-	-	-
					11	0.8	19805	37675	6.62	54.1	22.4	0.00
					12	-	-	-	-	-	-	-
					13	1.4	20020	37251	6.60	54.7	22.3	0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 3/22/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -10 to 5°F, wind 5 to 10 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 21 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 22, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:47 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI ProPlus meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI ProPlus meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 2,684 microsiemens per centimeter (µS/cm) at 800 feet upstream to a maximum of 37,872 µS/cm at 800 feet downstream.

DO saturation ranged between 49.1 percent (%) and 63.1%; average DO was 53.0%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 7 feet to a maximum of 0.03 ft/s at a depth of 11 feet in the downstream direction; average velocity was 0.01 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 4.0 feet to 4.7 feet; average ice thickness was 4.5 feet. Snow depth ranged from 0.8 feet to 1.6 feet; average snow depth was 1.0 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, March 29, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

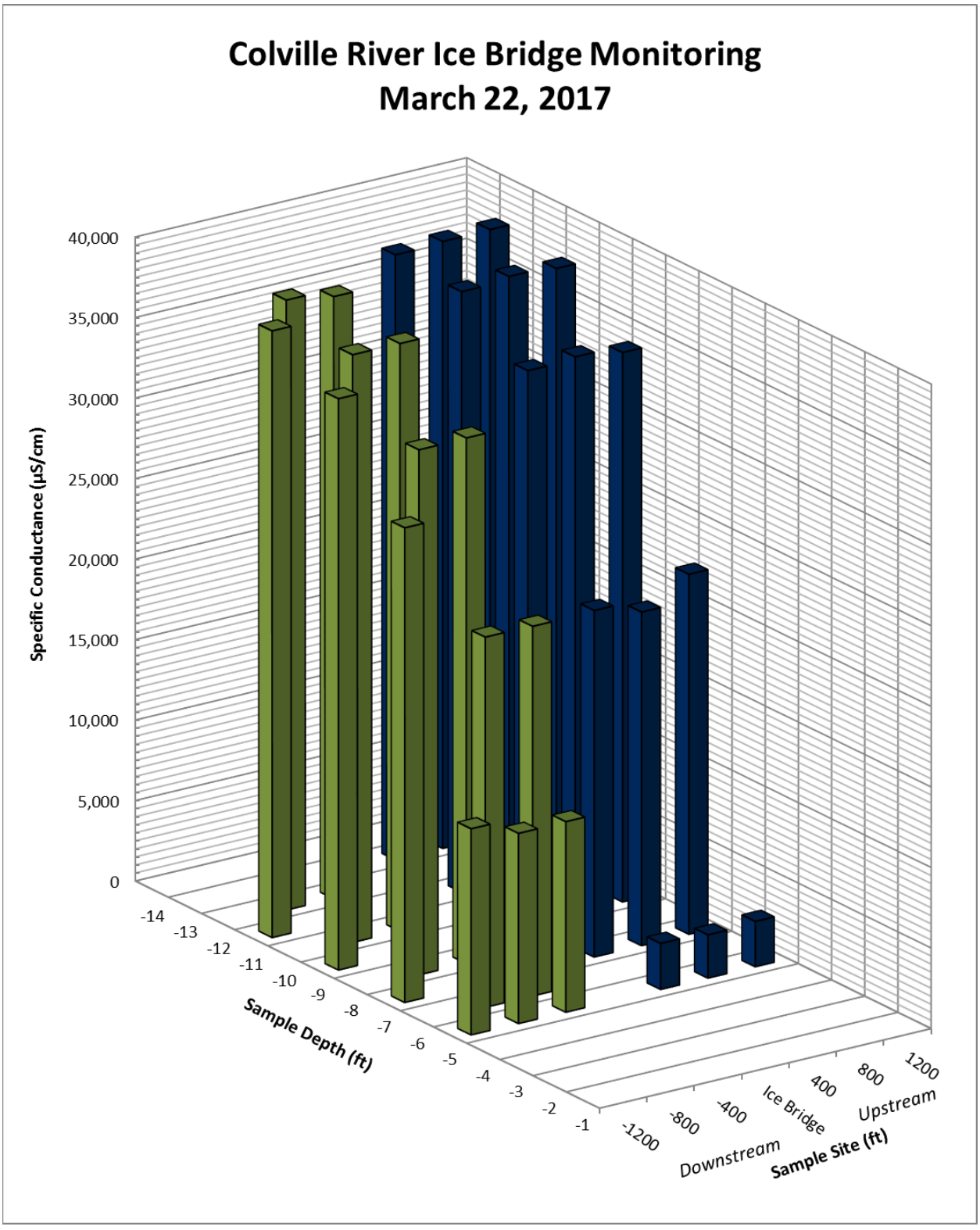
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:24 AM**	13.8	4.6	0.9	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1458	2859	8.73	60.3	1.4	-
					6	-	-	-	-	-	-	-
					7	0.2	11059	21519	6.70	50.2	12.2	-
					8	-	-	-	-	-	-	-
					9	0.3	17746	34399	6.50	51.7	20.4	-
					10	-	-	-	-	-	-	-
					11	0.5	19386	37295	6.16	49.9	22.3	-
					12	-	-	-	-	-	-	-
					13	0.6	19605	37575	6.04	49.1	22.5	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **10:07 AM**	13.8	4.5	0.8	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1369	2684	9.00	62.1	1.3	-
					6	-	-	-	-	-	-	-
					7	0.2	10646	20715	6.70	50.0	11.8	-
					8	-	-	-	-	-	-	-
					9	0.2	17756	34550	6.51	51.6	20.4	-
					10	-	-	-	-	-	-	-
					11	0.2	19289	37533	6.17	49.6	22.3	-
					12	-	-	-	-	-	-	-
					13	0.4	19522	37699	6.33	51.2	22.4	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:47 AM**	14.1	4.5	0.8	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1435	2814	9.14	63.1	1.4	-
					6	-	-	-	-	-	-	-
					7	0.2	11491	22360	6.61	49.7	12.7	-
					8	-	-	-	-	-	-	-
					9	0.7	17865	34112	6.37	51.2	20.4	-
					10	-	-	-	-	-	-	-
					11	0.7	19548	37325	6.09	49.5	22.1	-
					12	-	-	-	-	-	-	-
					13	0.9	19910	37734	6.00	49.1	22.2	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:40 AM**	13.2	4.7	0.9	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	6032	11827	7.79	55.7	6.4	-
					6	0.2	11793	22947	7.06	53.2	13.1	-
					7	-	-	-	-	-	-	-
					8	0.4	16897	32630	6.71	53.0	19.1	-
					9	-	-	-	-	-	-	-
					10	0.6	19034	36480	6.73	54.4	21.6	-
					11	-	-	-	-	-	-	-
					12	1.1	19872	37384	6.51	53.6	22.3	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:55 AM**	13.2	4.7	0.8	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	6021	11806	7.93	56.7	6.4	-
					6	0.1	11766	22982	6.94	52.1	13.0	-
					7	-	-	-	-	-	-	-
					8	0.4	16880	32597	6.72	53.1	19.1	-
					9	-	-	-	-	-	-	-
					10	0.5	18967	36489	6.75	54.4	21.6	-
					11	-	-	-	-	-	-	-
					12	0.6	19760	37872	6.37	51.8	22.6	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:11 AM**	14.3	4.0	1.6	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	6526	12796	7.46	53.6	7.0	0.01
					6	-	-	-	-	-	-	-
					7	0.2	15142	29464	7.00	54.3	17.1	0.00
					8	-	-	-	-	-	-	-
					9	0.2	18227	35467	6.67	53.1	20.9	-0.01
					10	-	-	-	-	-	-	-
					11	0.3	19432	37668	6.21	50.1	22.5	0.03
					12	-	-	-	-	-	-	-
					13	0.5	No Data, See Note 10					0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.
(10) Conductivity, specific conductance, and salinity were omitted after data analysis indicated measured conductivity value was erroneous.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 3/29/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -8 to -18°F, wind 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 28 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 29, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:16 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI ProPlus meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI ProPlus meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 3,210 microsiemens per centimeter (µS/cm) at 400 feet upstream to a maximum of 36,795 µS/cm at 1,200 feet downstream.

DO saturation ranged between 44.9 percent (%) and 64.3%; average DO was 49.3%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at a depth of 9 feet to a maximum of 0.06 ft/s at a depth of 7 feet in the downstream direction; average velocity was 0.02 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 4.3 feet to 4.9 feet; average ice thickness was 4.7 feet. Snow depth ranged from 0.7 feet to 2.0 feet; average snow depth was 1.0 foot.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next sampling event is scheduled for Wednesday, April 5, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

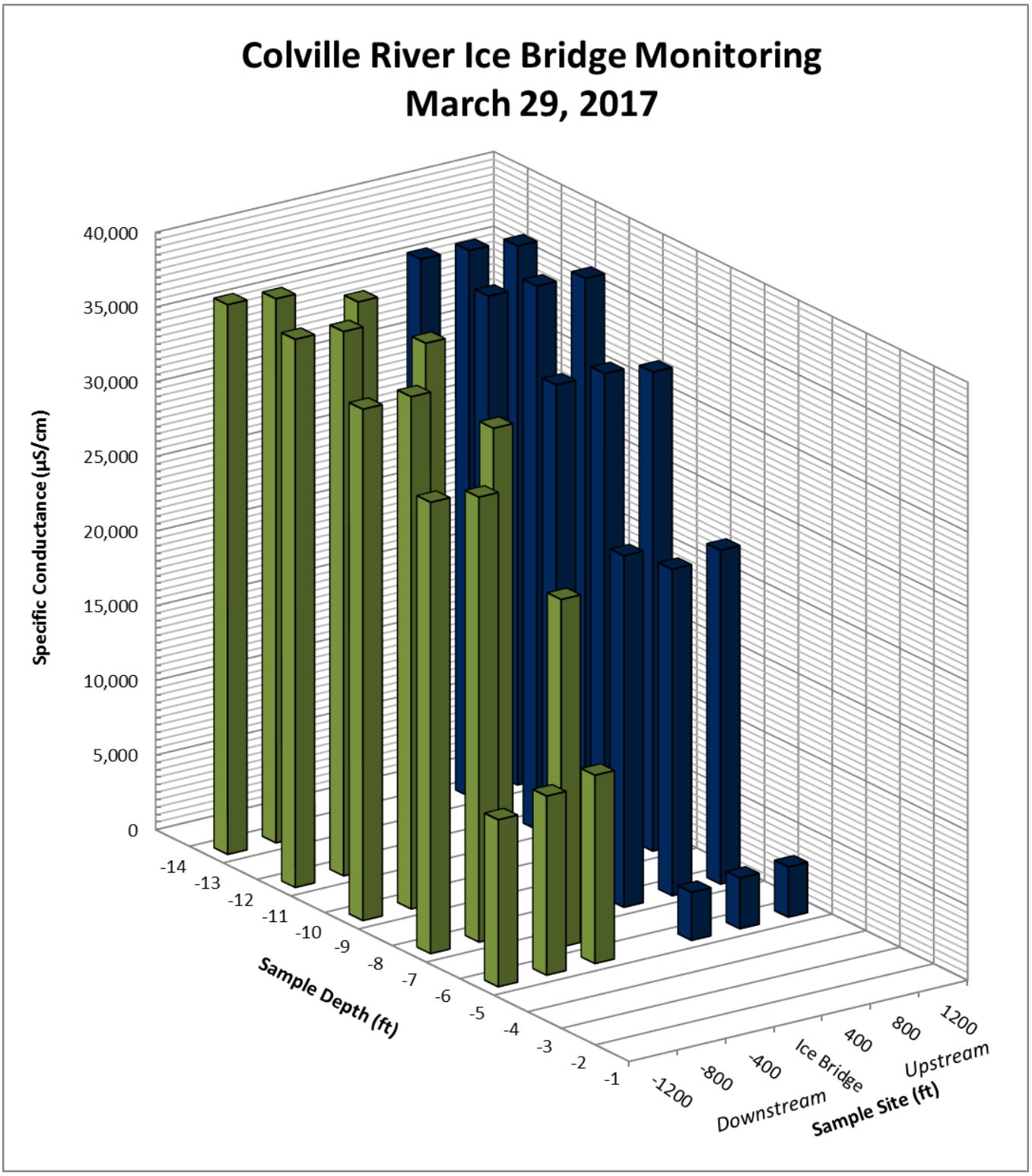
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **10:04 AM**	14.0	4.3	0.9	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1637	3210	9.30	64.3	1.6	-
					6	-	-	-	-	-	-	-
					7	0.2	12093	23531	6.43	48.6	13.4	-
					8	-	-	-	-	-	-	-
					9	0.2	16832	32752	6.23	49.0	19.2	-
					10	-	-	-	-	-	-	-
					11	0.3	18823	36487	5.84	46.8	21.6	-
					12	-	-	-	-	-	-	-
					13	0.3	18956	36745	5.60	44.9	21.7	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:42 AM**	14.0	4.7	0.7	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	1731	3394	8.55	59.2	1.7	-
					6	-	-	-	-	-	-	-
					7	0.1	11185	21847	6.26	46.9	12.7	-
					8	-	-	-	-	-	-	-
					9	0.2	16825	32739	6.27	49.3	19.2	-
					10	-	-	-	-	-	-	-
					11	0.3	18774	36392	5.93	47.5	21.5	-
					12	-	-	-	-	-	-	-
					13	0.4	18932	36560	5.73	46.1	21.6	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:16 AM**	14.3	4.6	0.9	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.1	1709	3364	8.85	61.1	1.7	-
					6	-	-	-	-	-	-	-
					7	0.1	11443	22351	-	-	12.8	-
					8	-	-	-	-	-	-	-
					9	0.3	16542	32066	6.26	49.2	18.8	-
					10	-	-	-	-	-	-	-
					11	0.6	18852	36132	5.56	44.9	21.4	-
					12	-	-	-	-	-	-	-
					13	0.8	18974	36094	5.56	45.1	21.4	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:29 AM**	13.2	4.9	0.8	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.2	6378	12603	8.12	57.9	6.8	-
					6	0.0	11861	23257	6.56	49.2	13.2	-
					7	-	-	-	-	-	-	-
					8	0.1	16640	32503	6.27	49.1	19.0	-
					9	-	-	-	-	-	-	-
					10	0.2	18493	35984	5.64	45.0	21.2	-
					11	-	-	-	-	-	-	-
					12	0.4	18922	36540	5.72	46.0	21.6	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:53 AM**	13.7	4.7	0.9	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-0.1	6088	11983	7.15	51.0	6.5	-
					6	-	-	-	-	-	-	-
					7	0.1	15243	29774	6.46	50.0	17.3	-
					8	-	-	-	-	-	-	-
					9	0.2	17617	34280	6.10	48.3	20.1	-
					10	-	-	-	-	-	-	-
					11	0.5	18938	36433	5.57	44.9	21.5	-
					12	-	-	-	-	-	-	-
					13	0.9	19218	36423	5.56	45.3	21.6	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:10 AM**	13.8	4.7	2.0	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5698	11173	7.04	50.2	6.0	0.04
					6	-	-	-	-	-	-	-
					7	0.2	15522	30203	6.38	49.6	17.5	0.06
					8	-	-	-	-	-	-	-
					9	0.4	17719	34217	6.15	48.9	20.1	0.00
					10	-	-	-	-	-	-	-
					11	0.4	18998	36687	5.68	45.7	21.6	0.01
					12	-	-	-	-	-	-	-
					13	0.6	19198	36795	5.81	47.0	21.8	-0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 4/5/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** -4 to 12°F, wind 30 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, April 4 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, April 5, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:19 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI ProPlus meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI ProPlus meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 3,971 microsiemens per centimeter (µS/cm) at 400 feet upstream to a maximum of 39,468 µS/cm at 800 feet downstream.

DO saturation ranged between 42.2 percent (%) and 63.0%; average DO was 46.7%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at depths of 7 and 9 feet to a maximum of 0.01 ft/s at depths of 11 and 13 feet in the downstream direction and 0.01 ft/s at a depth of 5 feet in the upstream direction; average velocity was 0.00 ft/s. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 4.7 feet to 5.0 feet; average ice thickness was 4.9 feet. Snow depth ranged from 0.5 feet to 1.9 feet; average snow depth was 0.9 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. The next and final sampling event is scheduled for Wednesday, April 12, 2017.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

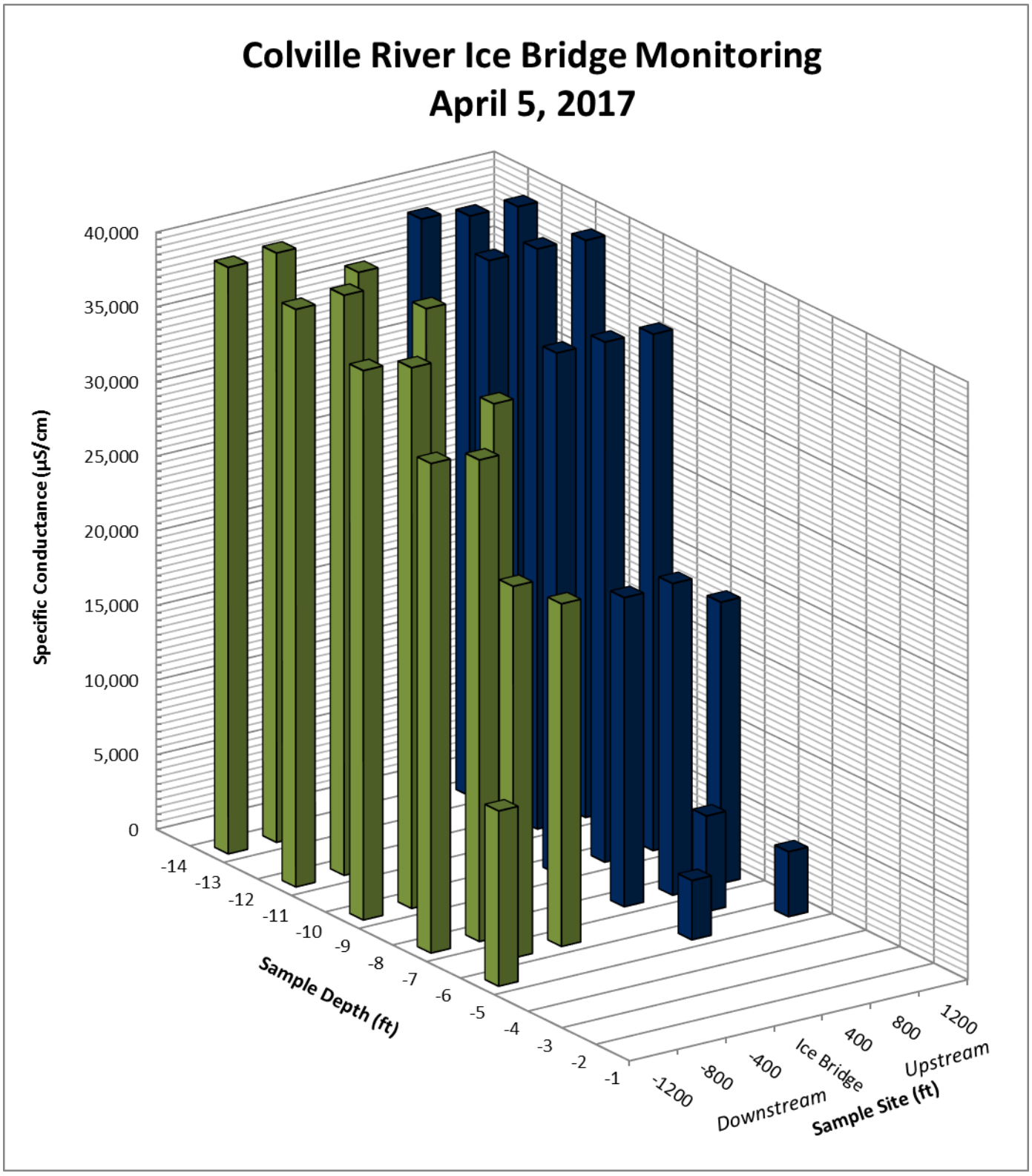
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **9:57 AM**	13.9	4.8	0.7	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	2025	3971	9.08	63.0	2.0	-
					6	-	-	-	-	-	-	-
					7	0.2	10639	20702	6.06	45.2	11.7	-
					8	-	-	-	-	-	-	-
					9	0.3	17987	34867	5.84	46.5	20.6	-
					10	-	-	-	-	-	-	-
					11	0.7	20347	38851	5.31	43.5	23.2	-
					12	-	-	-	-	-	-	-
					13	0.8	20727	39429	5.51	45.4	23.6	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:39 AM**	14.0	5.0	0.6	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-	-	-	-	-	-	-
					6	0.1	3282	6411	7.04	49.4	3.3	-
					7	0.3	10768	20873	5.94	44.5	11.9	-
					8	-	-	-	-	-	-	-
					9	0.3	17967	34828	6.02	47.9	20.5	-
					10	-	-	-	-	-	-	-
					11	0.7	20350	38857	5.26	43.1	23.2	-
					12	-	-	-	-	-	-	-
					13	1.0	20579	38858	5.39	44.5	23.2	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:19 AM**	14.2	4.7	0.9	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	2216	4345	8.77	60.9	2.2	-
					6	-	-	-	-	-	-	-
					7	0.4	9760	18848	5.94	44.2	10.6	-
					8	-	-	-	-	-	-	-
					9	0.5	17977	34584	5.97	47.7	20.4	-
					10	-	-	-	-	-	-	-
					11	0.9	20398	38659	5.12	42.2	23.1	-
					12	-	-	-	-	-	-	-
					13	1.7	21031	38708	5.03	42.3	23.1	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:22 AM**	13.3	5.0	0.8	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-	-	-	-	-	-	-
					6	0.1	11744	22939	6.35	47.7	13.0	-
					7	-	-	-	-	-	-	-
					8	0.3	17602	34120	6.10	48.4	20.1	-
					9	-	-	-	-	-	-	-
					10	0.3	19749	38282	5.61	45.3	22.7	-
					11	-	-	-	-	-	-	-
					12	1.0	20391	38503	5.69	46.9	23.0	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:41 AM**	13.7	5.0	0.5	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-	-	-	-	-	-	-
					6	0.1	12740	24885	6.19	46.9	14.2	-
					7	0.2	16569	32240	6.04	47.4	18.9	-
					8	-	-	-	-	-	-	-
					9	0.4	18748	36204	5.67	45.5	21.4	-
					10	-	-	-	-	-	-	-
					11	0.5	20193	38848	5.28	43.0	23.1	-
					12	-	-	-	-	-	-	-
					13	0.9	20825	39468	5.32	44.0	23.7	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **11:03 AM**	13.8	4.7	1.9	0.1	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	5981	11727	6.98	49.9	6.3	-0.01
					6	-	-	-	-	-	-	-
					7	0.3	16907	32773	6.11	48.2	19.2	0.00
					8	-	-	-	-	-	-	-
					9	0.5	19121	36785	5.69	45.9	21.8	0.00
					10	-	-	-	-	-	-	-
					11	0.8	20332	38678	5.19	42.6	23.1	0.01
					12	-	-	-	-	-	-	-
					13	1.0	20804	39282	5.16	42.6	23.0	0.01
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: 2016/2017 Alpine Ice Road Support Water Quality Sampling	**SAMPLING DATE:** 4/12/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: L. Hathaway	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Colville River Ice Bridge	**WEATHER:** 6 to 18°F, wind <15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, April 11 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, April 12, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. UMIAQ and Michael Baker personnel then traveled to the Colville River via Hägglund tracked vehicle and began sampling at 9:09 AM.

Ice thickness, snow depth, total water depth, and freeboard were measured and temperature, salinity, conductivity, and dissolved oxygen (DO) were recorded at locations 400, 800, and 1,200 feet both upstream and downstream of the ice bridge centerline. Specific conductance (SC) was calculated using water temperature and conductivity. The presence of flow was determined by recording water velocity at 1,200 feet downstream of the ice bridge centerline. All measurements were made from below the ice surface to the river bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI ProPlus meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. Water velocity was measured using a HACH FH950 velocity meter. The YSI ProPlus meter was calibrated for conductivity by Michael Baker personnel prior to sampling and the YSI ProODO meter was calibrated for DO by TTT Environmental and checked for accuracy prior to sampling.

2. COLVILLE RIVER WATER QUALITY RESULTS

At all sampling locations, SC ranged from a minimum of 4,265 microsiemens per centimeter (µS/cm) at 800 feet upstream to a maximum of 38,920 µS/cm at 1,200 feet downstream.

DO saturation ranged between 35.3 percent (%) and 61.8%; average DO was 44.5%.

Velocities ranged from a minimum of 0.00 feet per second (ft/s) at depths of 9 and 13 feet to a maximum of 0.04 ft/s at 6 feet in the downstream direction; average velocity was 0.01 ft/s in the downstream direction. The accuracy of the velocity measurements is +/- 0.05 ft/s.

Ice thickness ranged between 4.5 feet to 5.1 feet; average ice thickness was 4.9 feet. Snow depth ranged from 0.6 feet to 2.0 feet; average snow depth was 1.0 feet.

Water quality parameters upstream and downstream of the Colville River ice bridge are included in Table 1 and Table 2. Comparison of SC at all sample locations is presented in Graph 1. This was the final sampling event for the 2016/2017 ice road season.

Table 1: Water Quality Parameters Upstream of the Colville River Ice Bridge

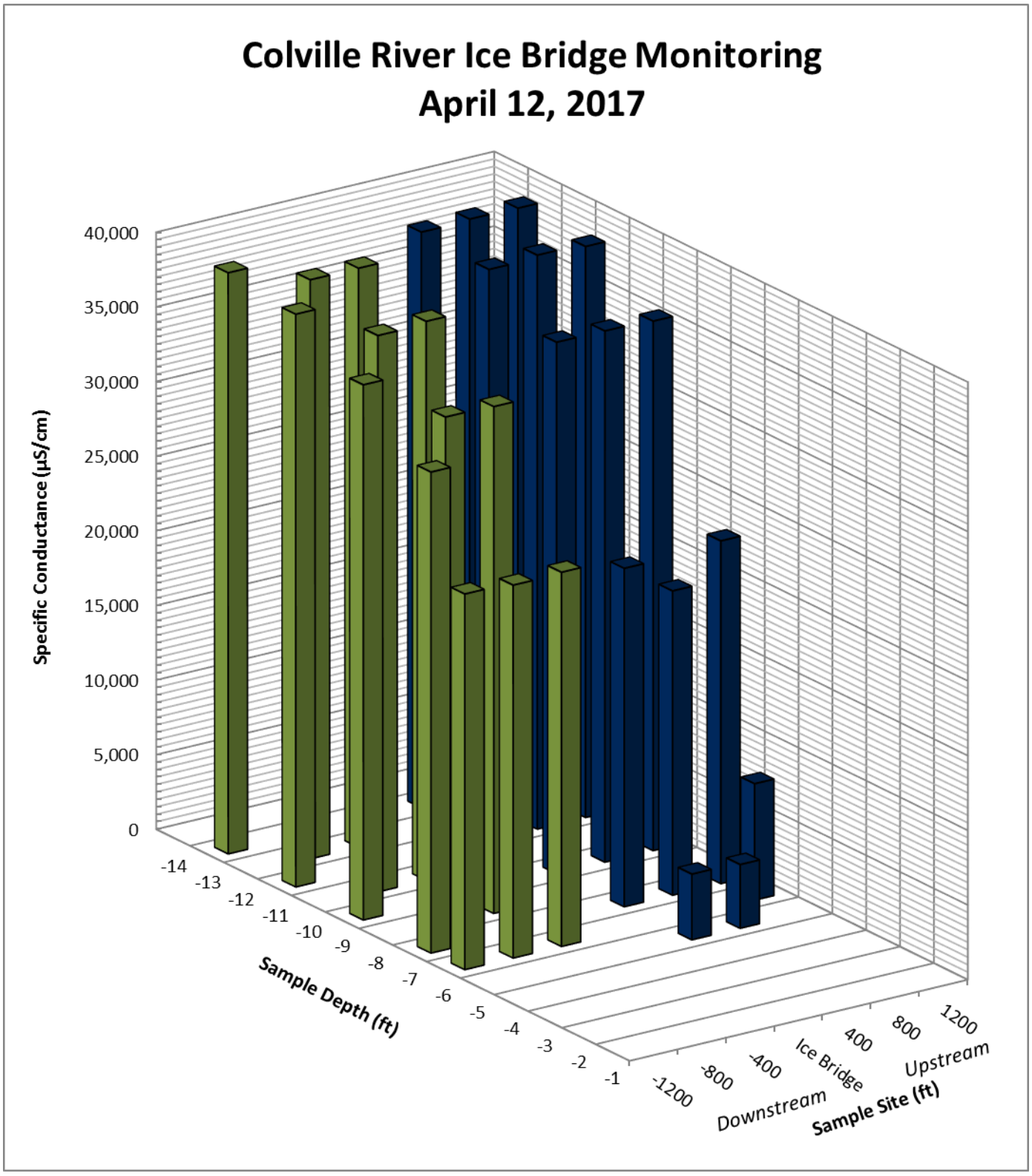
Upstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Upstream N70°14'13.4" W150°50'10.1" **9:55 AM**	13.9	4.6	0.6	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	2244	4400	8.90	61.8	2.2	-
					6	-	-	-	-	-	-	-
					7	0.4	11737	22665	5.42	41.0	12.9	-
					8	-	-	-	-	-	-	-
					9	0.1	18224	35597	5.70	45.3	21.1	-
					10	-	-	-	-	-	-	-
					11	0.0	19513	38261	4.96	39.8	22.8	-
					12	-	-	-	-	-	-	-
					13	0.4	19965	38554	4.72	38.3	23.0	-
					14	-	-	-	-	-	-	-
800-ft Upstream N70°14'09.8" W150°50'06.7" **9:36 AM**	13.9	4.5	0.8	0.4	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	0.0	2175	4265	8.64	60.0	2.2	-
					6	-	-	-	-	-	-	-
					7	0.4	10553	20379	5.66	42.4	11.5	-
					8	-	-	-	-	-	-	-
					9	0.4	18424	35579	5.98	47.9	21.0	-
					10	-	-	-	-	-	-	-
					11	0.3	19833	38445	5.08	41.1	22.9	-
					12	-	-	-	-	-	-	-
					13	0.4	20016	38653	4.90	39.8	23.0	-
					14	-	-	-	-	-	-	-
1200-ft Upstream N70°14'06.0" W150°50'02.8" **9:09 AM**	14.0	5.0	0.7	0.4	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-	-	-	-	-	-	-
					6	0.3	4022	7796	6.18	43.9	4.1	-
					7	0.5	11932	22955	5.66	43.0	13.1	-
					8	-	-	-	-	-	-	-
					9	0.6	18503	35463	5.87	47.2	20.9	-
					10	-	-	-	-	-	-	-
					11	0.9	20184	38253	5.20	42.7	22.8	-
					12	-	-	-	-	-	-	-
					13	1.0	20449	38612	5.05	41.6	22.8	-
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

Table 2: Water Quality Parameters Downstream of the Colville River Ice Bridge

Downstream Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	Velocity (ft/sec)
400-ft Downstream N70°14'21.1" W150°50'17.1" **10:14 AM**	12.8	5.1	0.8	0.3	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-	-	-	-	-	-	-
					6	0.1	12828	25057	5.82	44.1	14.3	-
					7	-	-	-	-	-	-	-
					8	0.2	17440	33935	5.70	45.1	19.9	-
					9	-	-	-	-	-	-	-
					10	0.2	19239	37436	5.40	43.4	22.2	-
					11	-	-	-	-	-	-	-
					12	0.3	20008	38784	5.46	44.2	23.0	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
800-ft Downstream N70°14'24.8" W150°50'20.6" **10:31 AM**	13.6	5.1	0.8	0.4	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-	-	-	-	-	-	-
					6	0.3	12880	24967	5.79	44.1	14.3	-
					7	-	-	-	-	-	-	-
					8	0.4	17612	34011	5.84	46.4	20.0	-
					9	-	-	-	-	-	-	-
					10	0.6	19439	37257	5.74	46.6	22.1	-
					11	-	-	-	-	-	-	-
					12	0.8	20387	38782	5.14	42.2	23.1	-
					13	-	-	-	-	-	-	-
					14	-	-	-	-	-	-	-
1200-ft Downstream N70°14'28.7" W150°50'24.2" **10:58 AM**	13.7	5.1	2.0	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	-	-	-	-	-	-	-
					5	-	-	-	-	-	-	-
					6	0.2	12924	25148	5.88	44.7	14.4	0.04
					7	0.3	16615	32207	5.87	46.2	18.9	0.01
					8	-	-	-	-	-	-	-
					9	0.4	18557	35835	5.75	46.1	21.2	0.00
					10	-	-	-	-	-	-	-
					11	0.5	19937	38355	5.04	41.0	22.8	0.01
					12	-	-	-	-	-	-	-
					13	0.6	20307	38920	4.32	35.3	23.2	0.00
					14	-	-	-	-	-	-	-

Notes:
(1) All sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) Velocity was measured using a Hach FH950, which has a zero stability of +/- 0.05 ft/s and an accuracy of +/- 2% of reading + zero stability.



Graph 1: Comparison of Specific Conductance Upstream and Downstream of the Colville River Ice Bridge

B.2 ASRC Minesite 2005 Cell

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 12/14/2016
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: C. Ziemet	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -8°F, Wind 15 mph, Overcast

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 13 at 5:30 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, December 14, Ms. Runa attended LCMF's daily health and safety meeting. LCMF and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell on snow machines and began sampling at 6:00 PM.

A volumetric test was performed at the ASRC Minesite following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the December 14 visit. At 6:00 PM, 2 liters of water were collected from a hole drilled in the ice at latitude/longitude N70°14'10.1"/W150°48'17.6". No pumping was observed at the ASRC Minesite at the time of water sample collection. At the time of collection, pH was recorded to be 7.0 and the temperature was 0.3°C. Upon returning to CD1, a settleable solids test was performed from 8:00 PM to 9:00 PM. The settleable solids measurement was 0.0 mL/L. Results of the December 14 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Rev. 1
08/08/2013

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 12/21/2016
MICHAEL BAKER FIELD PERSONNEL: B. Woelber	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: C. Ziemet	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -18 to -8, wind 0-5 knots

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 20 at 5:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, December 21, Mr. Woelber attended LCMF's daily health and safety meeting. After sampling at the Colville River, LCMF and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell on snow machines and began sampling at 3:15 PM.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the December 21 monitoring event. At 3:15 PM, 2 liters of water were collected from a hole drilled in the ice at latitude/longitude N70°14'10.1"/W150°48'17.6". At the time of collection, pH was recorded to be 7.5 and the temperature was 1.1°C. Upon returning to CD1, a settleable solids test was performed from 8:20 PM to 9:20 PM. The settleable solids measurement was 0.0 mL/L. Results of the December 21 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING
PROJECT TRIP REPORT

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 12/28/2016
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** A. Smith
LCMF FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -35 to -25, wind 0-15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 27 at 5:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, December 28, Ms. Gillenwater attended LCMF's daily health and safety meeting. After sampling at the Colville River, LCMF and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via snow machines and began sampling at 4:05 PM.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the December 28 monitoring event. At 4:05 PM, 2 liters of water were collected from a hole drilled in the ice at latitude/longitude N70°14'10.1"/W150°48'17.6". At the time of collection, pH was recorded to be 7.4 and the temperature was 1.0°C. Upon returning to CD1, a settleable solids test was performed from 6:00 PM to 7:00 PM. The settleable solids measurement was 0.0 mL/L. Results of the December 28 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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08/08/2013

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 1/4/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** 10 to 16°F, wind 10-20 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 3 at 5:30 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, January 4, Ms. Runa attended LCMF's daily health and safety meeting. After sampling at the Colville River, LCMF and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 11:50 AM.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the January 4 monitoring event. At 11:50 AM, 2 liters of water were collected from a hole drilled in the ice at latitude/longitude N70°14'10.1"/W150°48'17.6". At the time of collection, pH was recorded to be 7.5 and the temperature was 0.1°C. Upon returning to CD1, a settleable solids test was performed from 1:05 PM to 2:05 PM. The settleable solids measurement was 0.0 mL/L. Results of the January 4 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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08/08/2013

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 1/11/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: T. Bass	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** 10 - 20°F, wind 0-15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 10 at 5:30 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Wednesday, January 11, Ms. Gillenwater attended LCMF's daily health and safety meeting. After sampling at the Colville River, LCMF and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 11:15 AM.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the January 11 monitoring event. At 11:20 AM, 2 liters of water were collected from the return hose in the pump house. At the time of collection, pH was recorded to be 7.2 and the temperature was 1.8°C. Upon returning to CD1, a settleable solids test was performed from 12:20 PM to 1:20 PM. The settleable solids measurement was 0.0 mL/L. Results of the January 11 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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08/08/2013

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 1/18/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Bass	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -18 to -30°F, wind 0-15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 17 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, January 18, Ms. Gillenwater attended UMIAQ's daily health and safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 11:18 AM.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the January 18 monitoring event. At 11:18 AM, 2 liters of water were collected from the truck hose connected to the exterior of the pump house. At the time of collection, pH was recorded to be 6.7 and the temperature was 0.9°C. Upon returning to CD1, a settleable solids test was performed from 12:05 PM to 1:05 PM. The settleable solids measurement was 0.0 mL/L. Results of the January 18 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 1/25/2017
MICHAEL BAKER FIELD PERSONNEL: G. Yager	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -20°F, wind 0-5 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 24 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, January 25, Mr. Yager attended UMIAQ's daily health and safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 12:25 PM. There are now two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the January 25 monitoring event. At 12:25 PM, 2 liters of water were collected from the truck hose connected to the exterior of the pump house. At the time of collection, pH was recorded to be 7.2 and the temperature was 0.0°C. Upon returning to CD1, a settleable solids test was performed from 3:14 PM to 4:14 PM. The settleable solids measurement was 0.0 mL/L. Results of the January 25 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 2/1/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** 0°F, wind 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 31 at 5:00 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 1, Ms. Runa attended UMIAQ's daily health and safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 12:05 PM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the February 1 monitoring event. At 12:05 PM, 2 liters of water were collected from the return hose inside the pump house. At the time of collection, pH was recorded to be 7.1 and the temperature was 1.5°C. Upon returning to CD1, a settleable solids test was performed from 4:00 PM to 5:00 PM. The settleable solids measurement was 0.0 mL/L. Results of the February 1 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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08/08/2013

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 2/8/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -9 to -16°F, wind 20 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 7 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 8, Ms. Runa attended UMIAQ's daily health and safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 12:20 PM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the February 8 monitoring event. At 12:20 PM, 2 liters of water were collected from the return hose inside the pump house. At the time of collection, pH was recorded to be 7.4 and the temperature was 2.7°C. Upon returning to CD1, a settleable solids test was performed from 2:20 PM to 3:20 PM. The settleable solids measurement was 0.0 mL/L. Results of the February 8 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

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Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 2/15/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -14 to -20°F, wind 0 to 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 14 at 5:00 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 15, Ms. Gillenwater attended UMIAQ's daily health and safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 12:02 PM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the February 15 monitoring event. At 12:02 PM, 2 liters of water were collected from the return hose inside the pump house. At the time of collection, pH was recorded to be 6.9 and the temperature was 1.2°C. Upon returning to CD1, a settleable solids test was performed from 1:30 PM to 2:30 PM. The settleable solids measurement was 0.0 ml/L. Results of the February 15 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 2/22/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -38°F, wind 0 to 10 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 21 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, February 22, Ms. Runa attended UMIAQ's daily health and safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 11:50 AM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the February 22 monitoring event. At 11:50 AM, 2 liters of water were collected from the return hose inside the pump house. At the time of collection, pH was recorded to be 7.5 and the temperature was 1.4°C. Upon returning to CD1, a settleable solids test was performed from 12:40 PM to 1:40 PM. The settleable solids measurement was 0.0 ml/L. Results of the February 22 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 3/1/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -25 to -12°F, wind 15 to 25 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, February 28 at 5:45 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 1, Ms. Gillenwater attended UMIAQ's daily health and safety meeting. Prior to sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 2:48 PM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the March 1 monitoring event. At 2:48 PM, 2 liters of water were collected from the truck fill return hose inside the pump house. At the time of collection, pH was recorded to be 7.3 and the temperature was 3.1°C. Upon returning to CD1, a settleable solids test was performed from 7:00 PM to 8:00 PM. The settleable solids measurement was 0.0 ml/L. Results of the March 1 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 3/8/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Bass	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -15 to -8°F, wind 15 to 20 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 7 at 5:45 PM and coordinated with UMIAQ to schedule transportation support. At 9:15 AM on Wednesday, March 8, Ms. Gillenwater and Mr. Bass conducted a toolbox safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 1:26 PM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the March 8 monitoring event. At 1:26 PM, 2 liters of water were collected from the truck fill return hose inside the pump house. At the time of collection, pH was recorded to be 7.5 and the temperature was 1.1°C. Upon returning to CD1, a settleable solids test was performed from 2:30 PM to 3:30 PM. The settleable solids measurement was 0.0 ml/L. Results of the March 8 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 3/15/2017
MICHAEL BAKER FIELD PERSONNEL: G. Yager	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -20°F, wind 10 to 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 14 at 5:30 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 15, Mr. Yager attended the UMIAQ morning toolbox safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 12:40 PM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the March 15 monitoring event. At 12:51 PM, 2 liters of water were collected from the truck fill return hose inside the pump house. At the time of collection, pH was recorded to be 7.2 and the temperature was 1.1°C. Upon returning to CD1, a settleable solids test was performed from 1:53 PM to 2:53 PM. The settleable solids measurement was 0.0 ml/L. Results of the March 15 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 3/22/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: C. Zeimet	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -10 to 5°F, wind 5 to 10 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 21 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 22, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 12:08 PM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the March 22 monitoring event. At 12:08 PM, 2 liters of water were collected from the truck fill return hose inside the pump house. At the time of collection, pH was recorded to be 6.8 and the temperature was 6.7°C. Upon returning to CD1, a settleable solids test was performed from 1:20 PM to 2:20 PM. The settleable solids measurement was 0.0 ml/L. Results of the March 22 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 3/29/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -8 to -18°F, wind 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, March 28 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, March 29, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 11:56 AM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the March 29 monitoring event. At 11:56 AM, 2 liters of water were collected from the truck fill return hose inside the pump house. At the time of collection, pH was recorded to be 7.0 and the temperature was 2.3°C. Upon returning to CD1, a settleable solids test was performed from 12:05 PM to 1:05 PM. The settleable solids measurement was 0.0 ml/L. Results of the March 29 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 4/5/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** -4 to 12°F, wind 30 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, April 4 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, April 5, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 11:54 AM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the April 5 monitoring event. At 11:54 AM, 2 liters of water were collected from the truck fill return hose inside the pump house. At the time of collection, pH was recorded to be 7.1 and the temperature was 1.5°C. Upon returning to CD1, a settleable solids test was performed from 12:50 PM to 1:50 PM. The settleable solids measurement was 0.0 ml/L. Results of the April 5 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

PROJECT NAME: Minesite Water Quality Data Collection	**SAMPLING DATE:** 4/12/2017
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: L. Hathaway	**PROJECT CODE:** 156665
SAMPLE LOCATION(S): ASRC Minesite 2005 Cell	**WEATHER:** 6 to 18°F, wind <15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, April 11 at 5:15 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on Wednesday, April 12, Ms. Gillenwater attended the UMIAQ morning toolbox safety meeting. After sampling at the Colville River, UMIAQ and Michael Baker personnel traveled to the ASRC Minesite 2005 Cell via Hägglund tracked vehicle and began sampling at 11:41 AM. There are currently two active pumps at the ASRC Minesite 2005 Cell. For consistency with previous weeks, water samples were collected from the pump operated by Nanuq AFC.

Any visual observation of oily sheen was documented and pH was measured. A volumetric test was performed at the ASRC Minesite 2005 Cell following the methods outlined in the Nebraska Water Environment Association lab manual *The Standard Methods for the Examination of Water and Wastewater: 2540 F: Settleable Solids.*

No oily sheen was observed during the April 12 monitoring event. At 11:41 AM, 2 liters of water were collected from the truck fill return hose inside the pump house. At the time of collection, pH was recorded to be 7.0 and the temperature was 3.8°C. Upon returning to CD1, a settleable solids test was performed from 12:45 PM to 1:45 PM. The settleable solids measurement was 0.0 ml/L. Results of the April 12 monitoring event are included in the attached APDES Discharge Sampling Form, provided by ConocoPhillips.

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

Sample Location: ASRC Minesite 2005 Cell

Analysis Location: ASRC Minesite and Alpine CD1

Daily Analysis				Sampling Information			
Day	**Date**	**Analysis**	**Type**	**Time**	**Name**	**Result**	**Units**
Monday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Tuesday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Wednesday	12/14/2016	Total Flow	Estimate				MG
		Oily Sheen	Visual	18:00	H. Runa	No Oily Sheen	-
Thursday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Friday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Saturday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-
Sunday		Total Flow	Estimate				MG
		Oily Sheen	Visual				-

Notes:

Weekly Analysis				Sampling Information		Analysis Information				
Day	**Date**	**Analysis**	**Type**	**Time**	**Sampler Name**	**Analyist's Name**	**Time**	**Technique**	**Result**	**Units**
Wed.	12/14/16	pH	1 L Grab	18:00	H. Runa	H. Runa	18:05	Digital pH	7.0	SU
		S. Solids	1 L Grab	18:00	H. Runa	H. Runa	20:00	1 L Cone	0.0	ml/L

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

ConocoPhillips Alpine Resupply Ice Road
ASRC Minesite Water Withdrawal

APDES Discharge Sampling Form

ConocoPhillips

General Instructions: This form is to be kept on site while dewatering each week. Once the form has been completely filled out it should be e-mailed to Exploration Environmental (n1662@conocophillips.com). Be sure all fields are filled out completely on a daily basis. Sample location should always be the effluent/discharge location, and should be described as such. Analysis location should be the on-site work location in which the sample analysis was performed. Instructions for the individual monitoring requirements are described below.

Total Flow: Regulatory requirements limit the total flow during dewatering to **3 million gallons per day** (per 24 hours).

- Flow estimations are made from effluent source (discharge point),
- Flow calculated by surveying, flow meters, flow tests, or pump rate calculations (RPM and head pressure taken into consideration).
- **Document the time (end of day), name, and estimated total water discharged (in millions of gallons).**

The total flow rate is never to exceeded 3 million gallons per day. If a total flow exceedance does occur during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Oily Sheen: Regulatory requirements require all discharges to be **free of oily sheen or floating debris.**

- Visually inspect effluent/discharge location and source location for any sheening or floating debris/foam.
- The tundra may produce an organic oily sheen that is not a byproduct of hydrocarbons or releases. Determination between oily sheen and organic sheen is to be made by a qualified person only.
- **Document the time (any time during shift), name, and the presence or absence of oily sheen or floating debris/foam.**

No non-organic sheening allowed during dewatering. If an oily sheen is detected at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

pH Testing: Regulatory requirements require all discharges to have a **pH greater than or equal to 6.5 and less than or equal to 8.5 (pH = 6.5 to 8.5).**

- The pH is sampled once every week. Duplicate sample (2 samples at the same time) collected once during the project.
- One liter of water collected from discharge location in clean sample container.
- Digital pH meter should be calibrated as per the manufacturer's instructions prior to each sampling event.
- The pH reading should be collected between 5 and 15 minutes from collection.
- **Sampler to document their name and the time and date sample was collected. Tester to document name, time, and result of the pH Test.**

If the pH is determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Settleable Solids Testing: Regulatory requirements require all discharges to have a **settleable solids volume of less than or equal to 0.2 ml/L.**

- Settleable solids are sampled once every week. Duplicate sample (2 samples at the same time) completed once during the project.
- One liter of water is to be collected from discharge location in clean sample container.
- Pour the 1 liter of water into a volumetric cone, and allow it to sit for 45 minutes.
- After 45 minutes, gently tap the sides of the cone to release any solids, and allow it to sit for additional 15 minutes.
- After exactly one hour, read the measured the volume of solids collected, using the cone's volumetric markings.
- Sampler to document their name, and the time and date sample was collected. **Tester to document name, time, and result of test in milliliters (ml) of solids per Liter (L) of water.**

If the settleable solids are determined to be out of range at any point during dewatering, immediately stop the dewatering process and contact Exploration Environmental.

Contact Environmental Immediately if Sheen or other pollutant is found in discharge water, or if inital field results show deviations from the permitted range.

Permit Limits: Daily Flow - must be less than 3 MMgal per day
Weekly pH - must be between 6.5 and 8.5
Weekly Settleable Solids - must be <0.2 mL/L

Contact : Exploration Enivironmental
n1662@conocophillips.com
Cell: (907) 943-0134

B.3 Lake M0675

Michael Baker INTERNATIONAL

2016/2017 ALPINE ICE ROAD SUPPORT WATER QUALITY SAMPLING

PROJECT TRIP REPORT

PROJECT NAME: Alpine Ad Hoc Ice Bridge Sampling	**SAMPLING DATE:** 11/21/2016
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: M. Rourick	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Lake M0675	**WEATHER:** 1°F, 10 mph winds, Overcast

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Monday, November 21, at 11:45 AM and coordinated with LCMF to schedule transportation support. At 2:45 PM, Ms. Gillenwater conducted a safety meeting with LCMF personnel. LCMF and Michael Baker personnel then traveled to Lake M0675 on snow machines and began sampling at 3:45 PM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected at the deepest point in the lake. Specific conductance (SC) was calculated using water temperature and conductivity. All measurements were made from below the ice surface to the lake bottom at a maximum of two-foot intervals.

In-situ water quality parameters were recorded using a YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter for DO. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

Ice samples were collected from ice auger cuttings obtained from the top two feet of ice. Two 1-liter ice samples were collected, transported to Alpine and thawed. Conductivity and temperature of the thawed samples were measured using the YSI Pro1030 meter. Specific conductance was calculated from conductivity and temperature. Total dissolved solids (TDS) was calculated from specific conductance.

2. LAKE M0675 WATER QUALITY RESULTS

In-situ SC ranged from a minimum of 9,241 microsiemens per centimeter (µS/cm) at a depth of 2 feet to a maximum of 9,523 µS/cm at depth of 4 feet, with an average of 9,421 µS/cm. The DO saturation ranged between 92.5 percent (%) and 98.0%, with an average of 94.8%. Ice thickness was 1.3 feet and snow depth was 0.2 feet. Average ice sample TDS was 1,226 mg/L. The water quality parameters and results for the ice samples and water column are included in Table 1.

Table 1: Lake M0675 Water Quality Parameters

Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)	TDS (mg/L)
N70°24'13.1" W151°00'32.5" 3:45 PM	6.6	1.3	0.2	0.4	Ice Sample 1	14.8	1,505	1,881	-	-	1.0	1,223
					Ice Sample 2	15.4	1,536	1,892	-	-	1.0	1,230
					1	-	-	-	-	-	-	-
					2	-0.9	4,550	9,241	13.40	92.5	4.9	6,007
					3	-	-	-	-	-	-	-
					4	-1.0	4,670	9,523	13.64	93.9	5.0	6,190
					5	-	-	-	-	-	-	-
					6	-1.0	4,659	9,500	14.23	98.0	5.0	6,175

Notes:
(1) Sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C
(9) TDS was calculated from Specific Conductivity using a multiplier of 0.65.

B.4 Lake M9313

2016/2017 ALPINE AD HOC ICE BRIDGE SAMPLING
SALINITY REPORT

PROJECT NAME: Alpine Ad Hoc Ice Bridge Sampling	**SAMPLING DATE:** 12/21/2016
MICHAEL BAKER FIELD PERSONNEL: B. Woelber	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: C. Ziemet	**PROJECT CODE:** 156664
SAMPLE LOCATION(S): Lake M9313	**WEATHER:** -18 to -8°F, wind 0-5 knots

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, December 20 at 5:00 PM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on December 21, Mr. Woelber attended LCMF's daily health and safety meeting. After sampling at the Colville River and ASRC Minesite 2005 Cell, LCMF and Michael Baker personnel traveled to Lake M9313 on snow machines and began sampling at 4:45 PM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected. Specific conductance (SC) was calculated using water temperature and conductivity. Sampling took place near the center of the lake.

In-situ water quality parameters were recorded using an YSI Pro1030 meter for temperature, conductivity, and salinity and an YSI ProODO meter was used to measure DO. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. LAKE M9313 RESULTS

SC ranged from a maximum of 882 microsiemens per centimeter (µS/cm) at 3 feet of depth to a minimum of 859 µS/cm at a depth of 9 feet; average SC was 870 µS/cm. SC was less than 900 µS/cm throughout the water column.

The DO saturation ranged between 67.5 percent (%) and 87.9%, with an average of 79.7%. Ice thickness was 2.2 feet and snow depth was 0.1 feet.

Water quality parameters at Lake M9313 are included in Table 1.

Table 1: Water Quality Parameters at Lake M9313

Monitoring Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)
Lake M9313 N70°25'19.7" W150°54'03.6" **4:45 PM**	11.2	2.2	0.1	0.1	1	-	-	-	-	-	-
					2	-	-	-	-	-	-
					3	0.3	455	882	12.71	87.9	0.4
					4	-	-	-	-	-	-
					5	0.4	455	879	12.50	86.7	0.4
					6	-	-	-	-	-	-
					7	0.8	455	866	11.63	81.6	0.4
					8	-	-	-	-	-	-
					9	1.0	455	859	10.58	74.6	0.4
					10	-	-	-	-	-	-
					11	1.1	460	865	9.54	67.5	0.4
					12	-	-	-	-	-	-

Notes:
(1) Sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C

2016/2017 ALPINE AD HOC ICE BRIDGE SAMPLING
SALINITY REPORT

PROJECT NAME: Alpine Ad Hoc Ice Bridge Sampling	**SAMPLING DATE:** 2/1/2017
MICHAEL BAKER FIELD PERSONNEL: H. Runa	**SUBMITTED BY:** S. Eklund
UMIAQ FIELD PERSONNEL: T. Burnett	**PROJECT CODE:** 156664
SAMPLE LOCATION(S): Lake M9313	**WEATHER:** 0°F, wind 15 mph

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Tuesday, January 31 at 5:00 PM and coordinated with UMIAQ to schedule transportation support. At 6:00 AM on February 1, Ms. Runa attended UMIAQ's daily health and safety meeting. After sampling at the Colville River and ASRC Minesite 2005 Cell, UMIAQ and Michael Baker personnel traveled to Lake M9313 via Hägglund and began sampling at 3:00 PM.

Ice thickness, snow depth, total water depth, freeboard, temperature, salinity, conductivity, and dissolved oxygen (DO) measurements were collected. Specific conductance (SC) was calculated using water temperature and conductivity. Total dissolved solids (TDS) were calculated from SC. Sampling took place at 2 foot intervals throughout the water column at a location near the center of the lake.

In-situ water quality parameters were recorded using an YSI Pro1030 meter for temperature, conductivity, and salinity and a YSI ProODO meter was used to measure DO. The YSI Pro1030 meter was calibrated for conductivity and the YSI ProODO meter was checked for DO accuracy and calibrated by TTT Environmental prior to sampling.

2. LAKE M9313 RESULTS

TDS ranged from a maximum of 685 milligrams per liter (mg/L) at 4 feet of depth to a minimum of 671 mg/L at 12 feet of depth; average TDS was 677 mg/L. TDS was less than 1,000 mg/L throughout the water column.

SC ranged from a maximum of 1,055 microsiemens per centimeter (µS/cm) at 4 feet of depth to a minimum of 1,033 µS/cm at a depth of 12 feet; average SC was 1,041 µS/cm.

The DO saturation ranged between 58.7 percent (%) and 74.0%, with an average of 68.9%. Ice thickness was 3.8 feet and snow depth was 0.0 feet.

Water quality parameters at Lake M9313 are included in Table 1.

Table 1: Water Quality Parameters at Lake M9313

Monitoring Location & Time	Water Depth (ft)	Ice Thickness (ft)	Snow Depth (ft)	Freeboard (ft)	Sample Depth (ft)	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	TDS (mg/L)	DO (mg/L)	DO (% Saturation)	Salinity (ppt)
Lake M9313 N70°25'19.7" W150°54'03.6" **3:00 PM**	12.8	3.8	0.0	0.2	1	-	-	-	-	-	-	-
					2	-	-	-	-	-	-	-
					3	-	-	-	-	-	-	-
					4	0.3	544	1055	685	10.69	74.0	0.5
					5	-	-	-	-	-	-	-
					6	0.6	546	1046	680	10.44	72.9	0.5
					7	-	-	-	-	-	-	-
					8	0.9	548	1039	675	10.09	71.0	0.5
					9	-	-	-	-	-	-	-
					10	1.1	550	1035	673	9.61	68.0	0.5
					11	-	-	-	-	-	-	-
					12	1.4	555	1033	671	8.22	58.7	0.5

Notes:
(1) Sample location coordinates referenced to NAD83 datum.
(2) Freeboard is the distance from the top of ice to the water surface.
(3) Sample depth is measured from the water surface.
(4) Temperature, salinity, and conductivity were measured using a YSI Pro1030 meter.
(5) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data.
(6) Dissolved oxygen was measured using a YSI ProODO meter.
(7) Time shown indicates the start of the measurement.
(8) Temperature measurements have an accuracy of +/- 0.2°C.
(9) TDS was calculated from Specific Conductivity using a multiplier of 0.65.

B.5 Nanuq Lake

PROJECT NAME: Alpine Ad Hoc Ice Bridge Sampling	**SAMPLING DATE:** 11/22/2016
MICHAEL BAKER FIELD PERSONNEL: J. Gillenwater	**SUBMITTED BY:** S. Eklund
LCMF FIELD PERSONNEL: M. Rourick	**PROJECT CODE:** 156665
SAMPLE LOCATIONS: Nanuq Lake Relic Site NW and Relic Site NE	**WEATHER:** 10°F, wind 10 mph, freezing fog, overcast

1. MONITORING EVENT DETAILS

Michael Baker International (Michael Baker) personnel arrived at Alpine on Monday, November 21, at 11:45 AM and coordinated with UMIAQ (LCMF) to schedule transportation support. At 6:00 AM on Tuesday, November 22, Ms. Gillenwater attended LCMF's daily health and safety meeting. Prior to sampling at the Colville River, LCMF and Michael Baker personnel traveled to Nanuq Lake via snow machine and began sampling at 12:30 PM.

Ice samples were collected at two locations on Nanuq Lake; Relic Site Northwest (NW) and Relic Site Northeast (NE). Ice samples were collected from ice auger cuttings obtained from the top one foot of ice. Two 1-liter samples were collected at each site, transported to Alpine and thawed. The conductivity of the thawed samples was measured using a YSI Pro1030 water quality meter. Specific conductance was calculated from conductivity and temperature. Total dissolved solids (TDS) were calculated from specific conductance. The meter was calibrated for conductivity prior to sampling.

2. NANUQ LAKE ICE TDS RESULTS

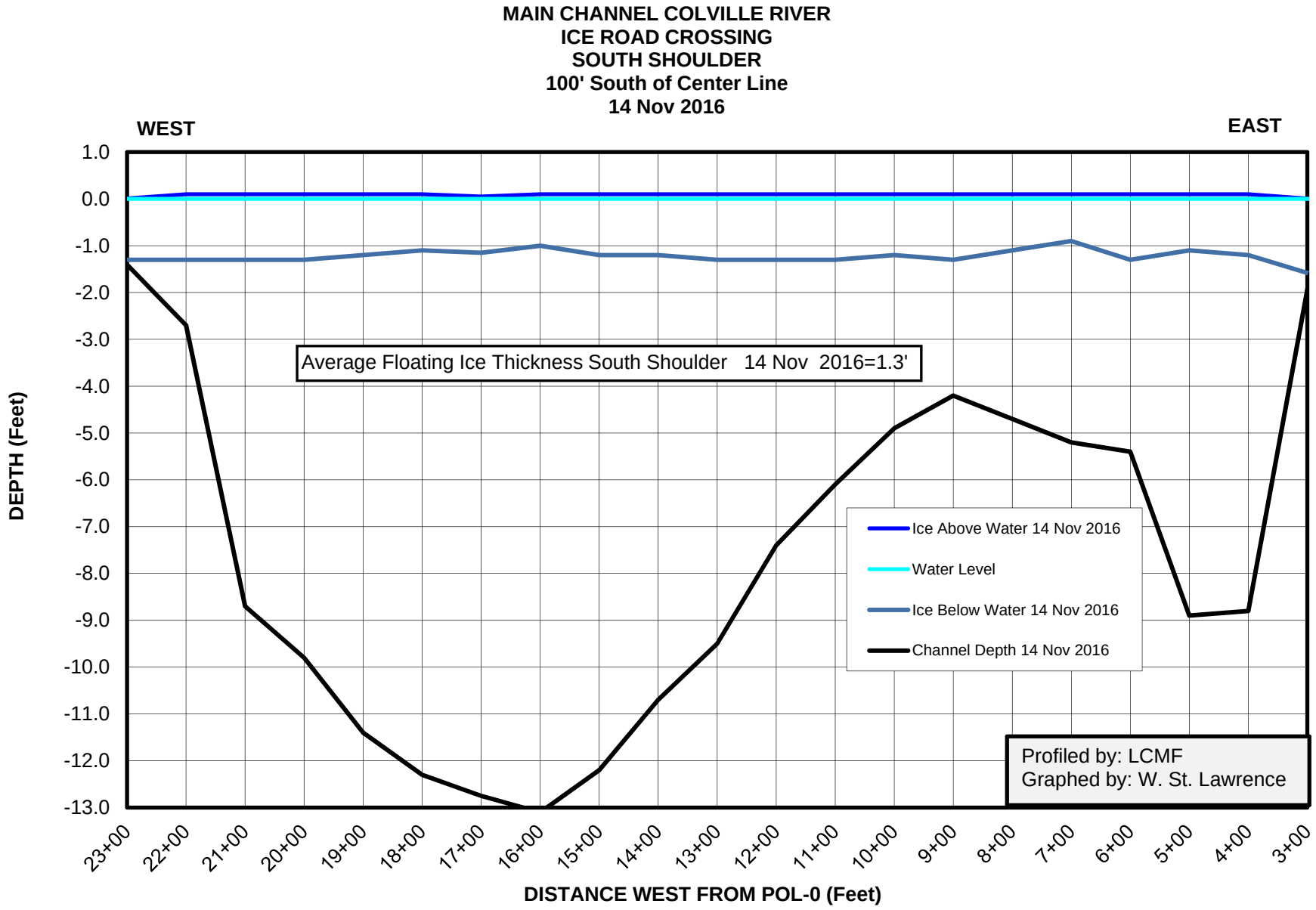
TDS in Nanuq Lake ice averaged 13.7 mg/L and 6.4 mg/L at the NW and NE sites, respectively. The water quality parameters from all samples are included in Table 1.

Table 1: Nanuq Lake Ice - Water Quality Parameters

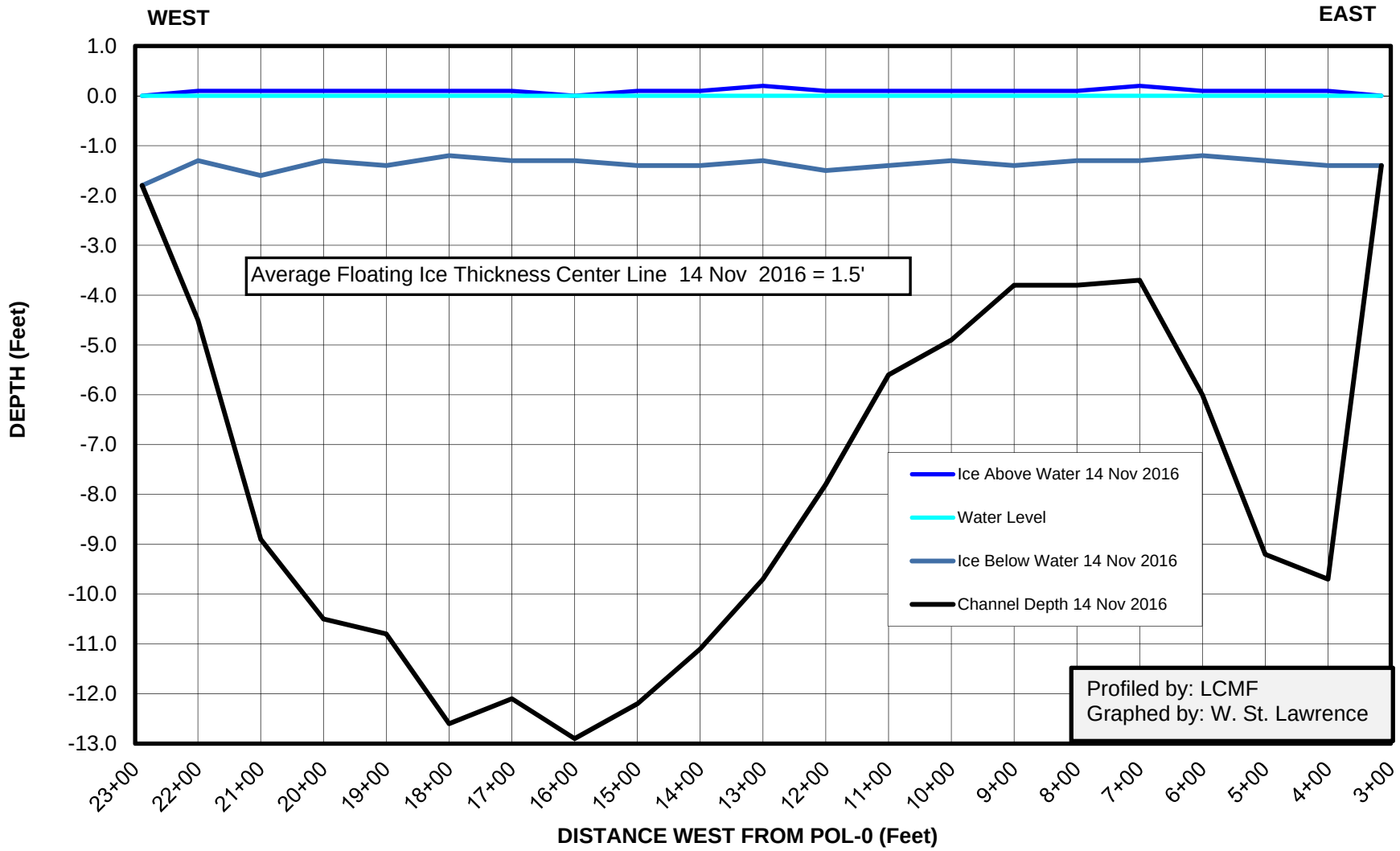
Location	Sample	Temp (°C)	Conductivity (µS/cm)	Specific Conductance (µS/cm)	Salinity (ppt)	TDS (mg/L)
Relic Site NW N 70.32735 W 151.04132	1	15.7	20.7	25.3	0.0	16.5
	2	15.3	13.7	16.9	0.0	11.0
Relic Site NE N 70.32668 W 151.01176	1	16.5	8.8	10.6	0.0	6.9
	2	15.1	7.4	9.2	0.0	6.0

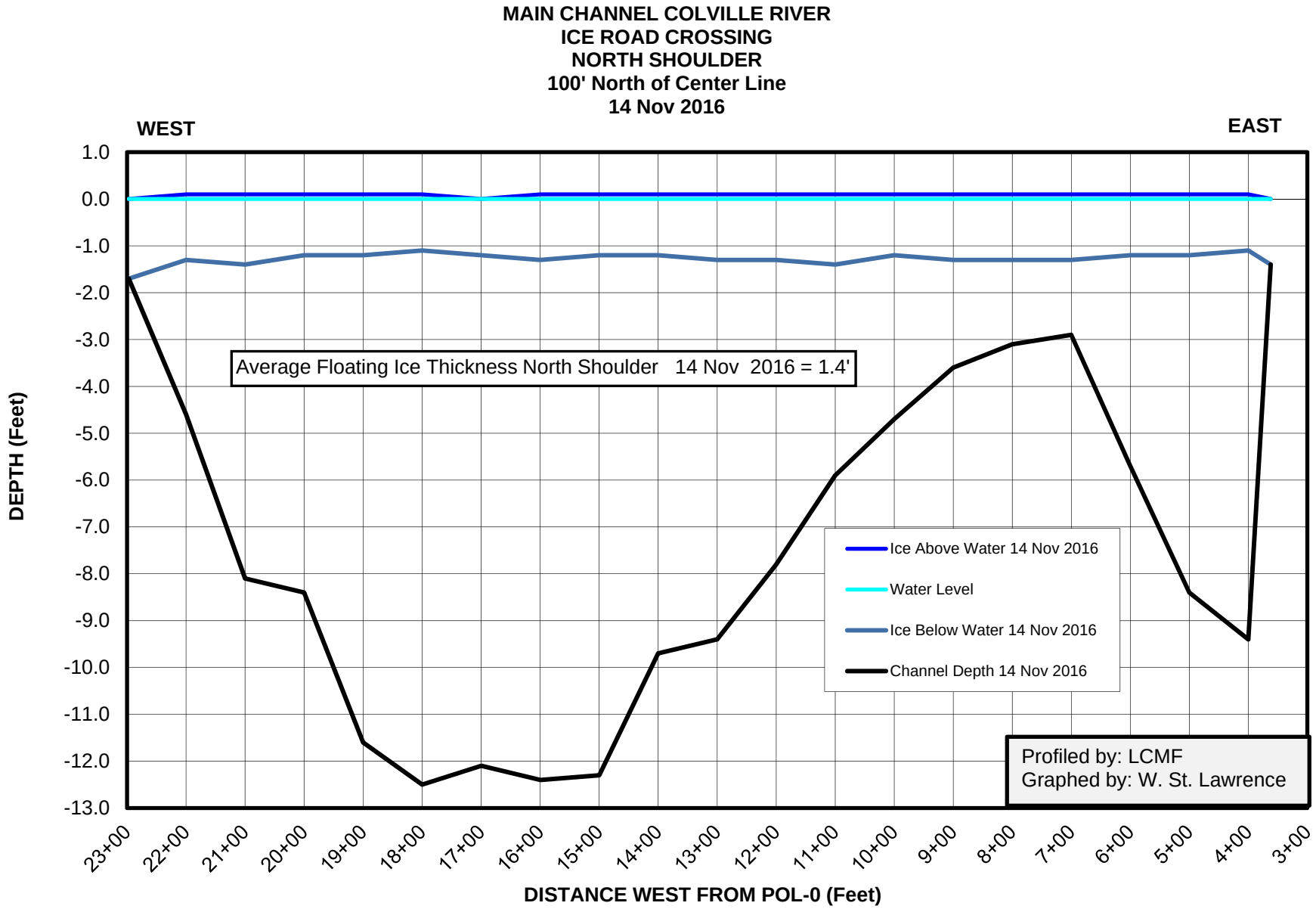
Notes:
(1) Specific conductance (referenced to 25°C) was obtained using a conversion coefficient of 0.0196 based on empirical data
(2) TDS was calculated from Specific Conductivity using a multiplier of 0.65

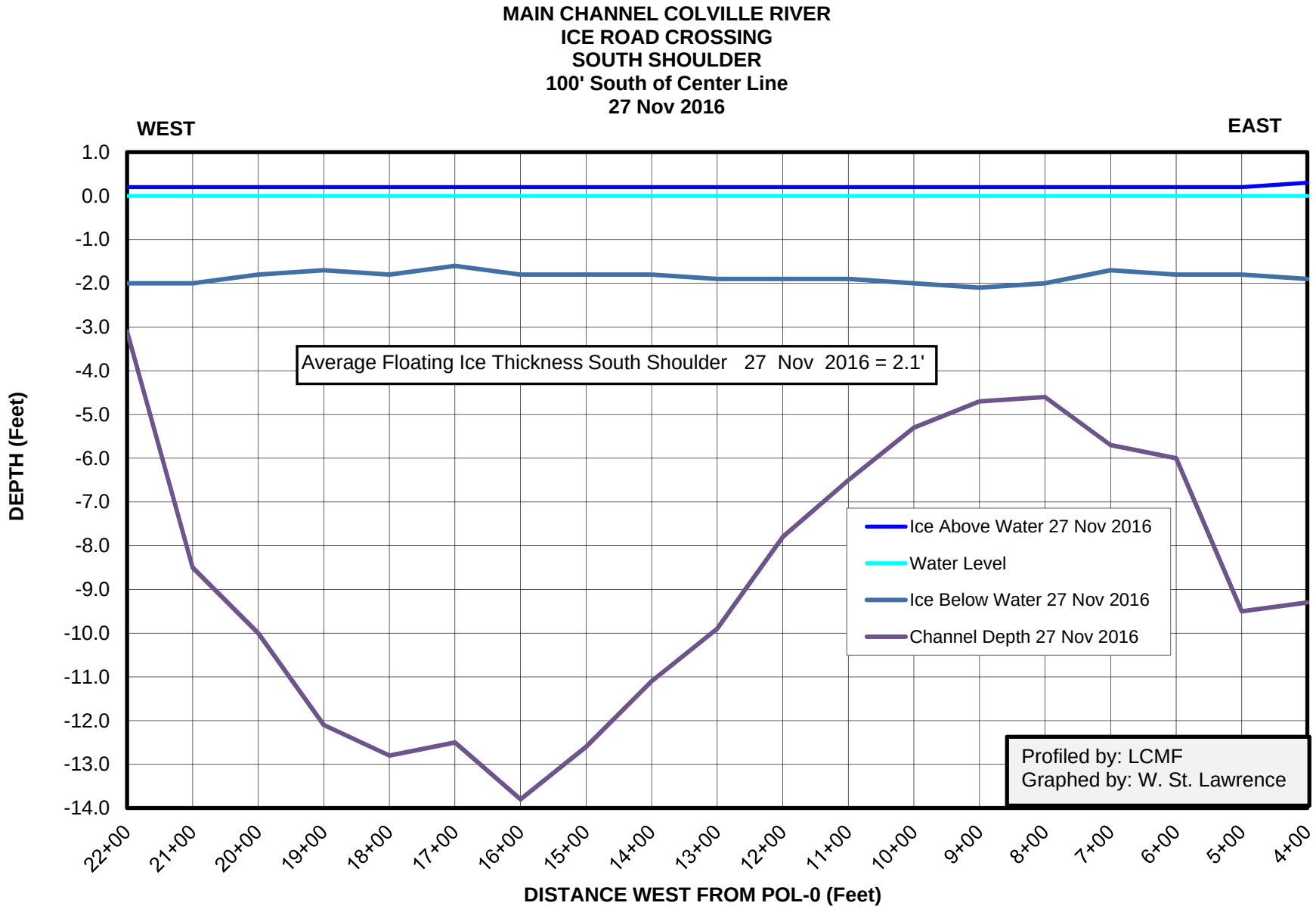
Attachment C Colville River Ice Bridge Crossing Profiles


MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
14 Nov 2016
WEST
EAST
DEPTH (Feet)
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
Average Floating Ice Thickness South Shoulder 14 Nov 2016=1.3'
Ice Above Water 14 Nov 2016
Water Level
Ice Below Water 14 Nov 2016
Channel Depth 14 Nov 2016
Profiled by: LCMF
Graphed by: W. St. Lawrence
23+00
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
3+00
DISTANCE WEST FROM POL-0 (Feet)

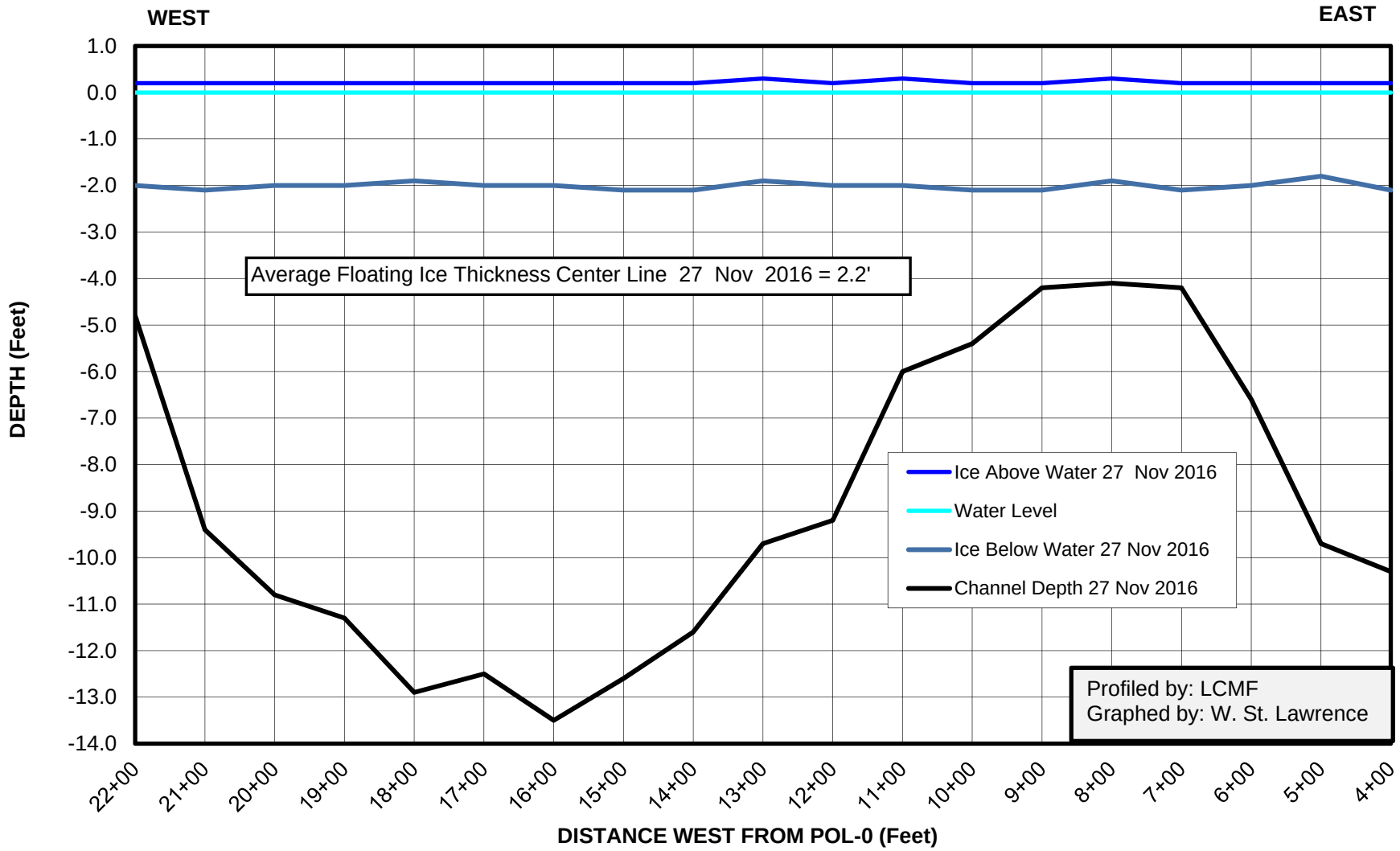
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE 14 Nov 2016

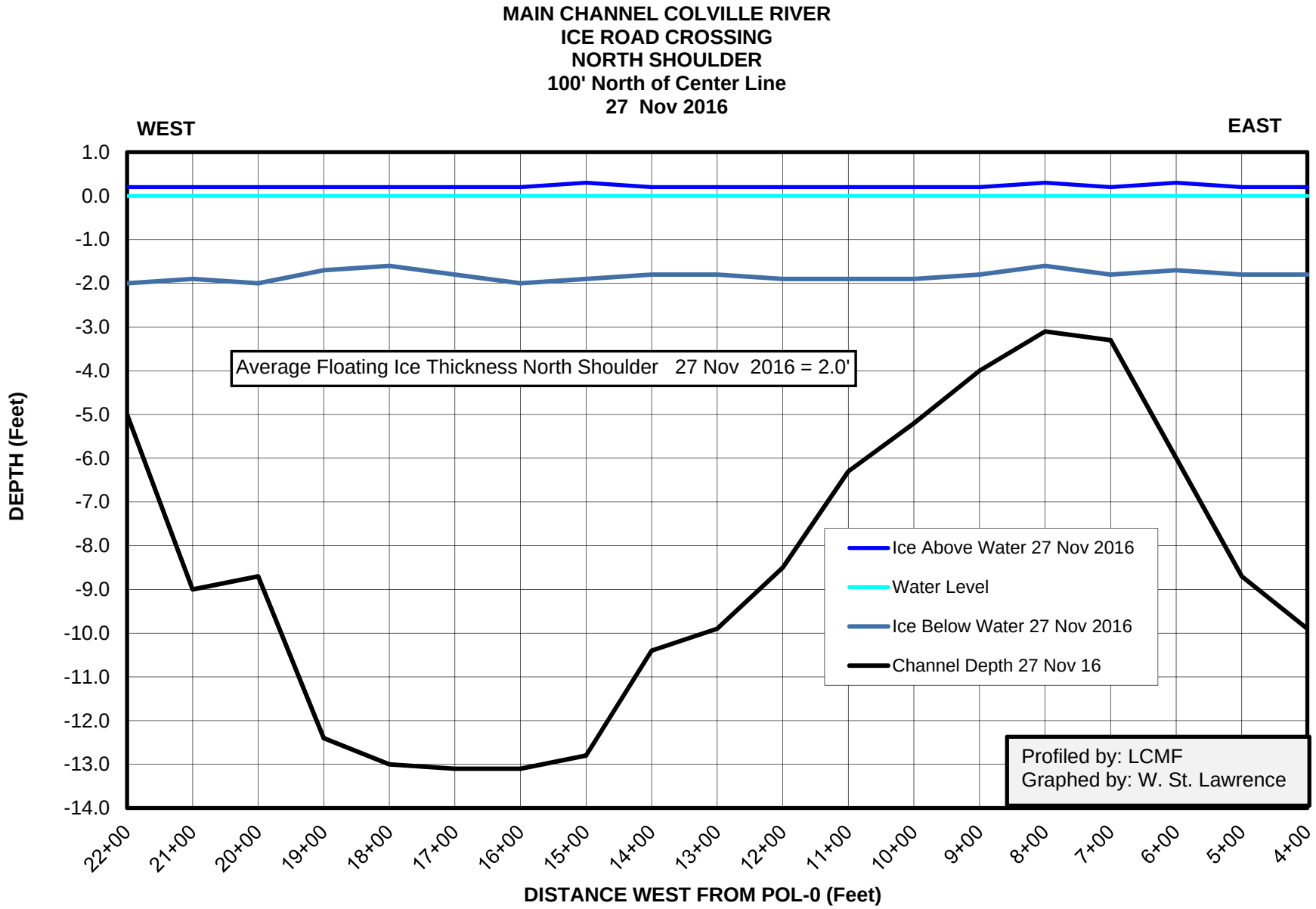



MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
14 Nov 2016
WEST
EAST
DEPTH (Feet)
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
Average Floating Ice Thickness North Shoulder 14 Nov 2016 = 1.4'
Ice Above Water 14 Nov 2016
Water Level
Ice Below Water 14 Nov 2016
Channel Depth 14 Nov 2016
Profiled by: LCMF
Graphed by: W. St. Lawrence
23+00
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
3+00
DISTANCE WEST FROM POL-0 (Feet)

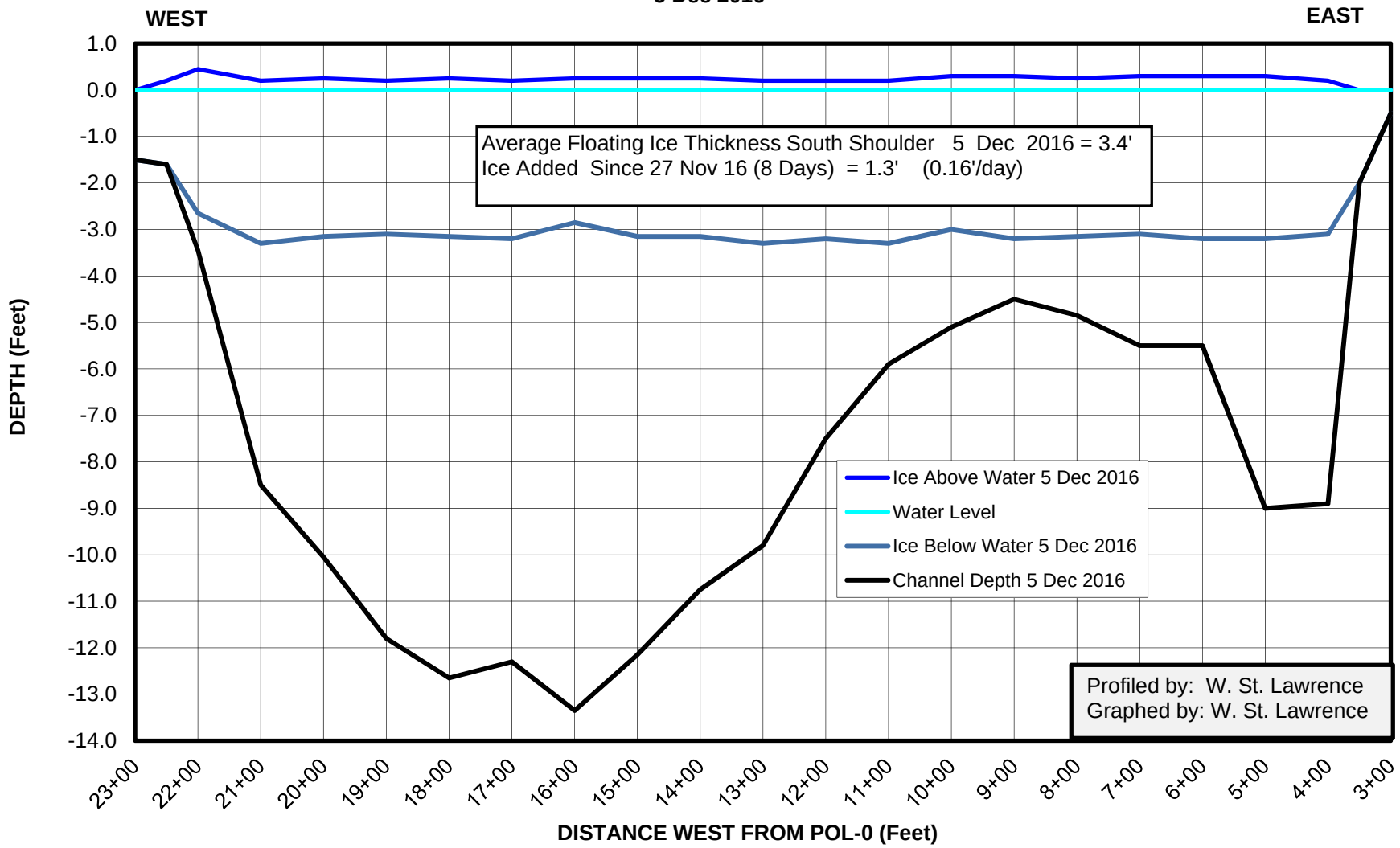

MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
27 Nov 2016
WEST
EAST
DEPTH (Feet)
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
Average Floating Ice Thickness South Shoulder 27 Nov 2016 = 2.1'
Ice Above Water 27 Nov 2016
Water Level
Ice Below Water 27 Nov 2016
Channel Depth 27 Nov 2016
Profiled by: LCMF
Graphed by: W. St. Lawrence
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
DISTANCE WEST FROM POL-0 (Feet)

MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
27 Nov 2016

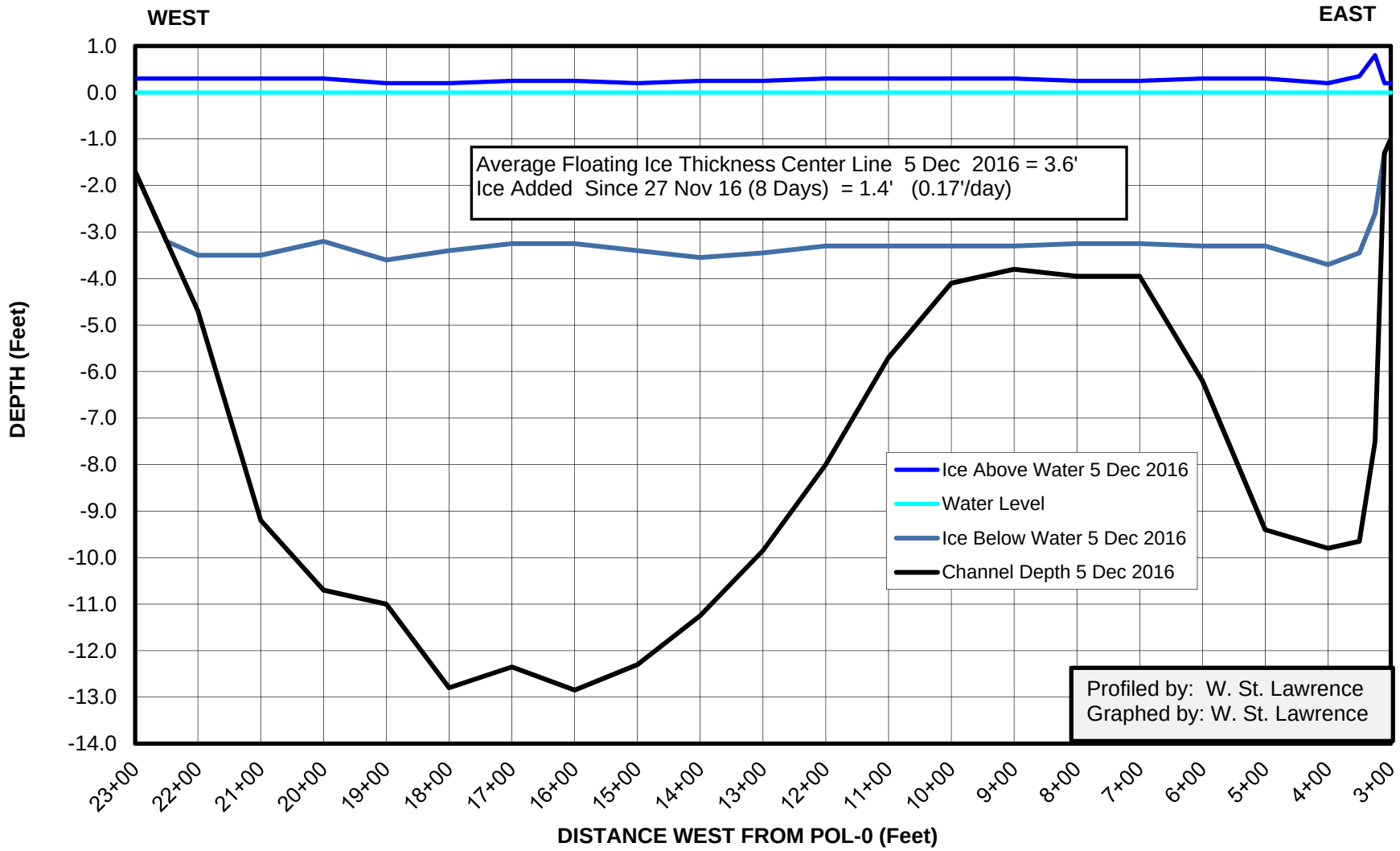



MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
27 Nov 2016
WEST
EAST
DEPTH (Feet)
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
Average Floating Ice Thickness North Shoulder 27 Nov 2016 = 2.0'
Ice Above Water 27 Nov 2016
Water Level
Ice Below Water 27 Nov 2016
Channel Depth 27 Nov 16
Profiled by: LCMF
Graphed by: W. St. Lawrence
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
DISTANCE WEST FROM POL-0 (Feet)

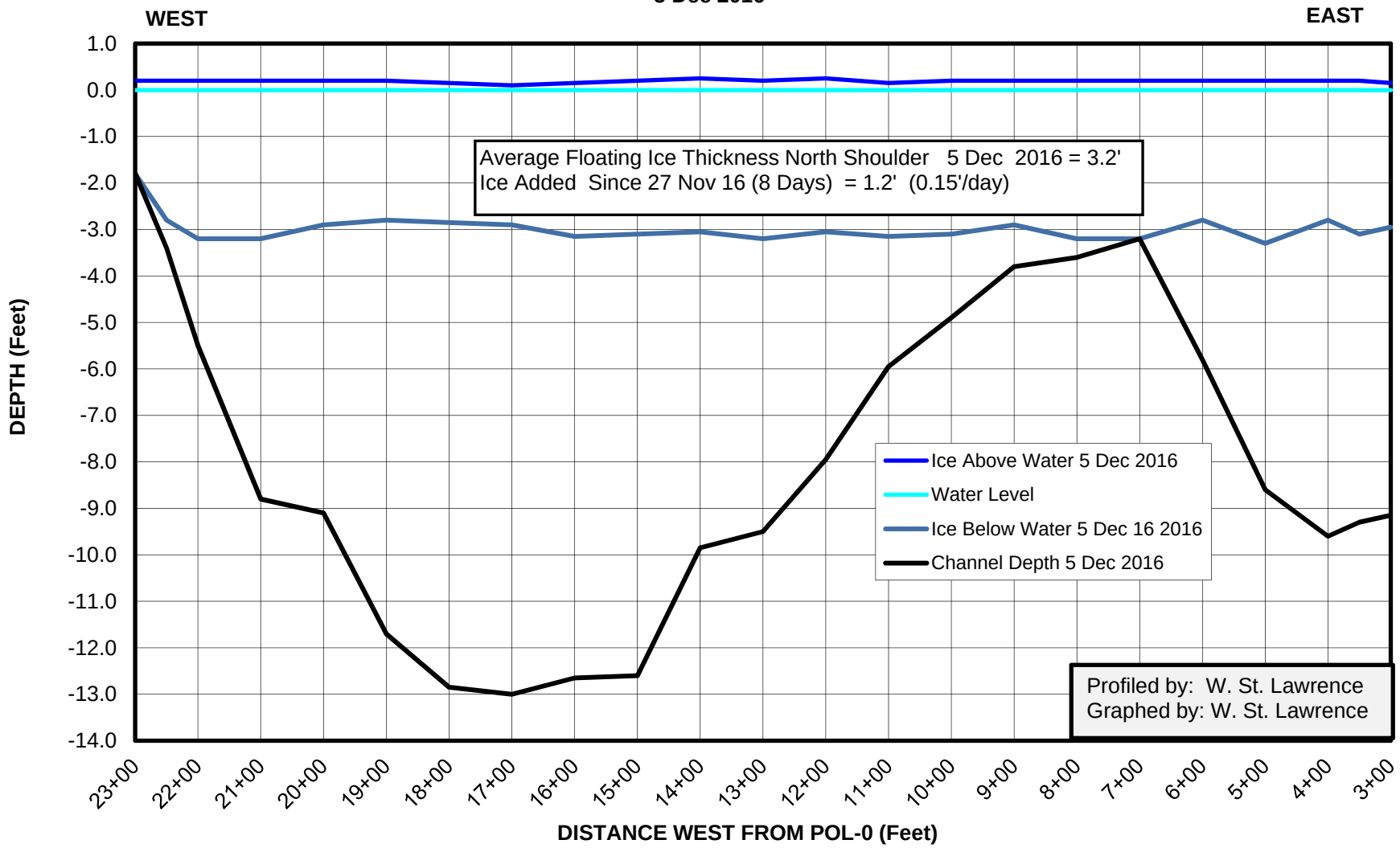
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
5 Dec 2016



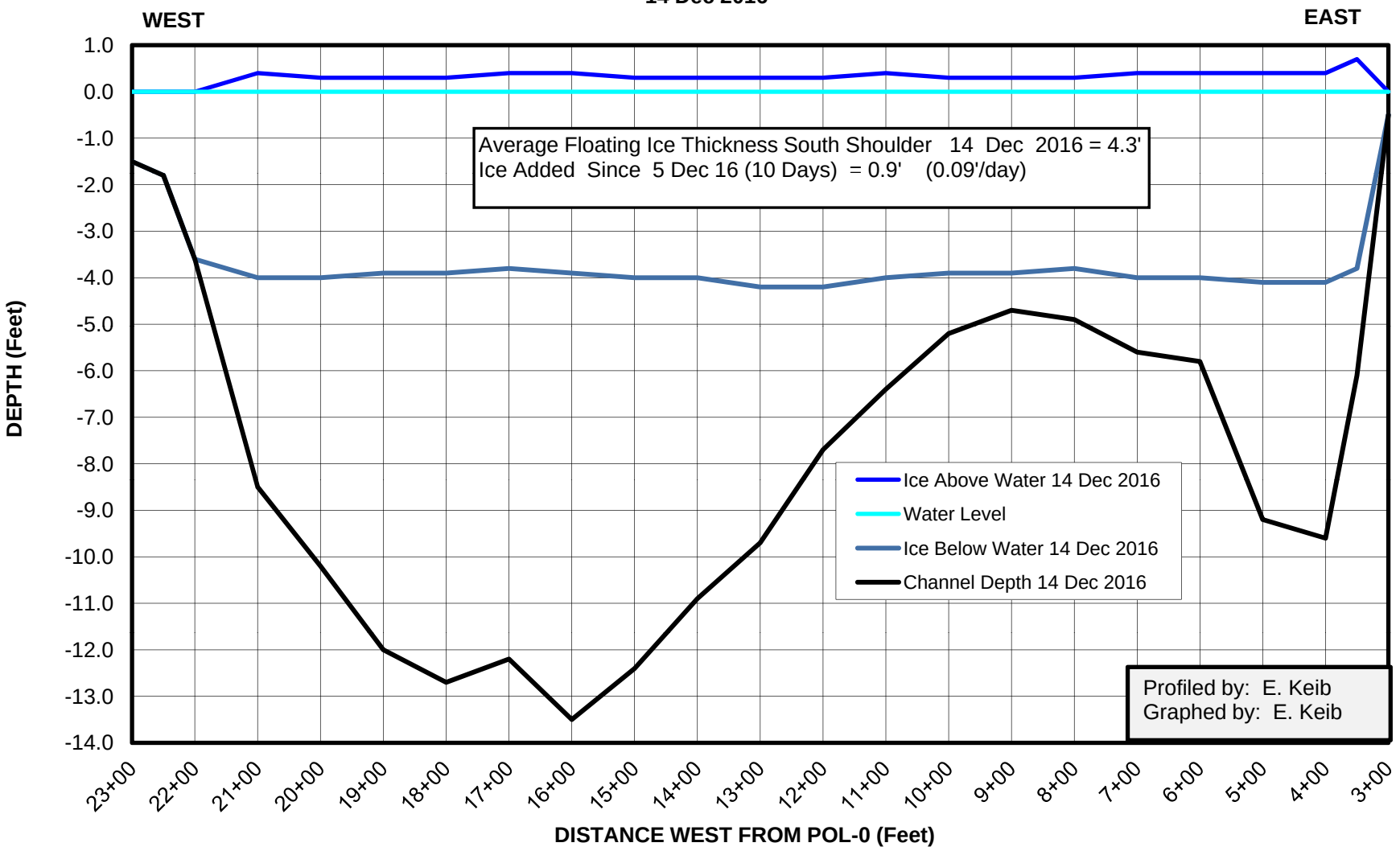
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
5 Dec 2016



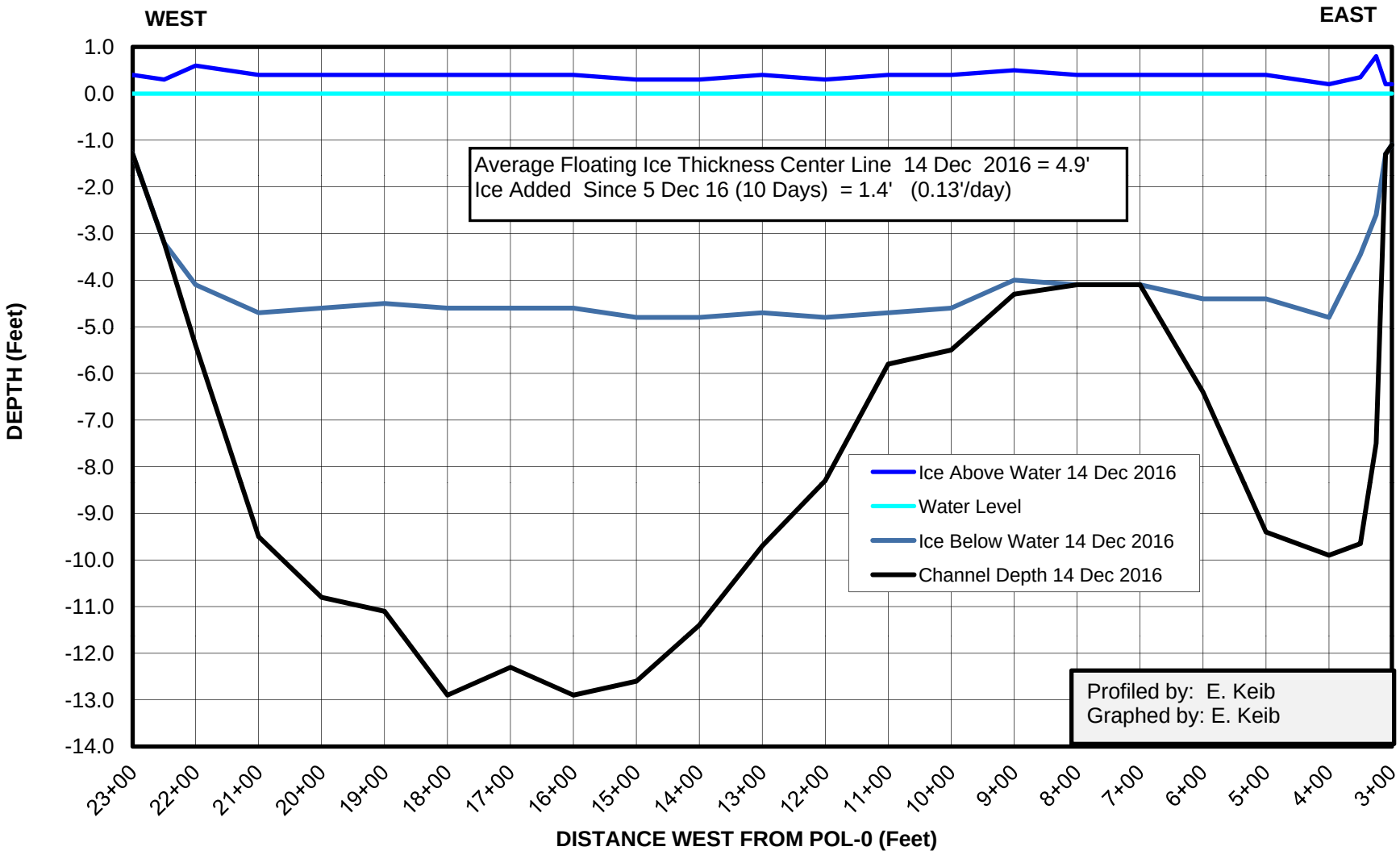
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
5 Dec 2016



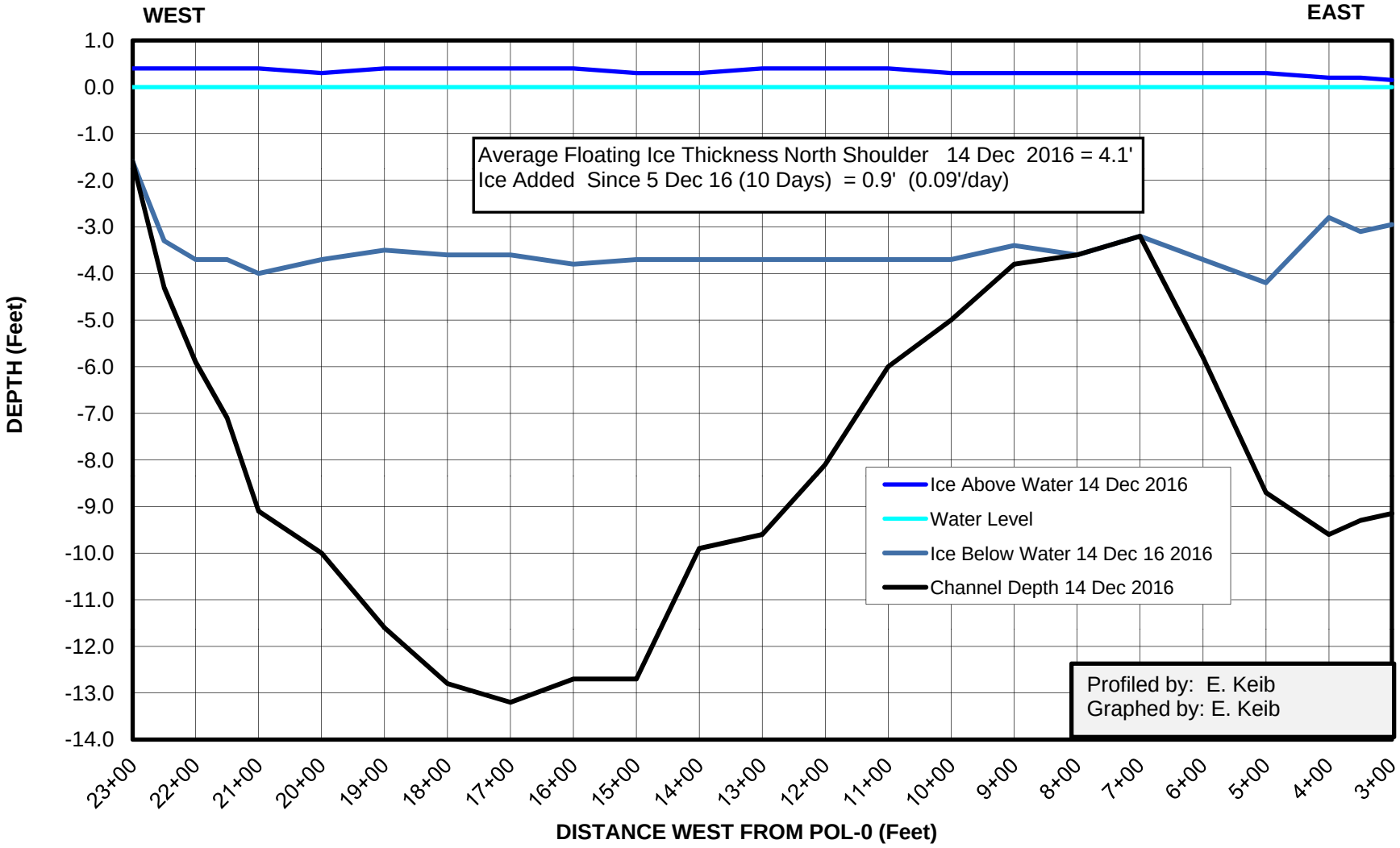
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
14 Dec 2016



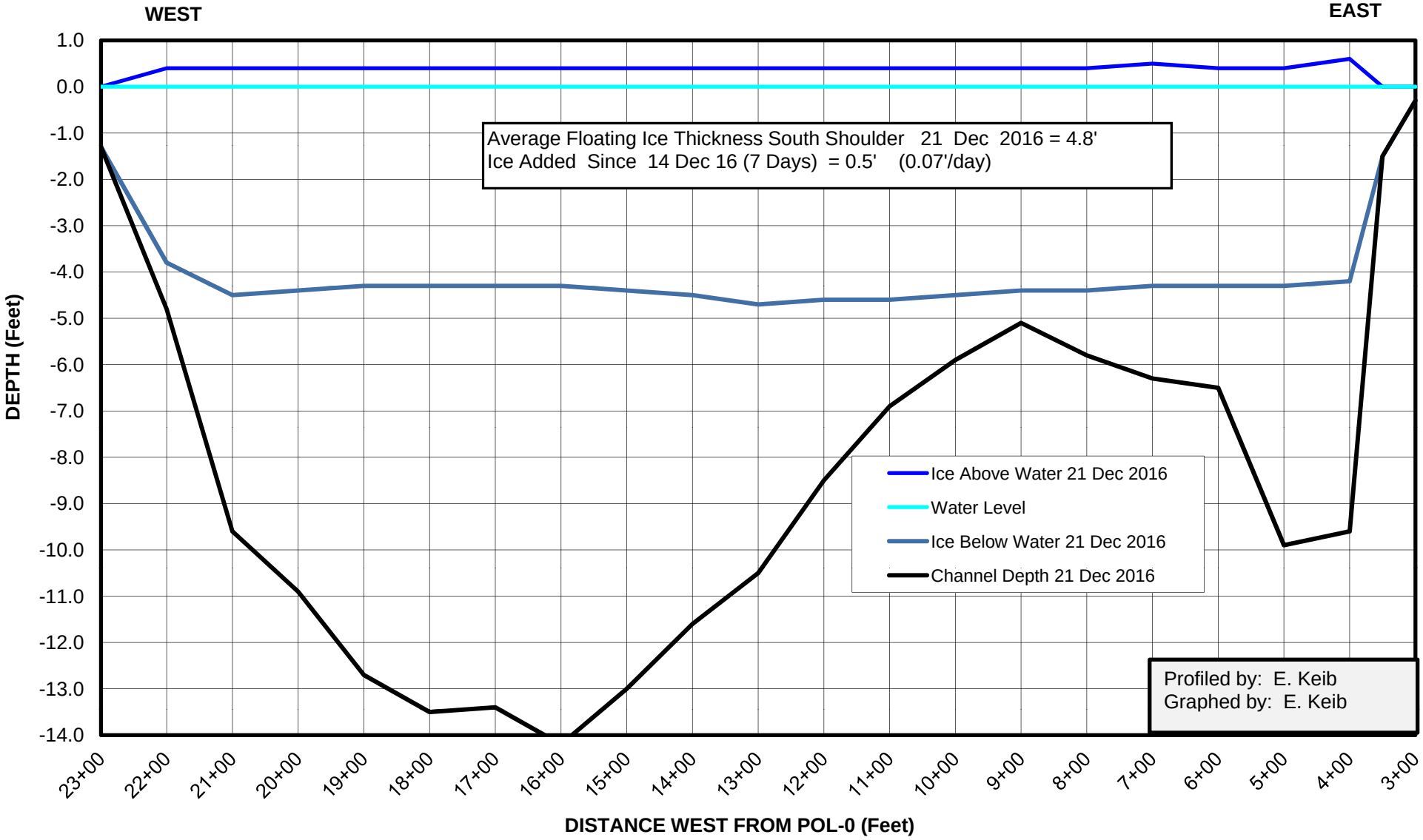
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
14 Dec 2016



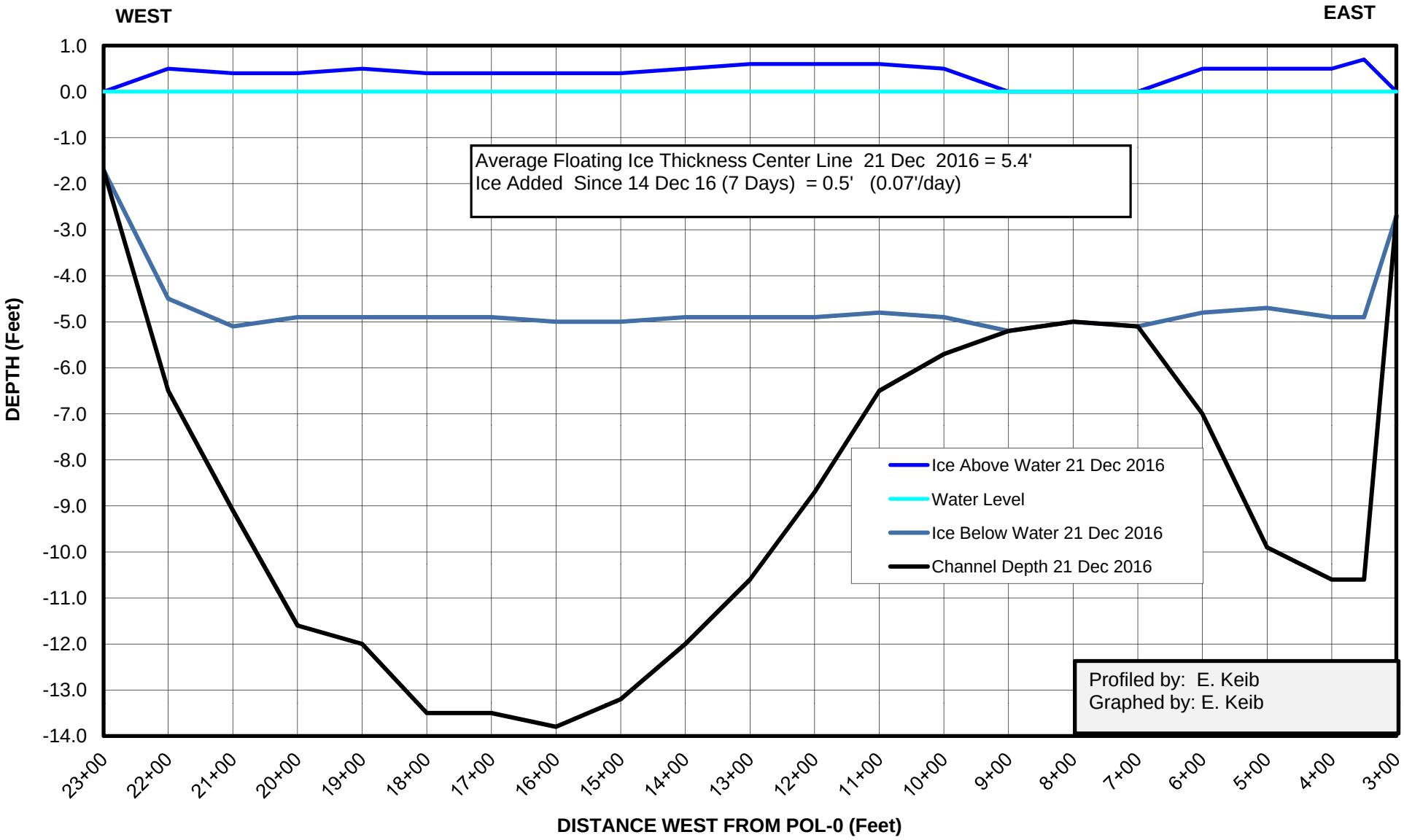
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
14 Dec 2016



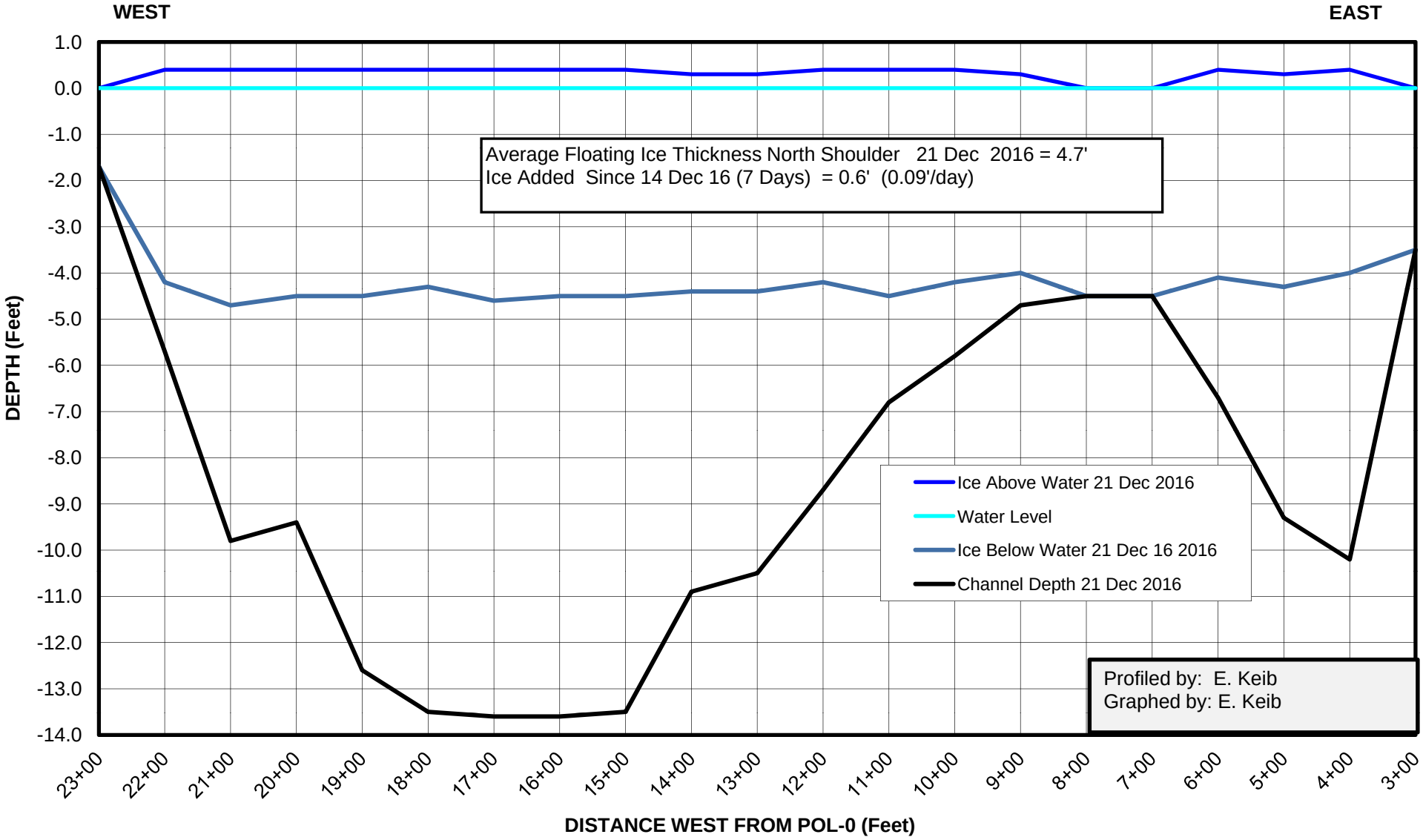
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
21 Dec 2016



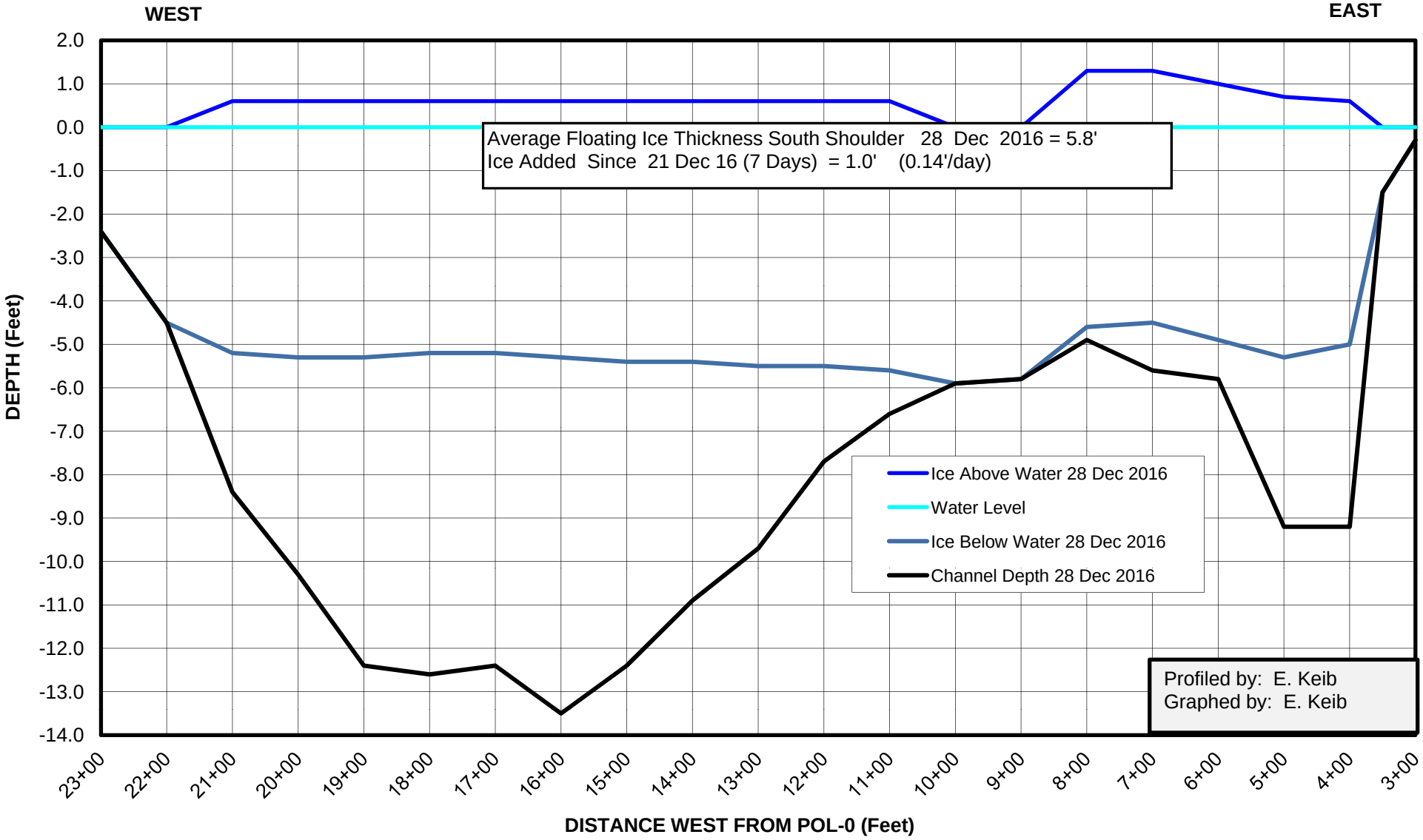
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
21 Dec 2016



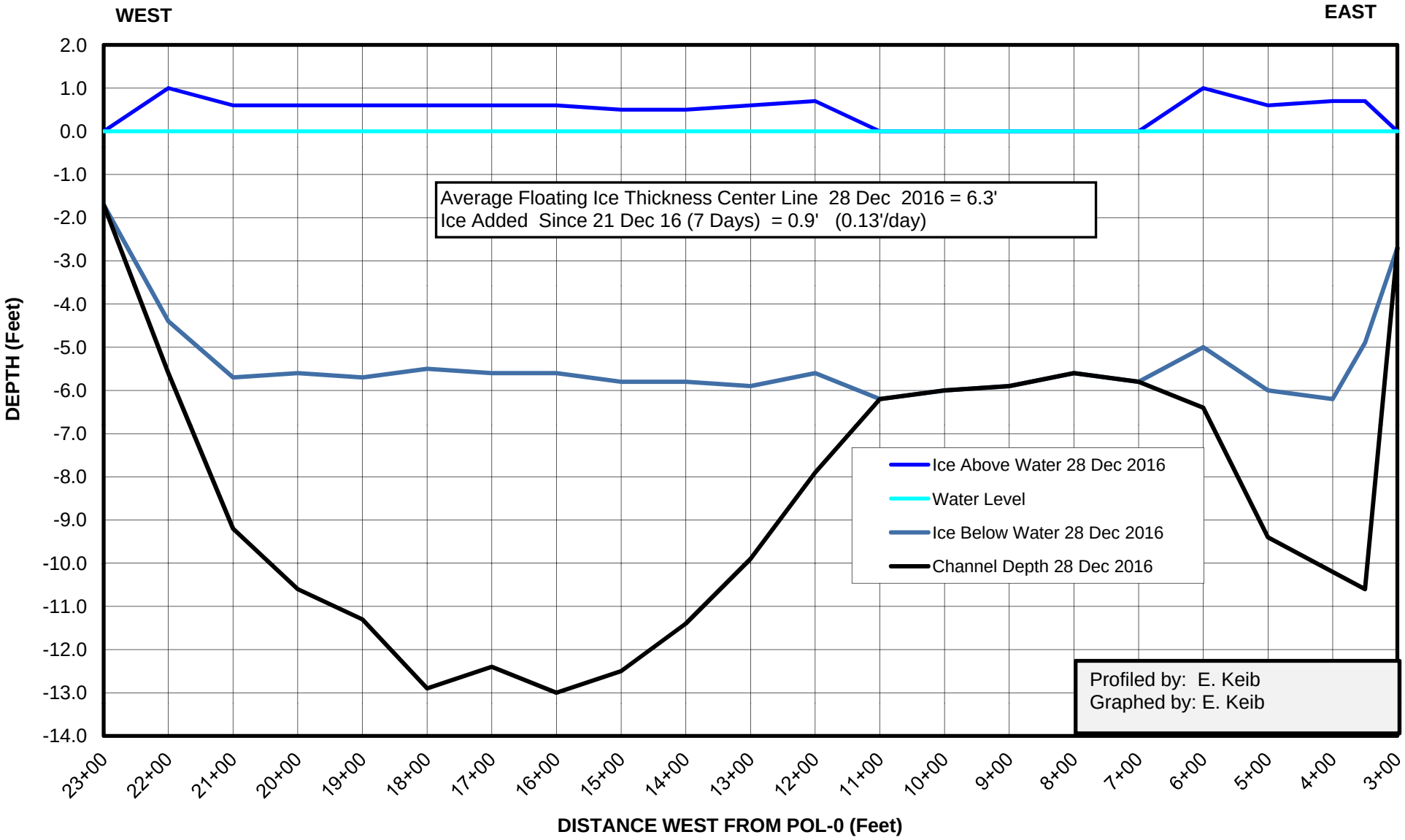
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
21 Dec 2016



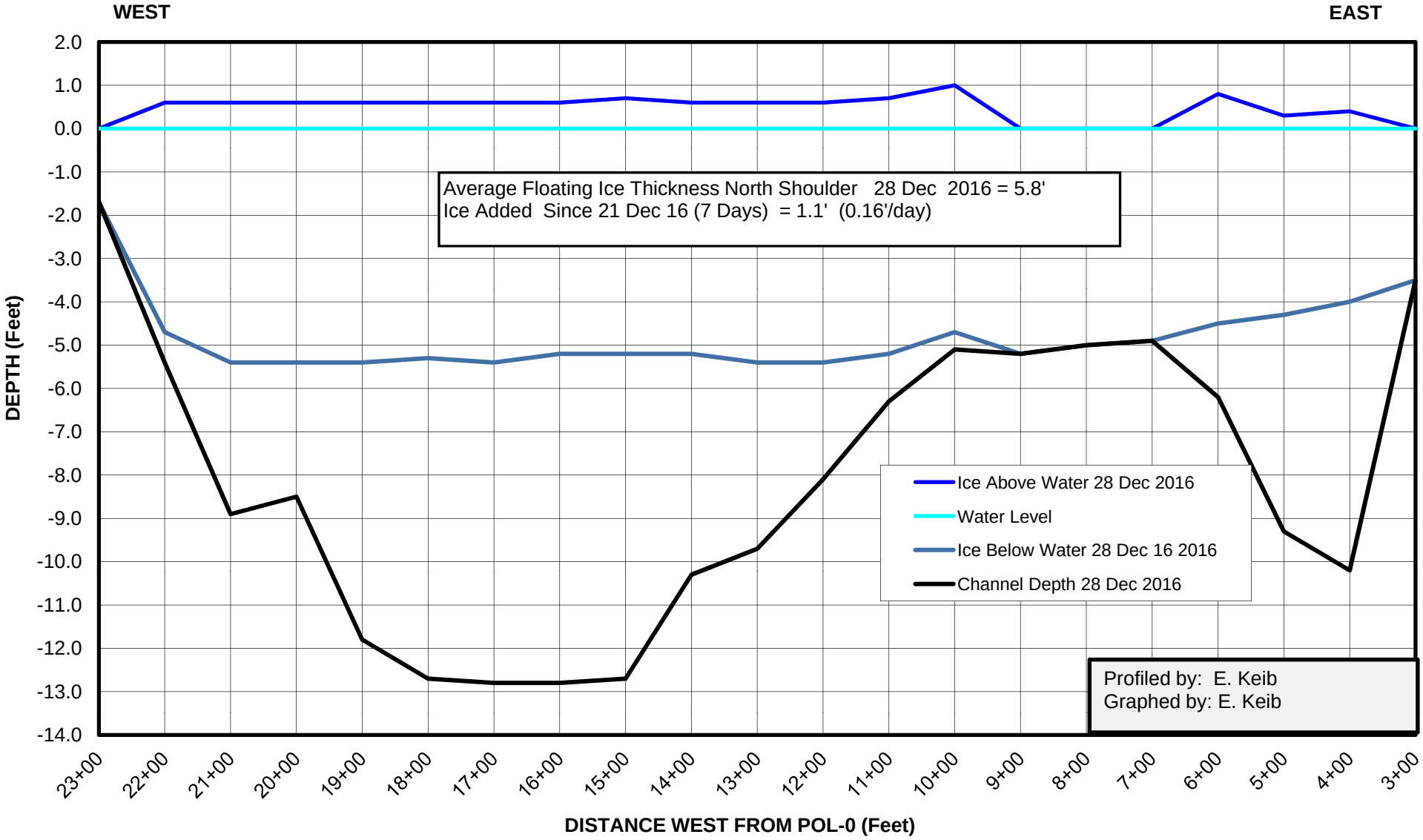
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
28 Dec 2016



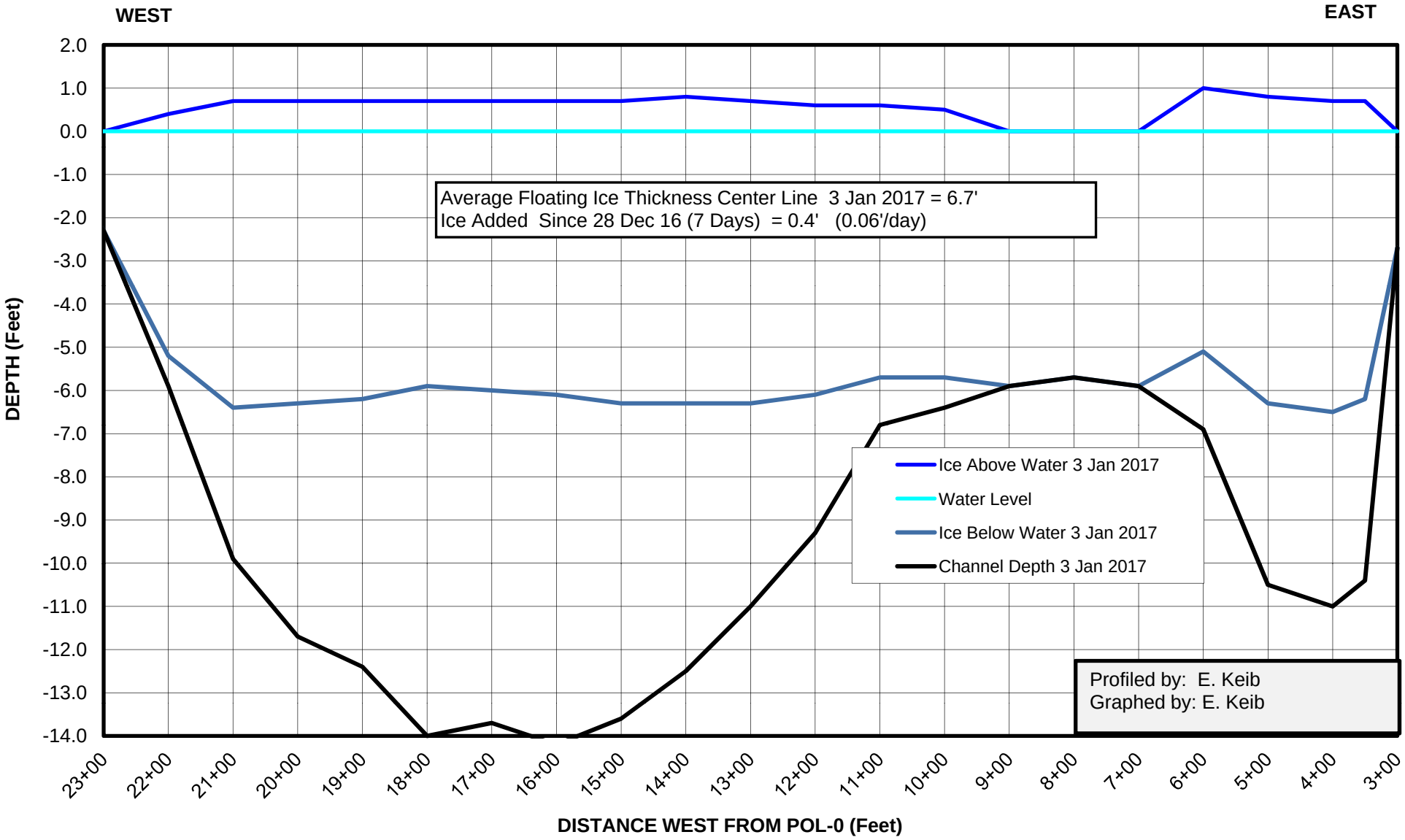
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
28 Dec 2016

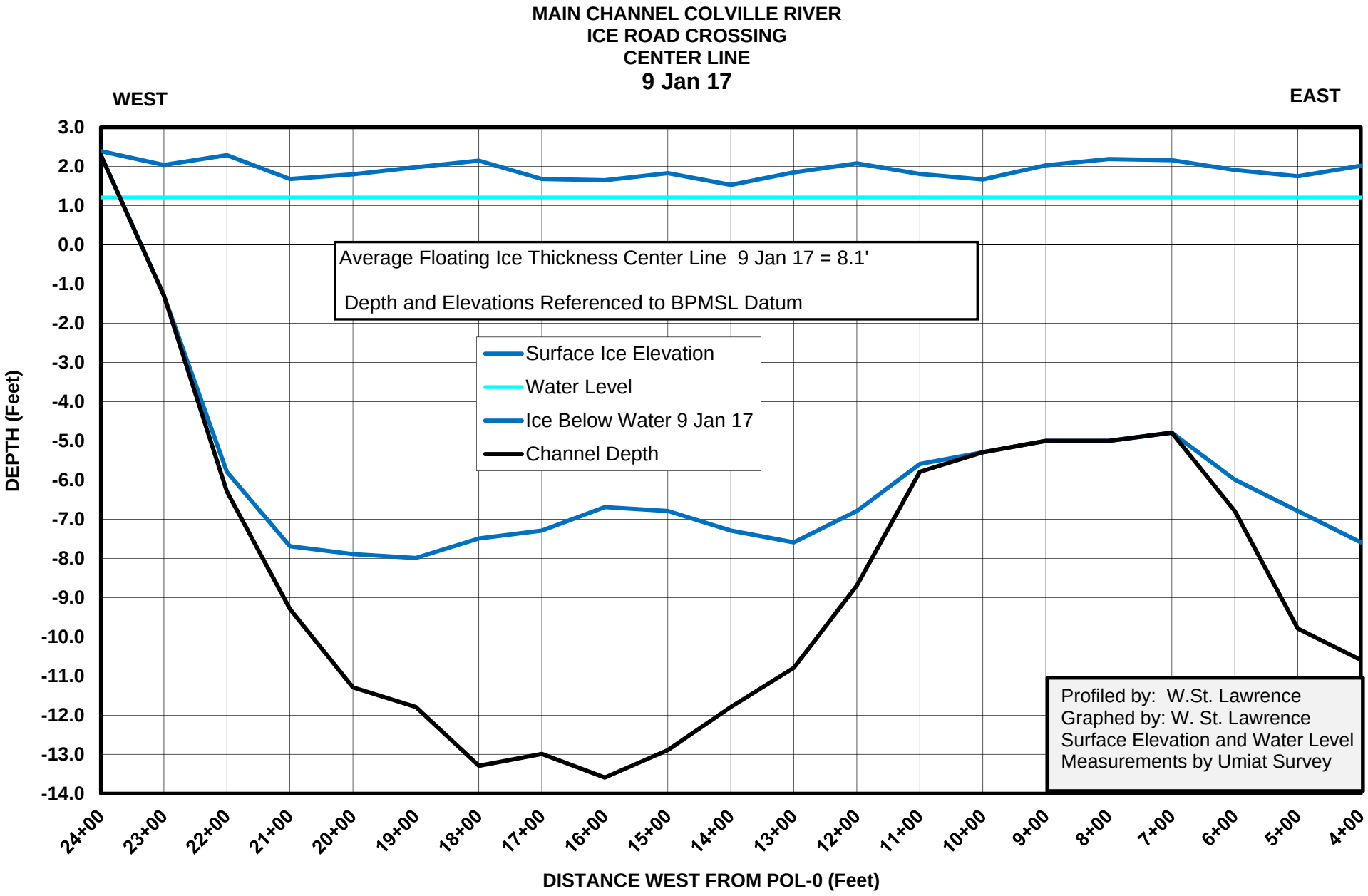


MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
28 Dec 2016

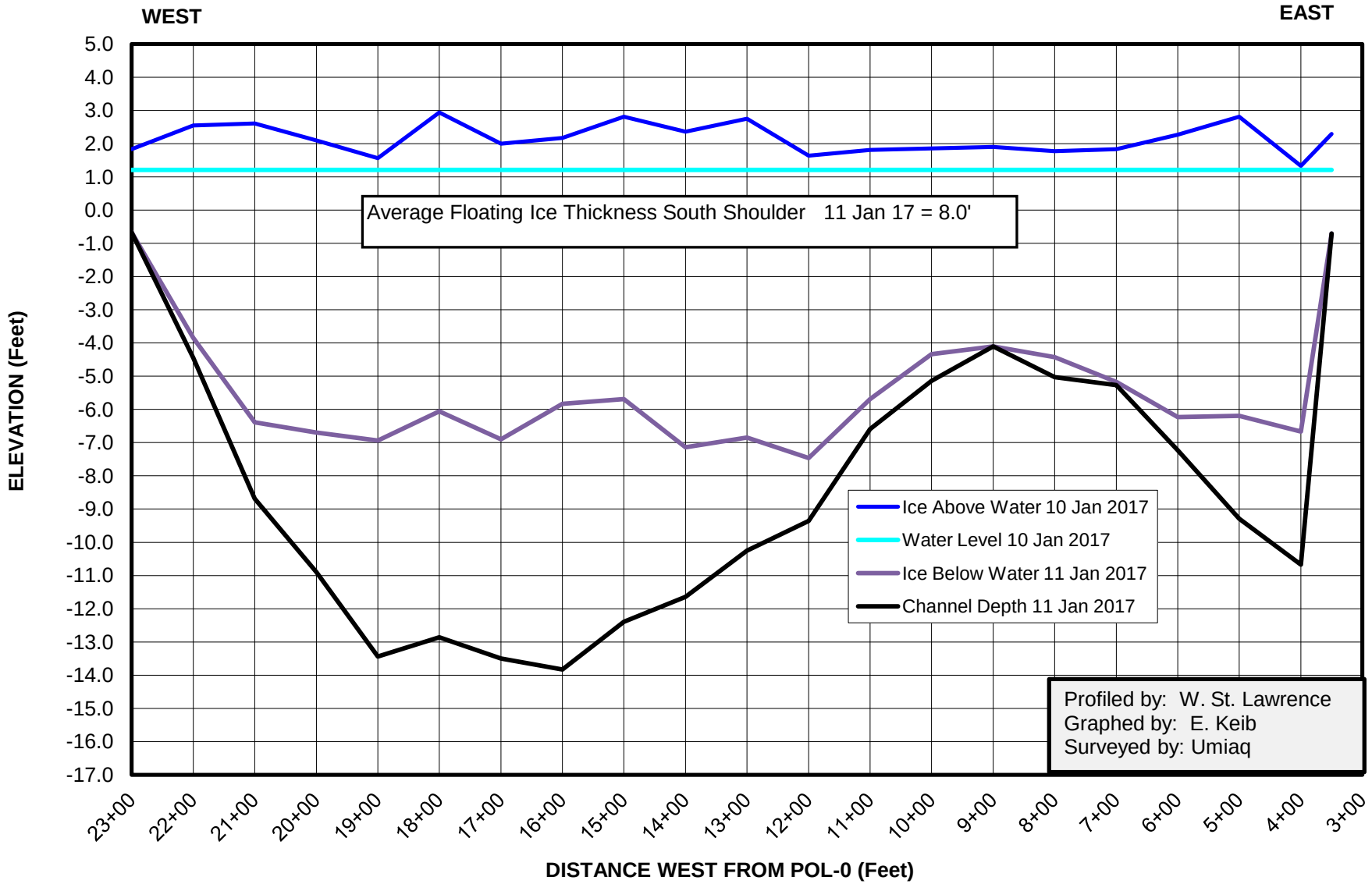


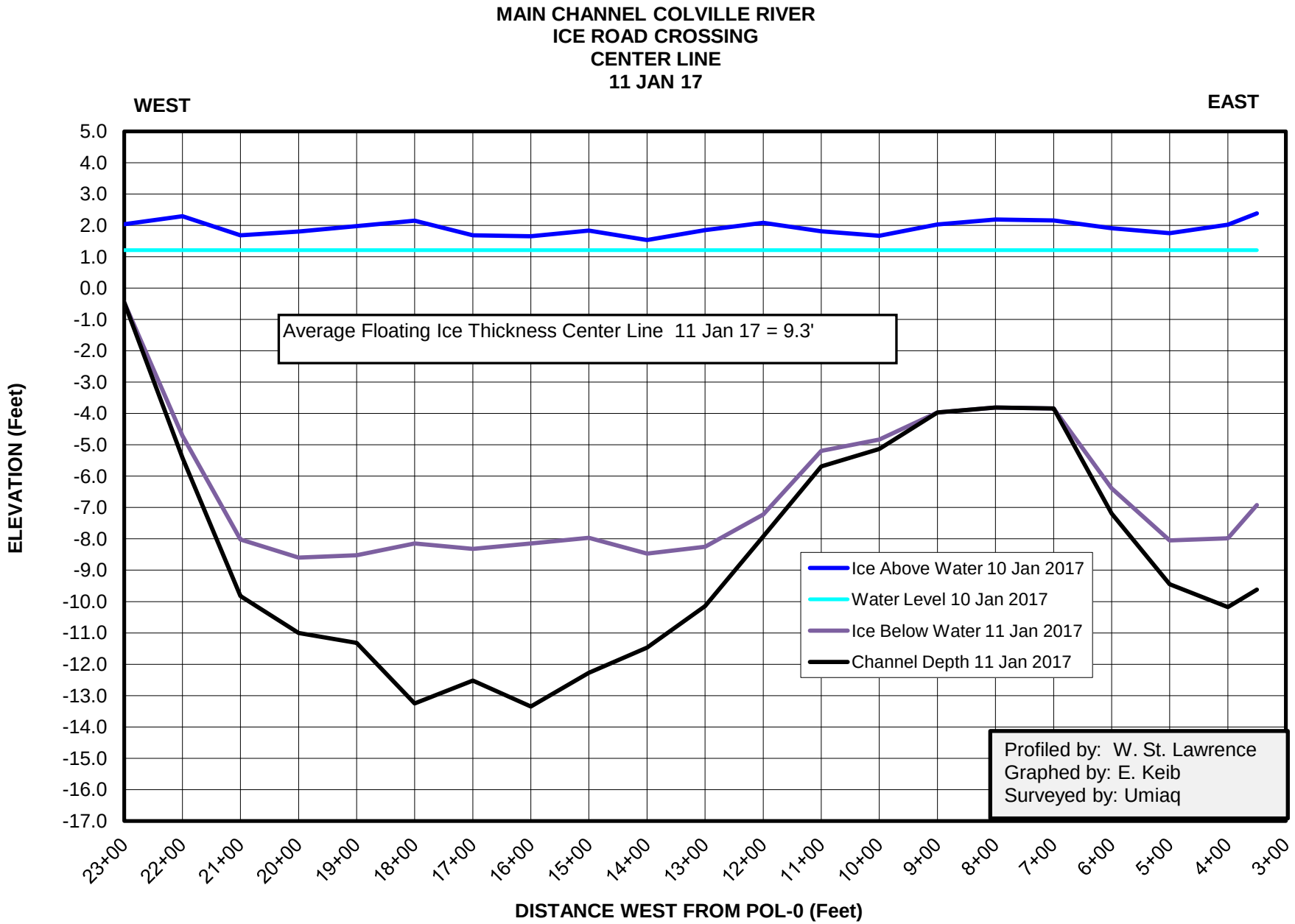
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
3 Jan 2017



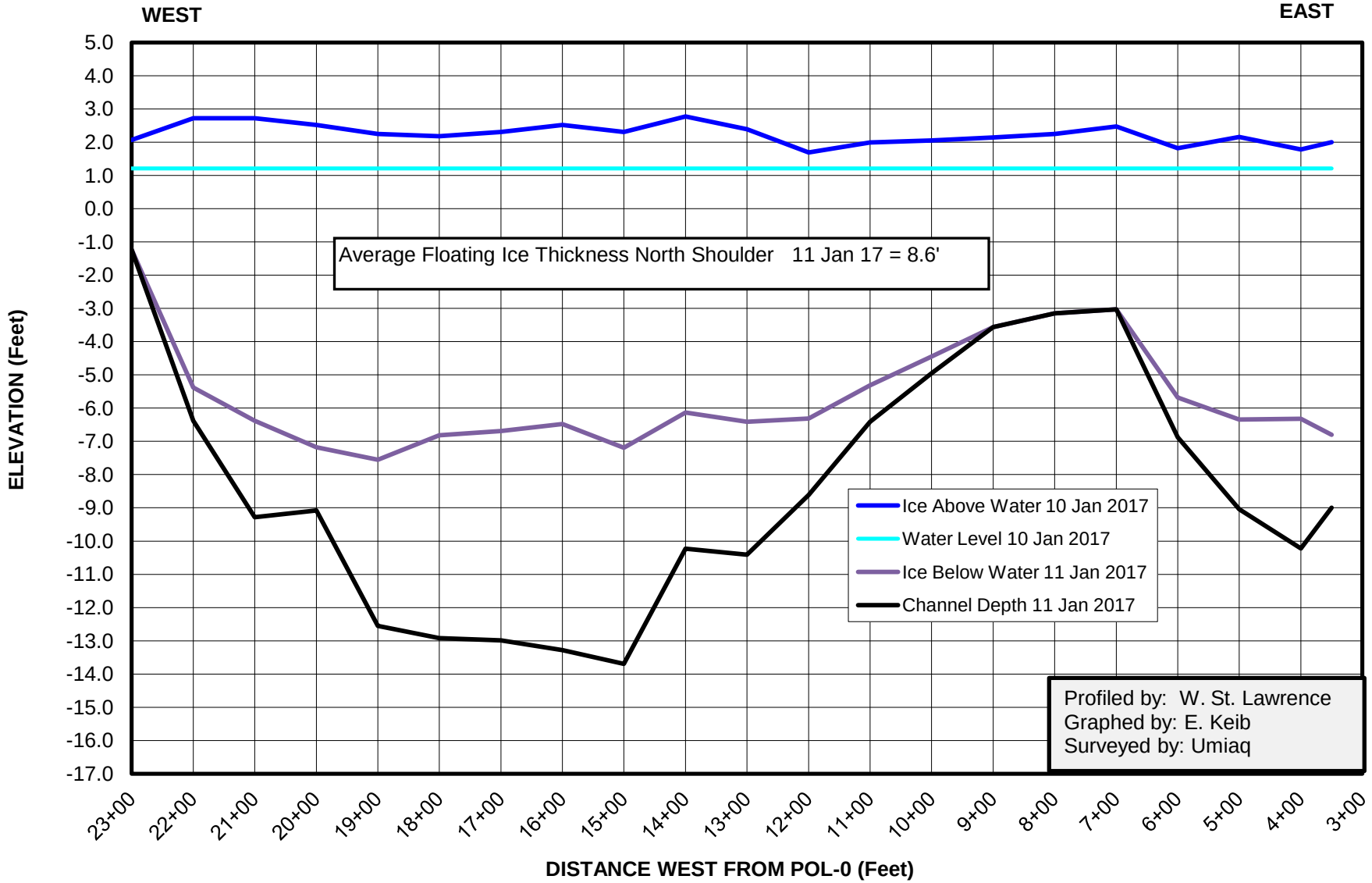

MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
9 Jan 17
WEST
EAST
DEPTH (Feet)
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
Average Floating Ice Thickness Center Line 9 Jan 17 = 8.1'
Depth and Elevations Referenced to BPMSL Datum
Surface Ice Elevation
Water Level
Ice Below Water 9 Jan 17
Channel Depth
Profiled by: W.St. Lawrence
Graphed by: W. St. Lawrence
Surface Elevation and Water Level
Measurements by Umiat Survey
24+00
23+00
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
DISTANCE WEST FROM POL-0 (Feet)

MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
11 JAN 17

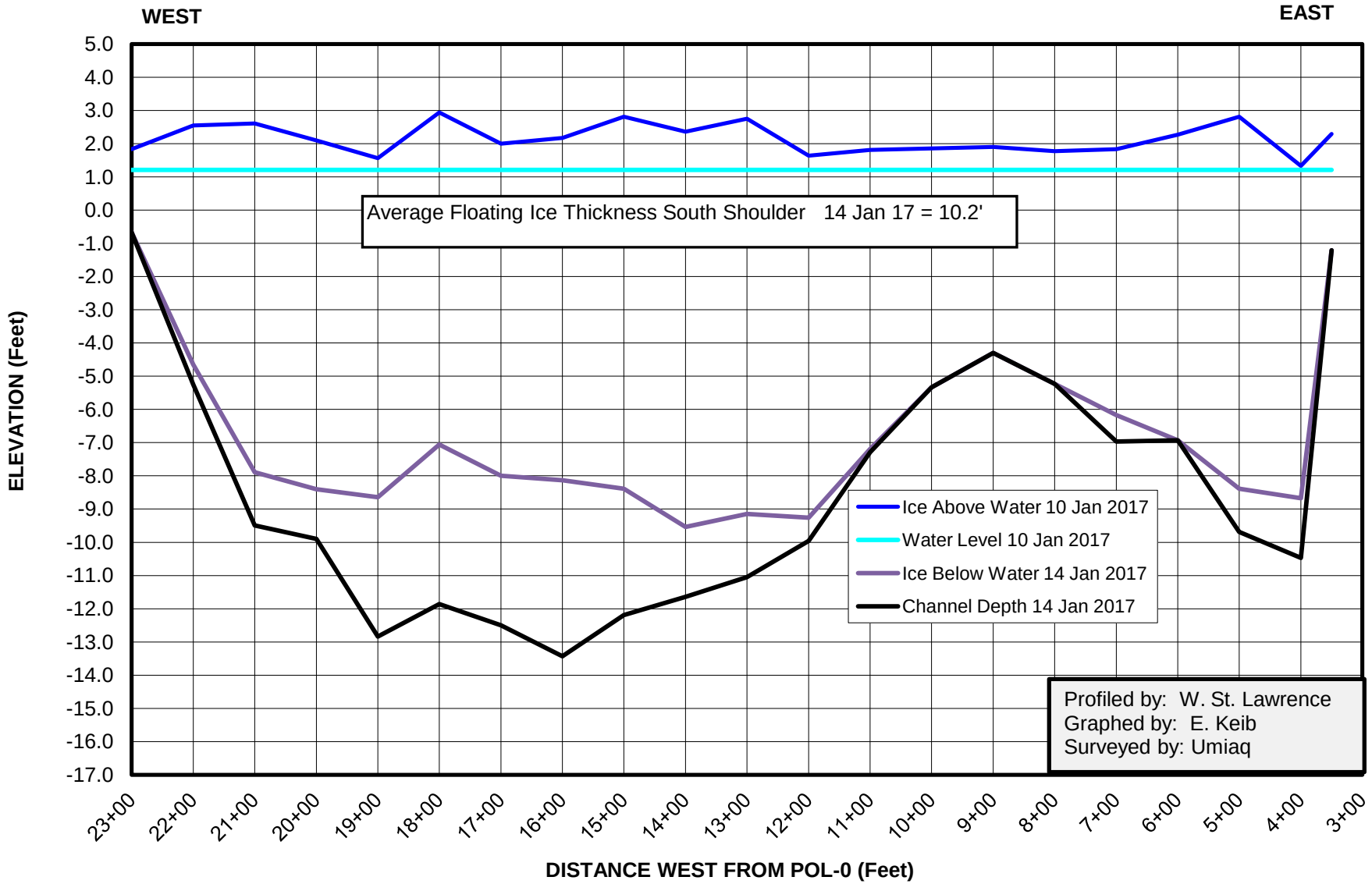


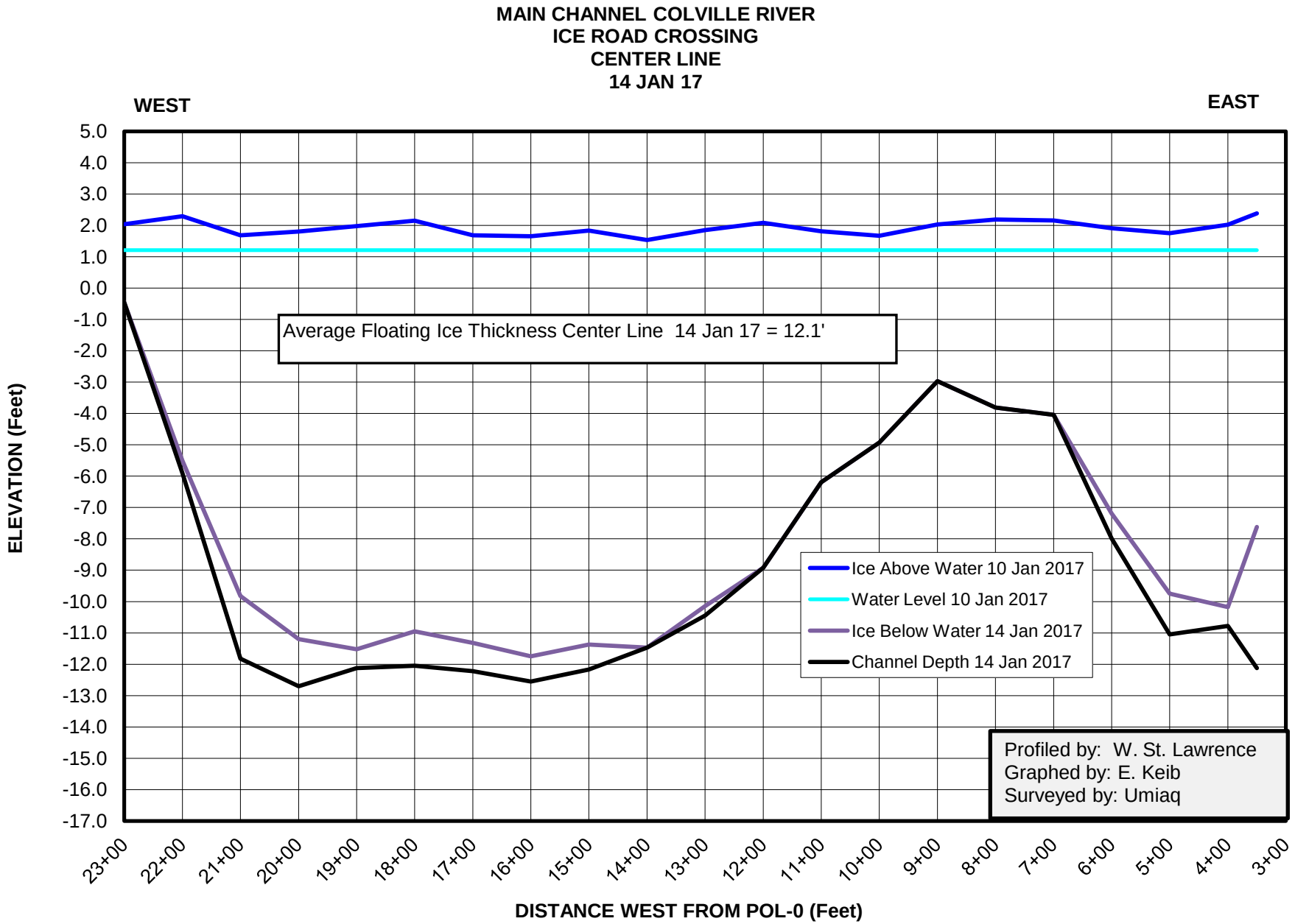

MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
11 JAN 17
WEST
EAST
ELEVATION (Feet)
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
-15.0
-16.0
-17.0
Average Floating Ice Thickness Center Line 11 Jan 17 = 9.3'
Ice Above Water 10 Jan 2017
Water Level 10 Jan 2017
Ice Below Water 11 Jan 2017
Channel Depth 11 Jan 2017
Profiled by: W. St. Lawrence
Graphed by: E. Keib
Surveyed by: Umiaq
23+00
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
3+00
DISTANCE WEST FROM POL-0 (Feet)

MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
11 JAN 17

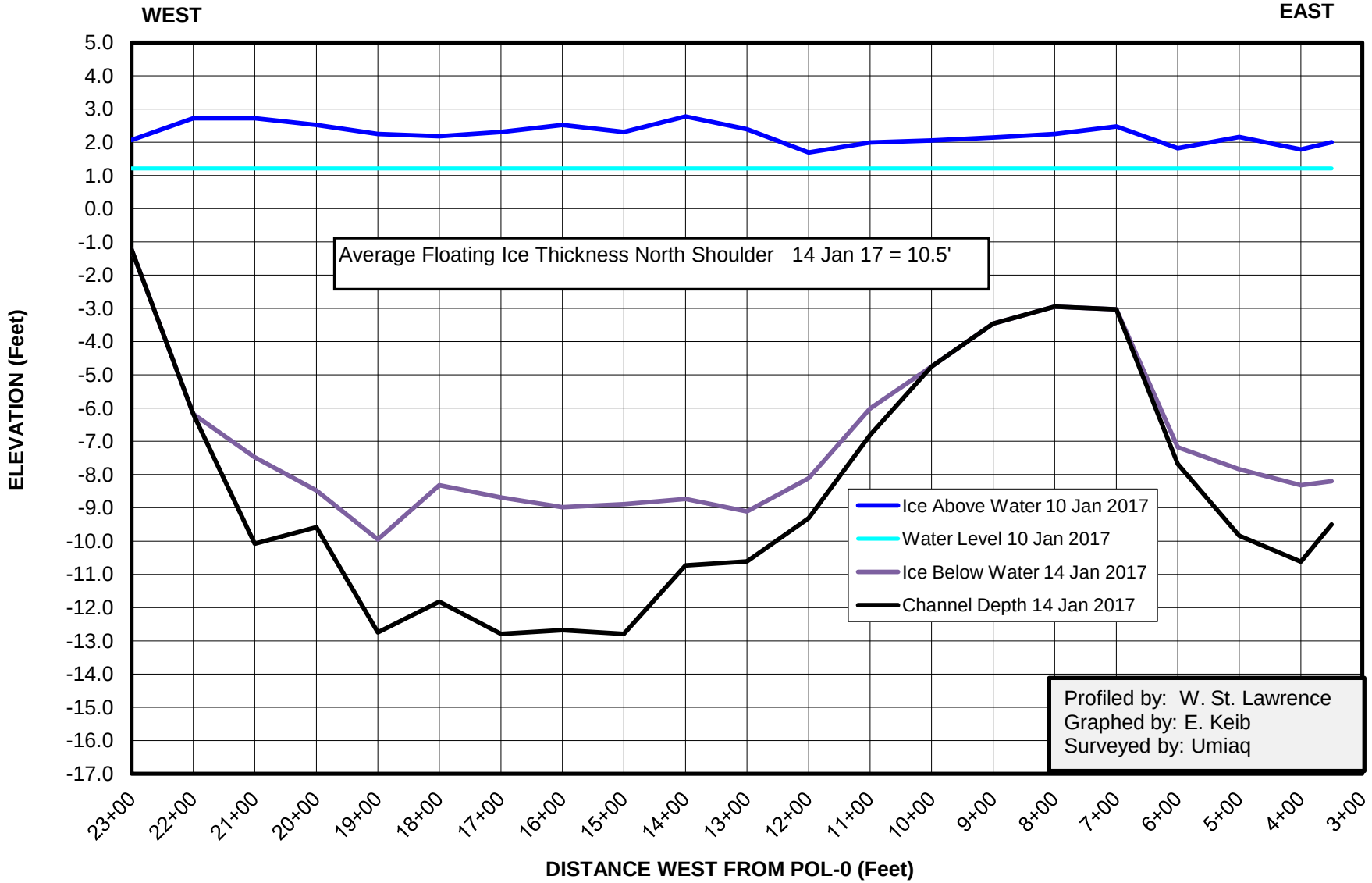


MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
14 JAN 17

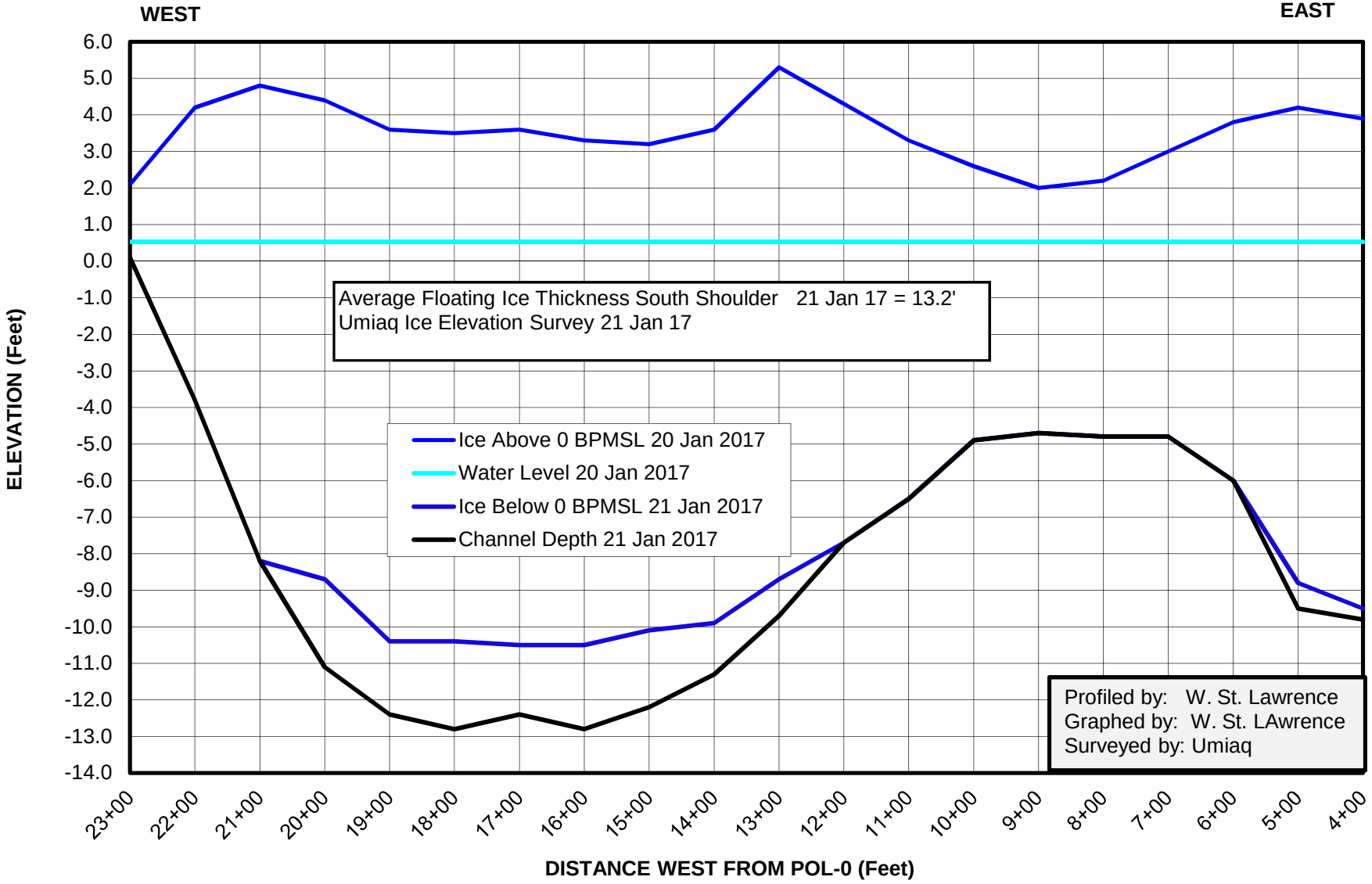



MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
14 JAN 17
WEST
EAST
ELEVATION (Feet)
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
-15.0
-16.0
-17.0
Average Floating Ice Thickness Center Line 14 Jan 17 = 12.1'
Ice Above Water 10 Jan 2017
Water Level 10 Jan 2017
Ice Below Water 14 Jan 2017
Channel Depth 14 Jan 2017
Profiled by: W. St. Lawrence
Graphed by: E. Keib
Surveyed by: Umiaq
23+00
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
3+00
DISTANCE WEST FROM POL-0 (Feet)

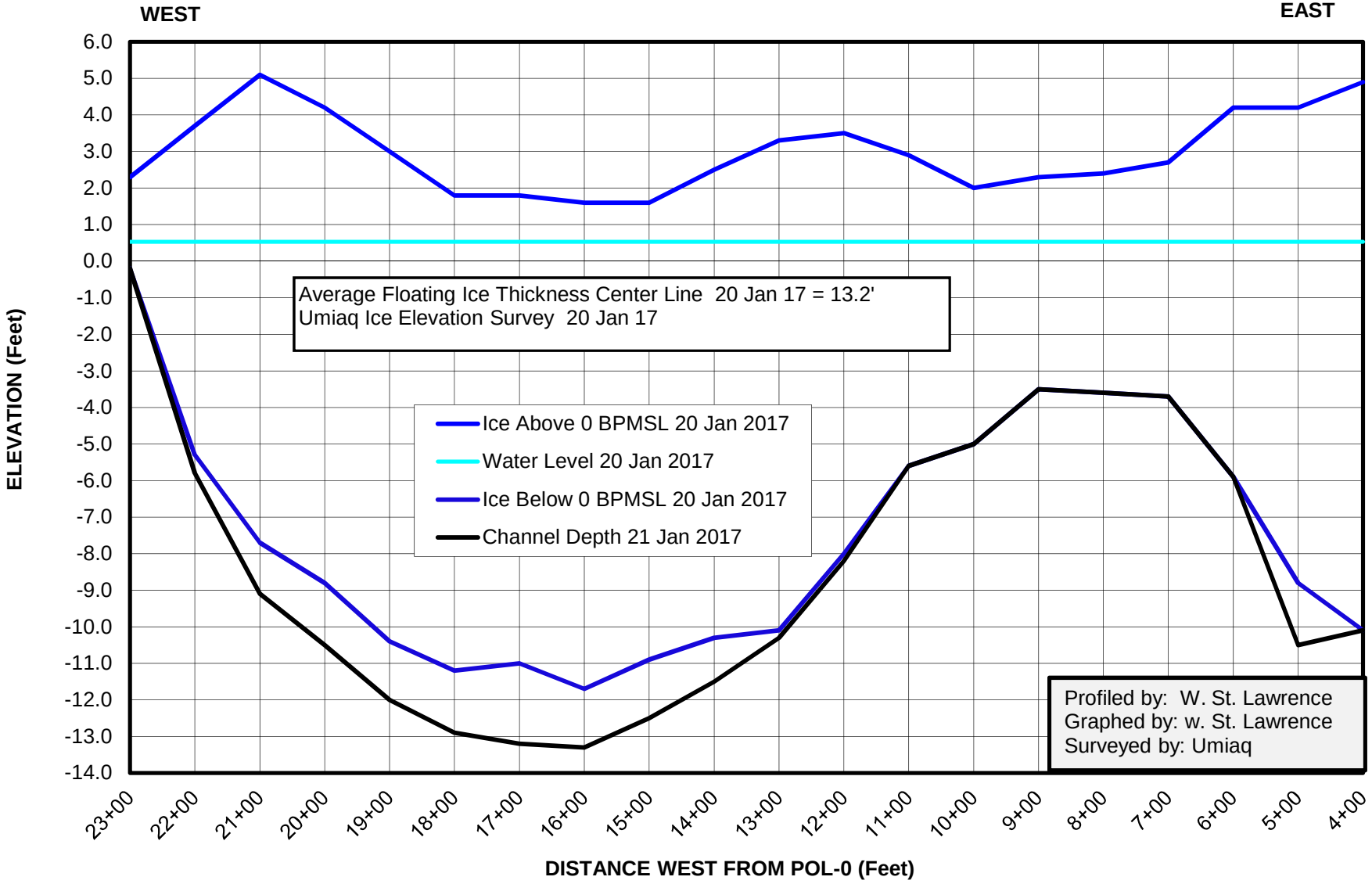
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
14 JAN 17



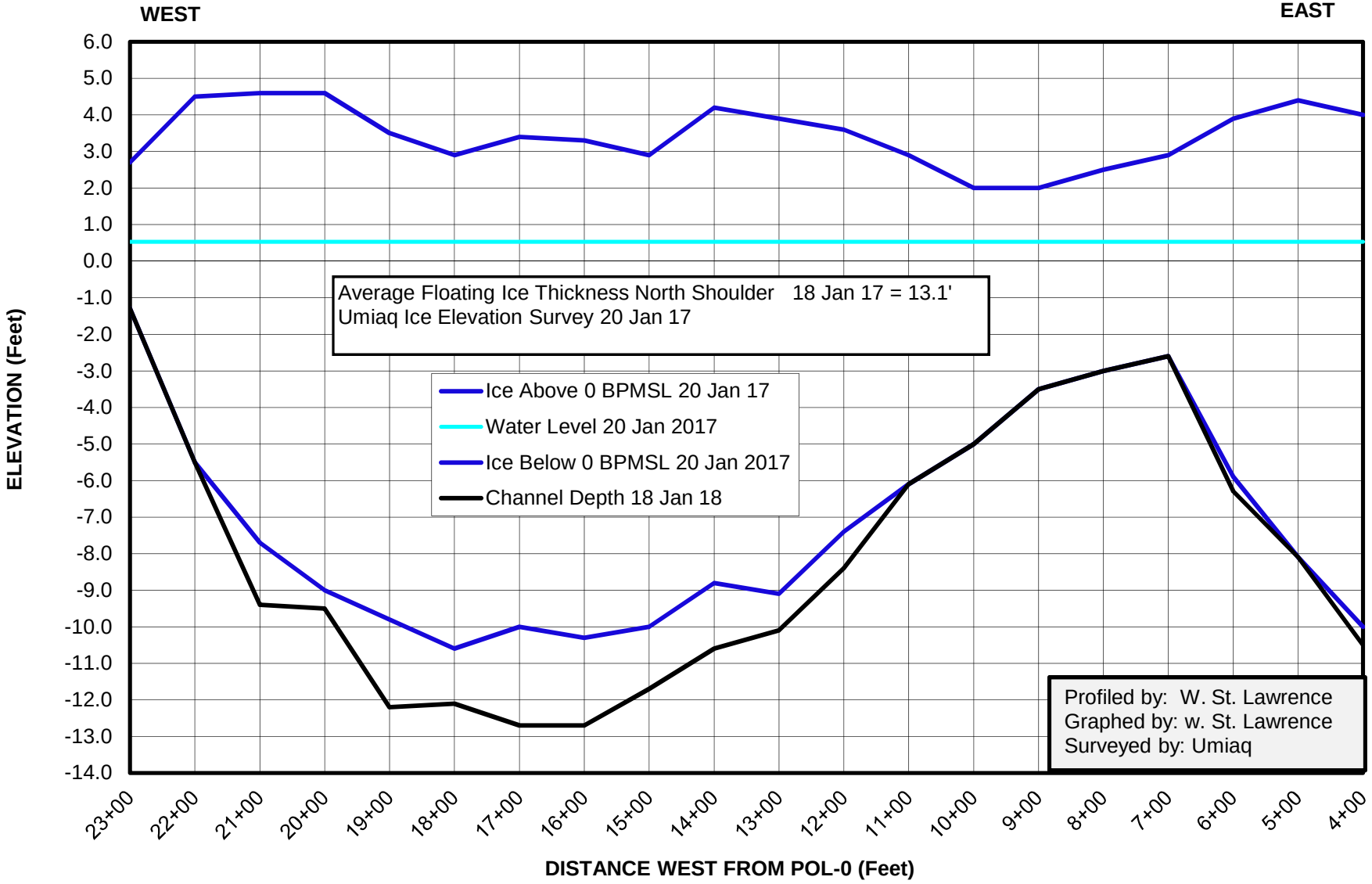
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
21 JAN 17



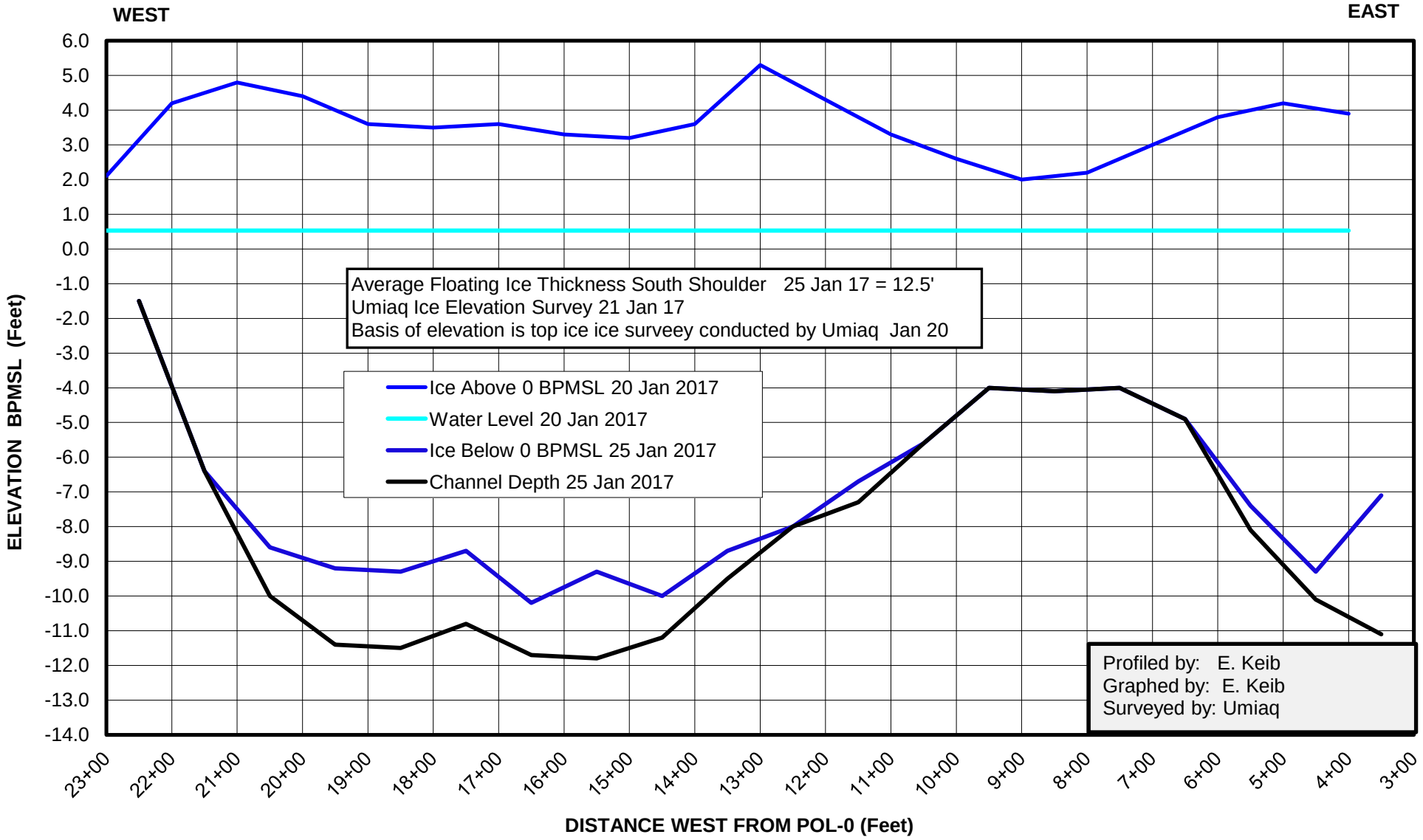
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER LINE
21 JAN 17



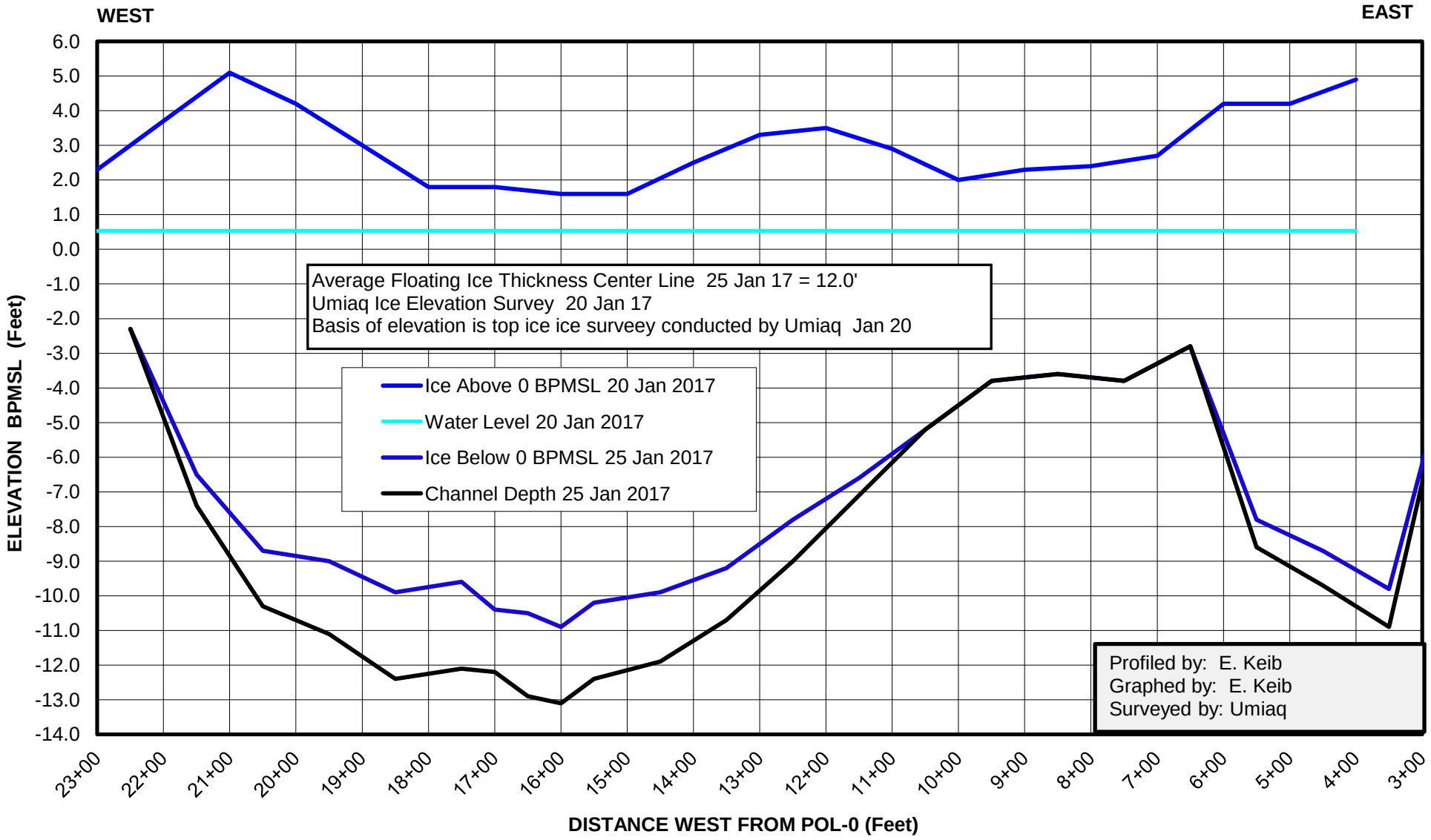
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
18 JAN 17



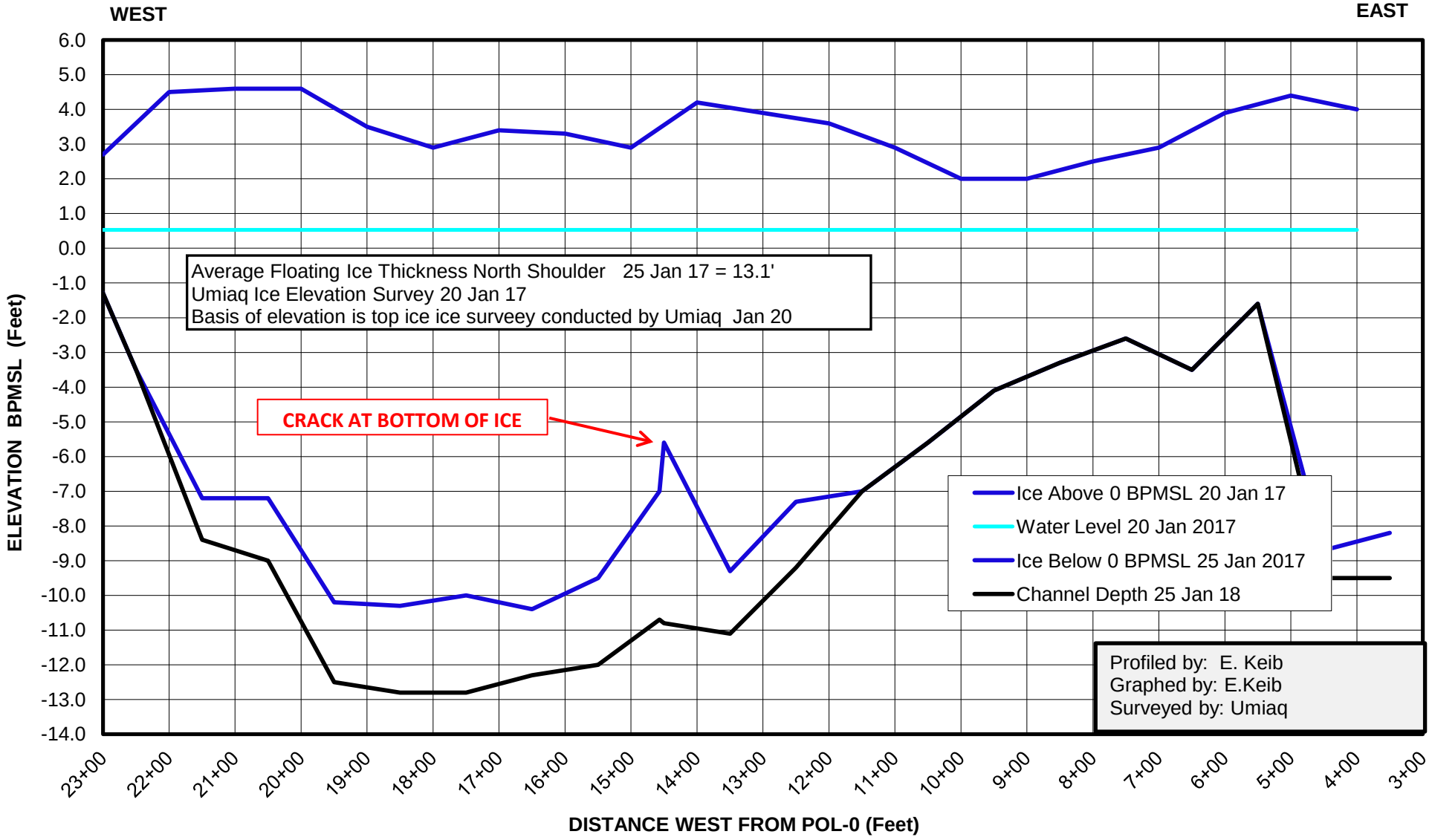
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
Centerline of B70 Lanes
63.5' South of Center Line
25 JAN 17



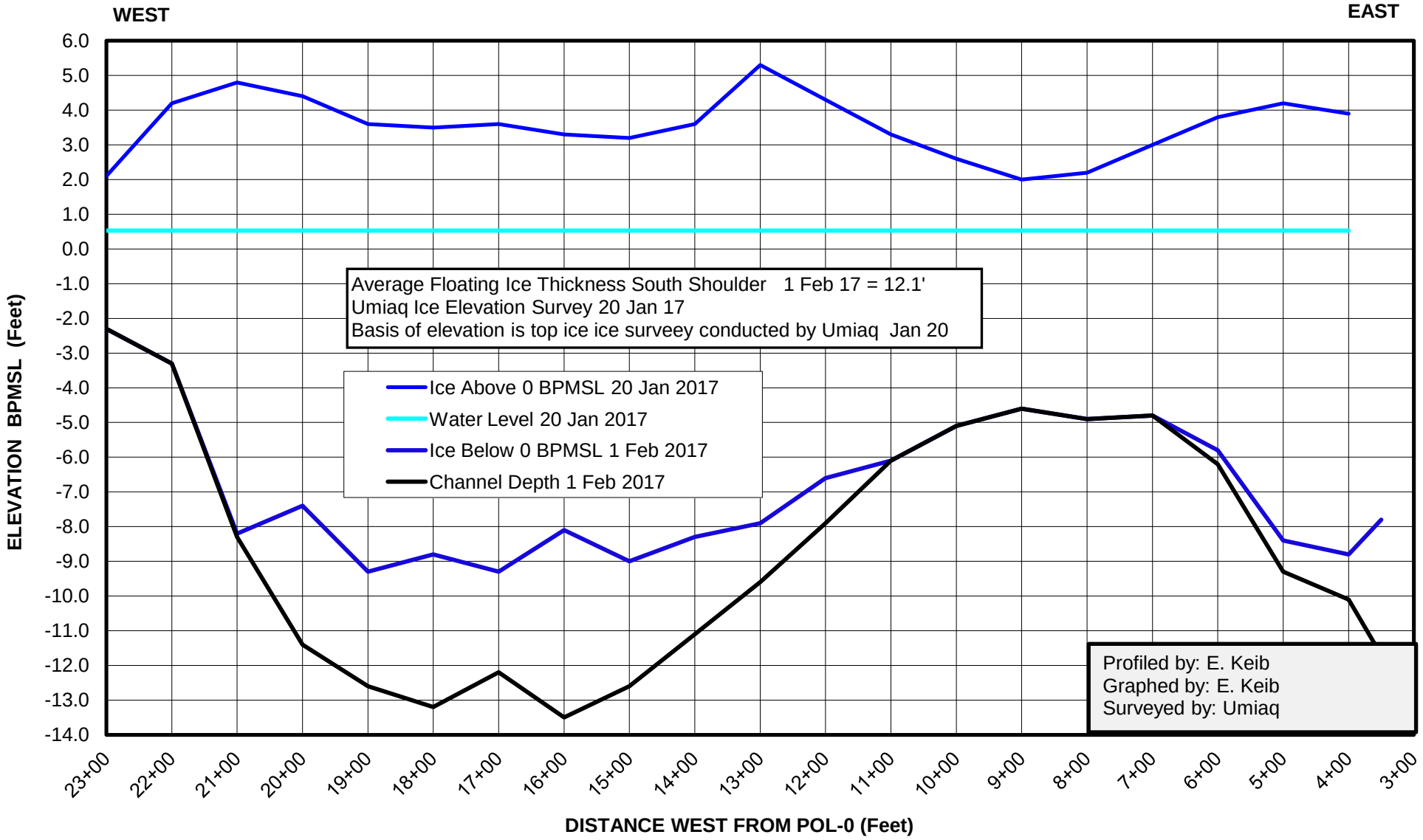
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
Centerline
25 JAN 17



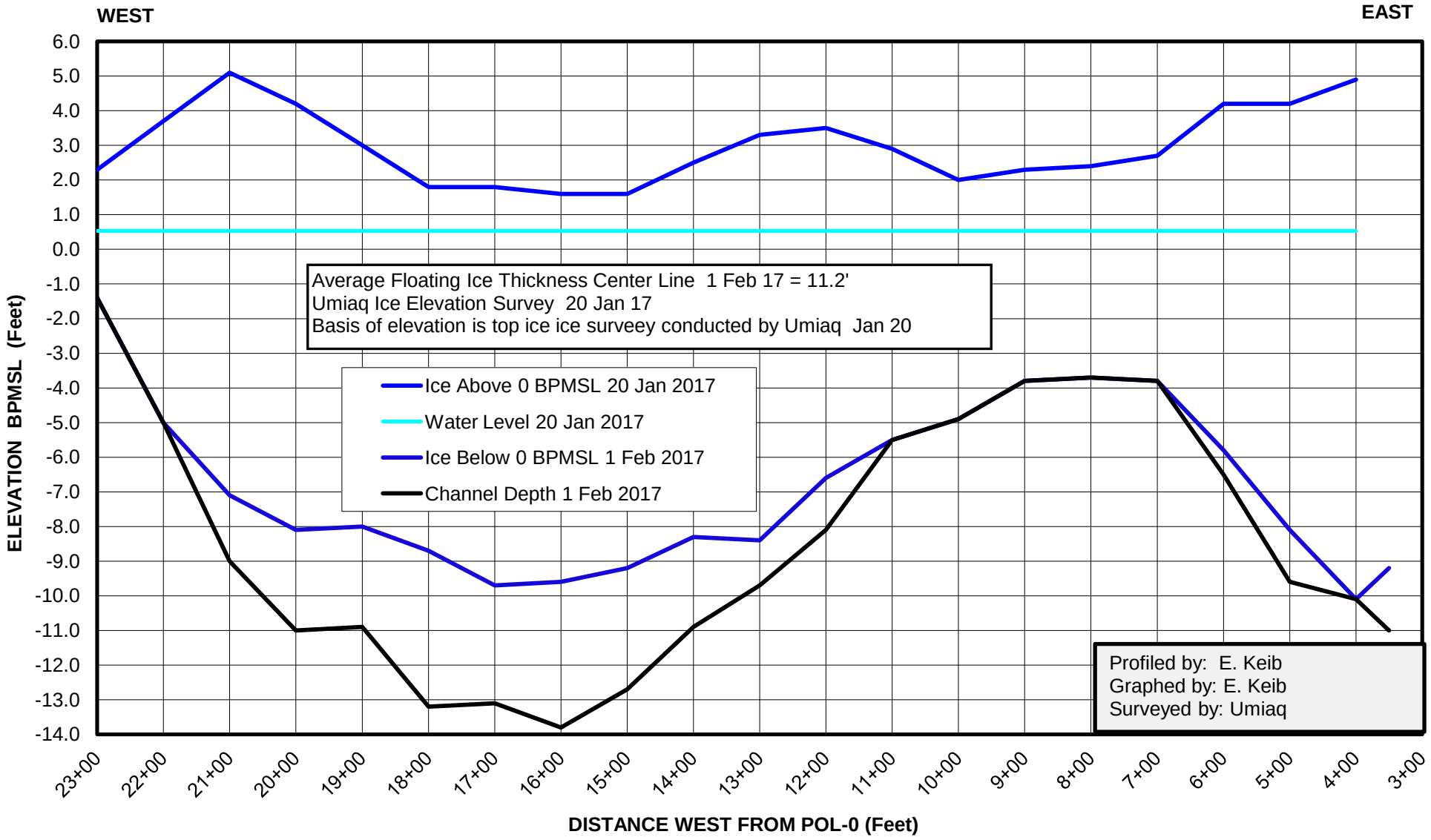
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
Centerline of Westbound Lane
67.5' North of Center Line
25 JAN 17



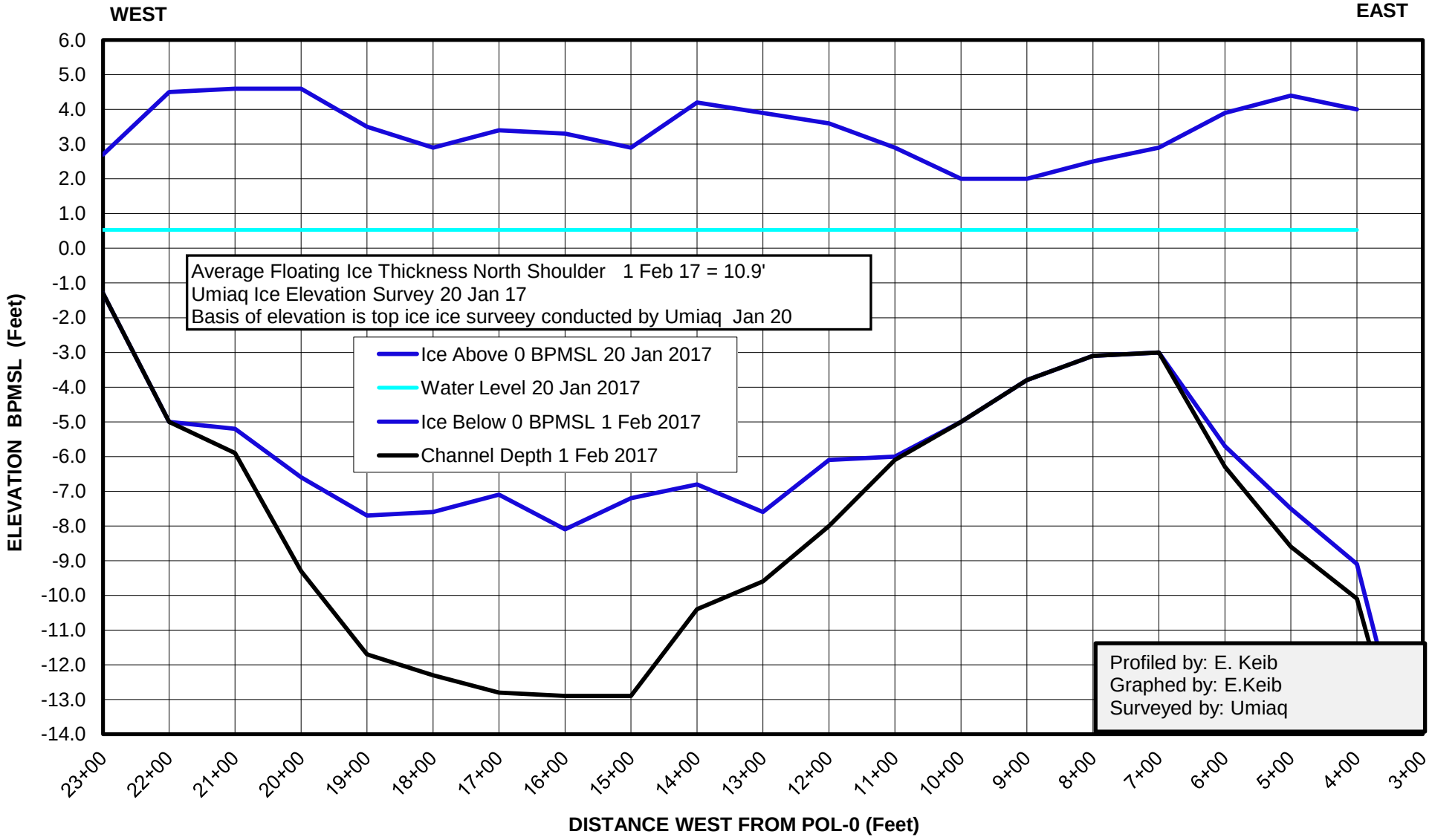
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Center Line
1 FEB 17



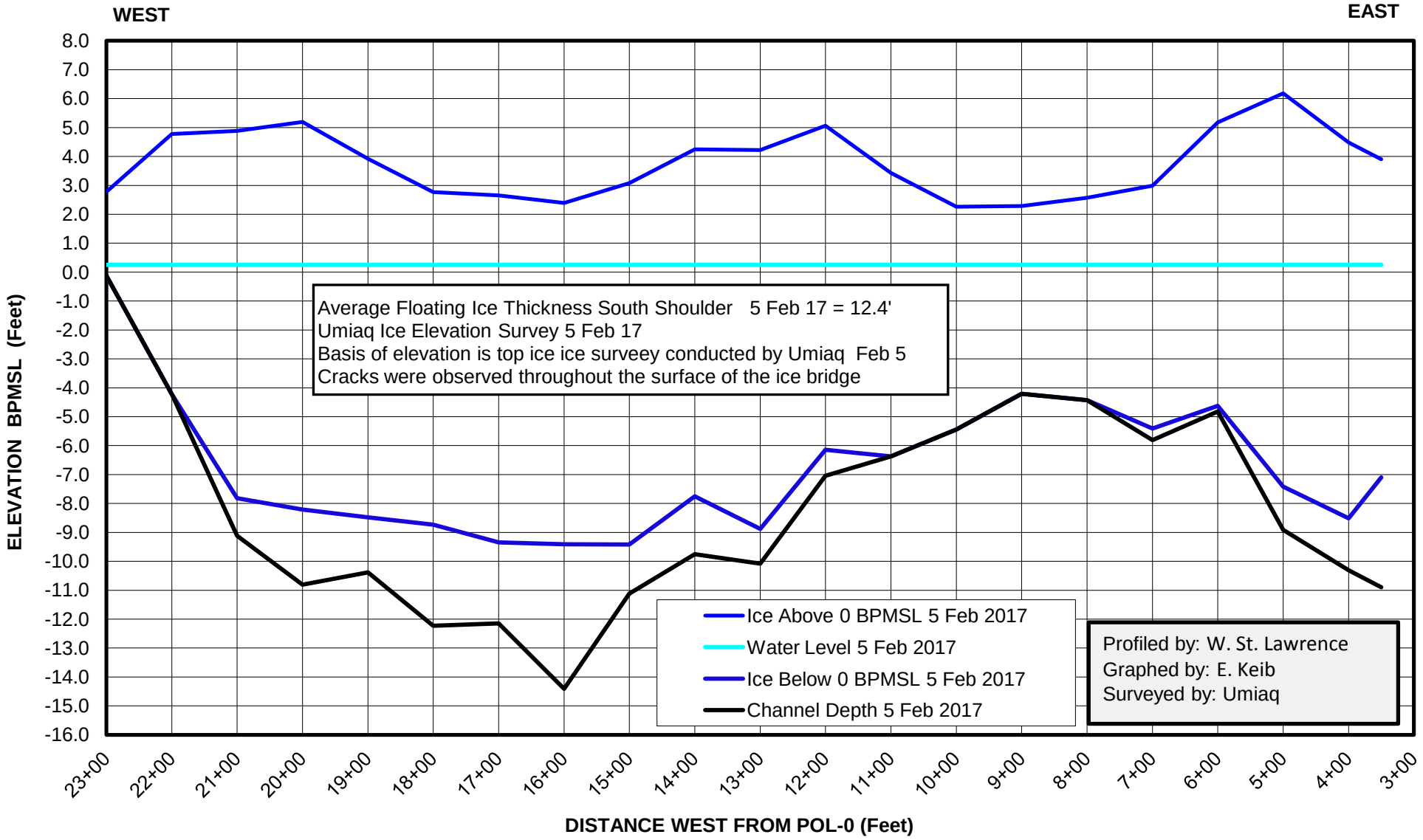
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
Centerline
1 FEB 17



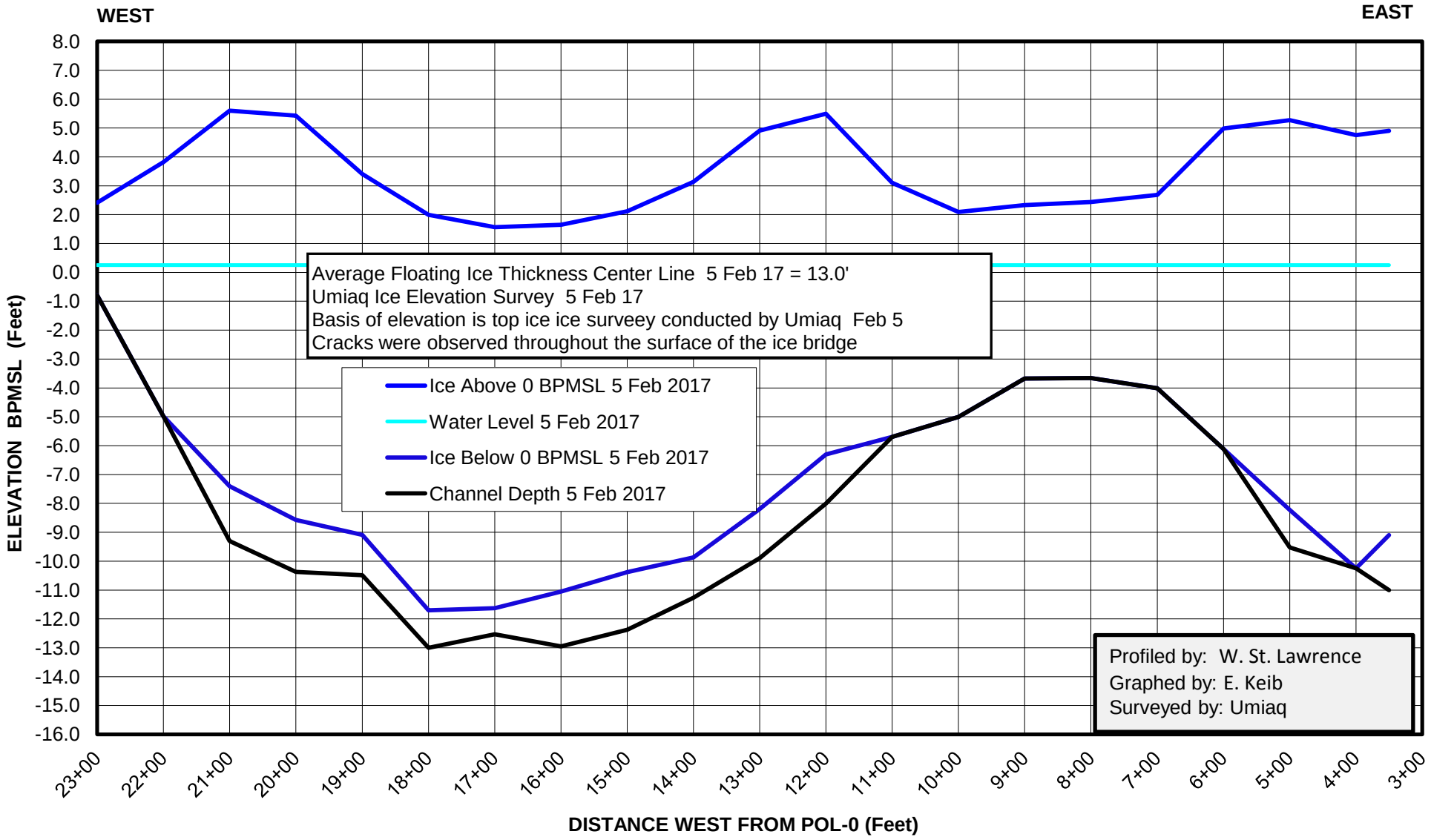
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Center Line
1 FEB 17



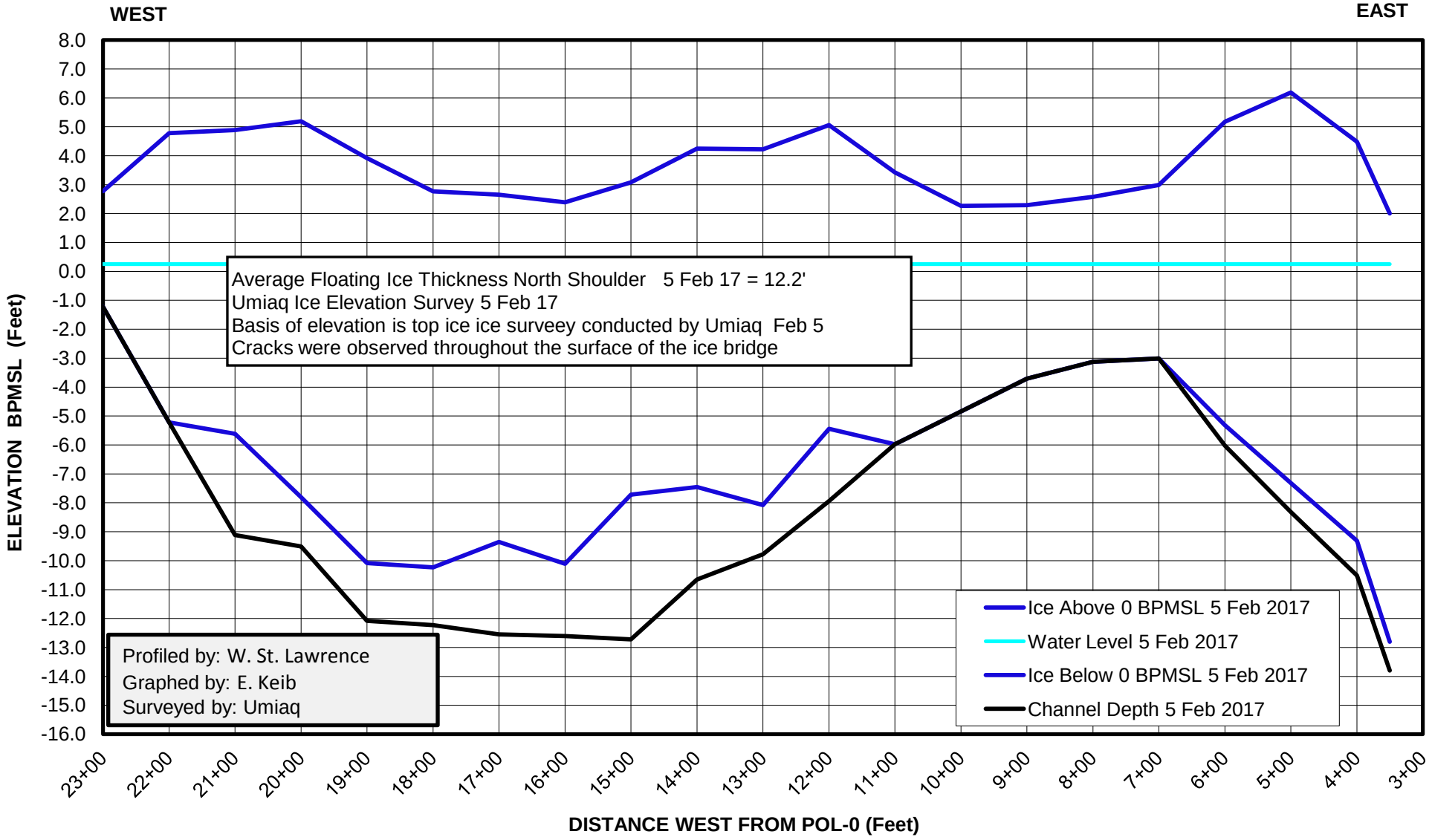
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Centerline
5 FEB 17



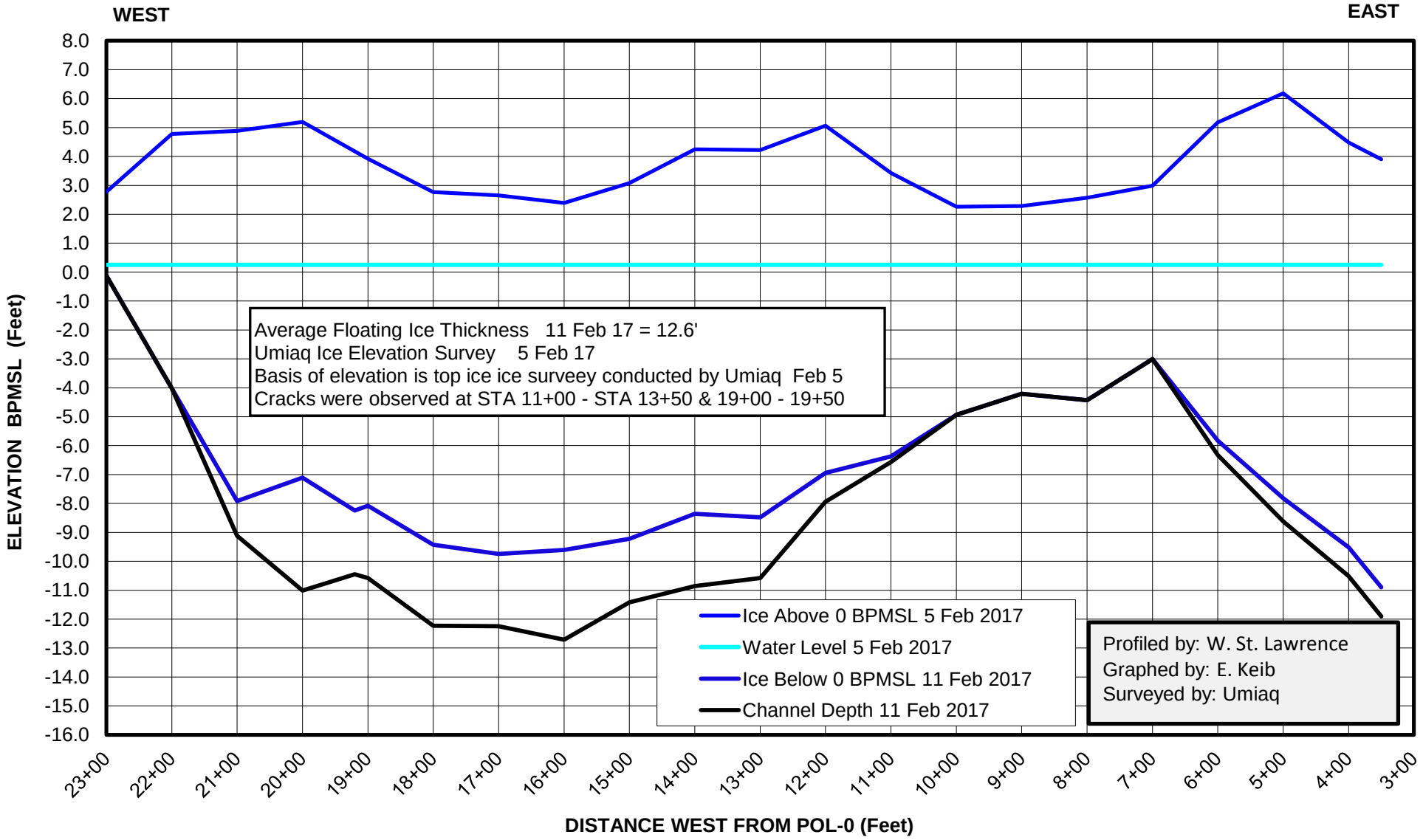
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTERLINE
5 FEB 17



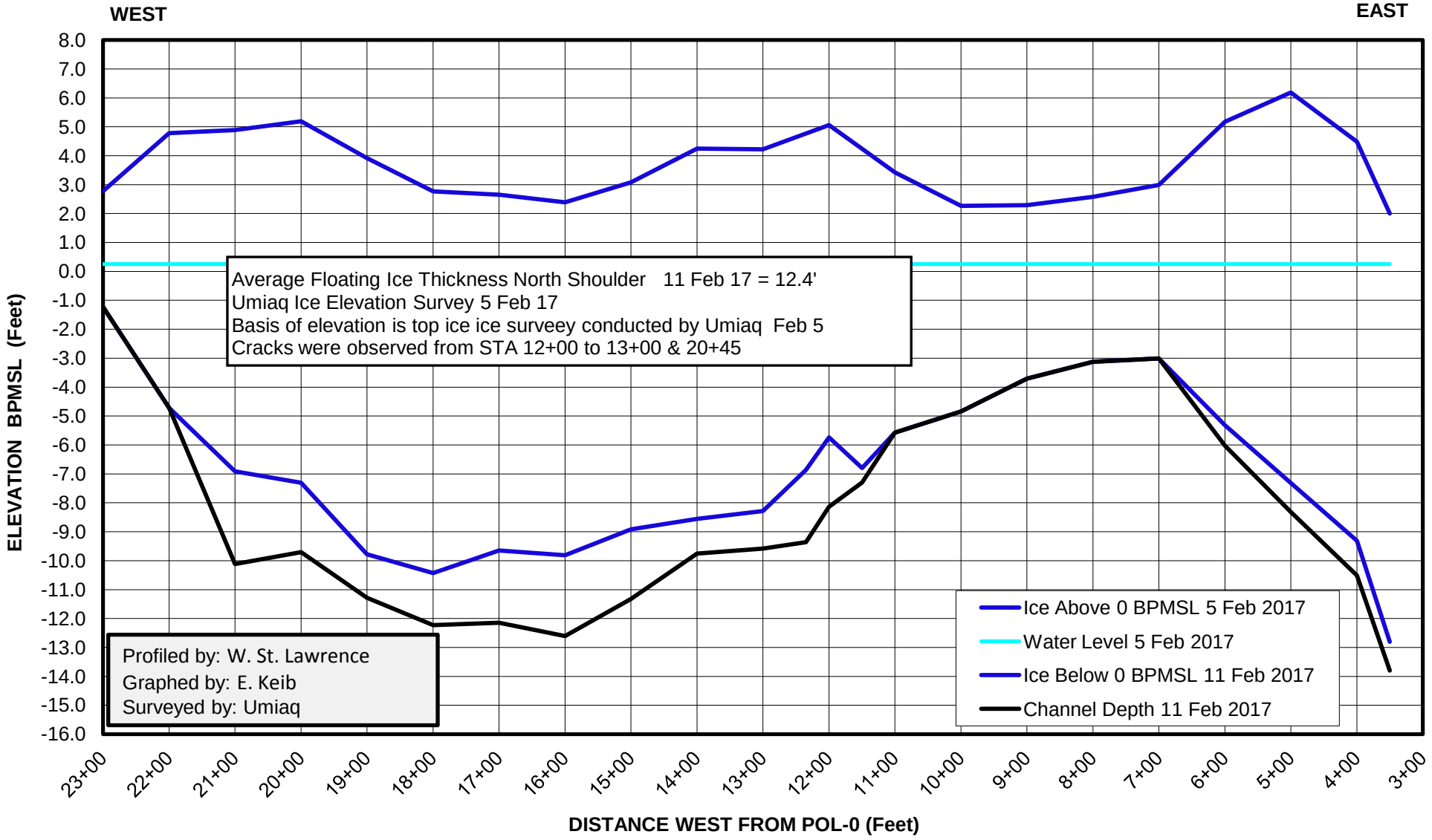
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Centerline
5 FEB 17

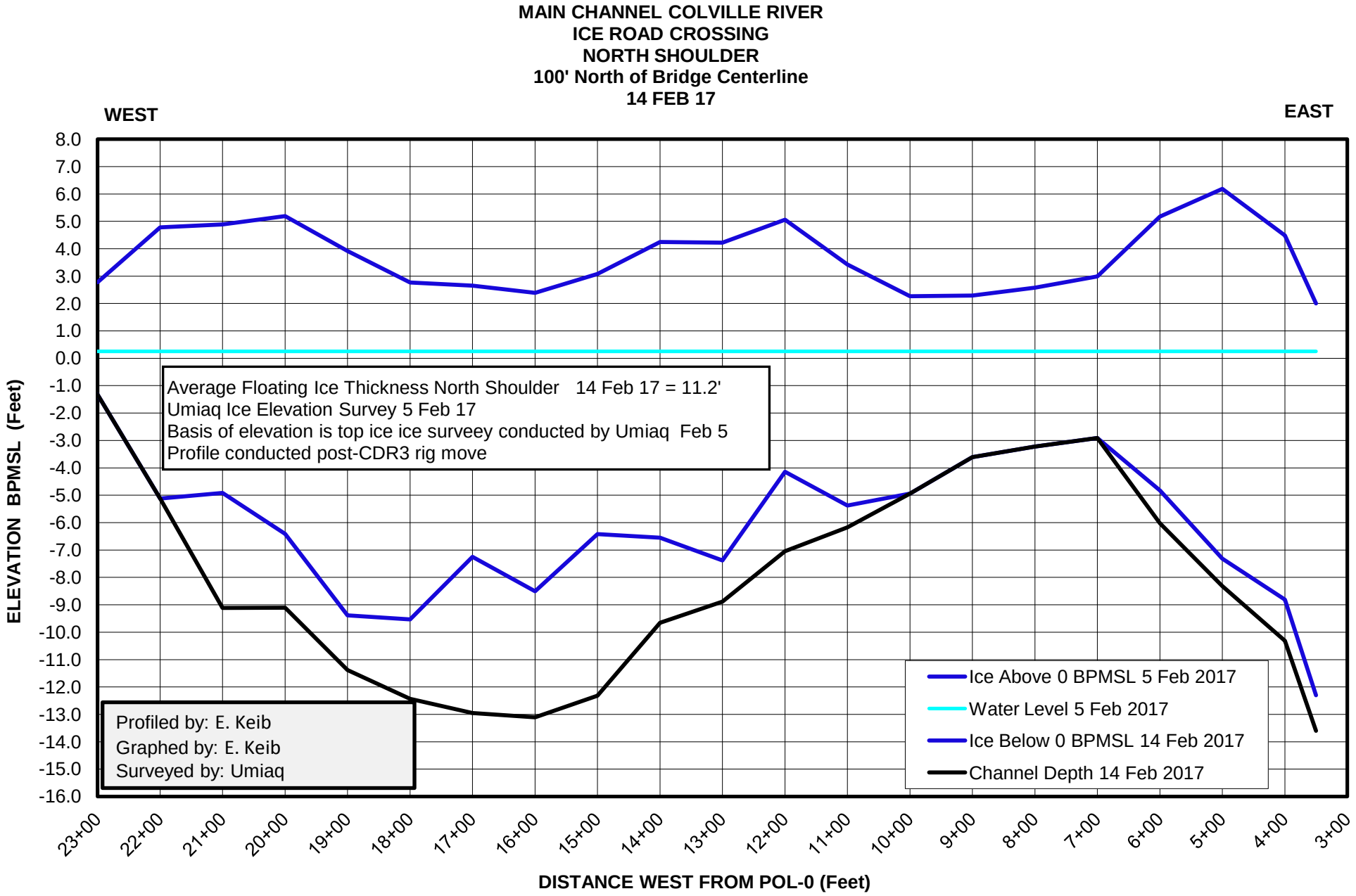


MAIN CHANNEL COLVILLE RIVER ICE
ROAD CROSSING
SOUTH SIDE OF MATS
Mats are along Centerline of Ice Bridge
11 FEB 17

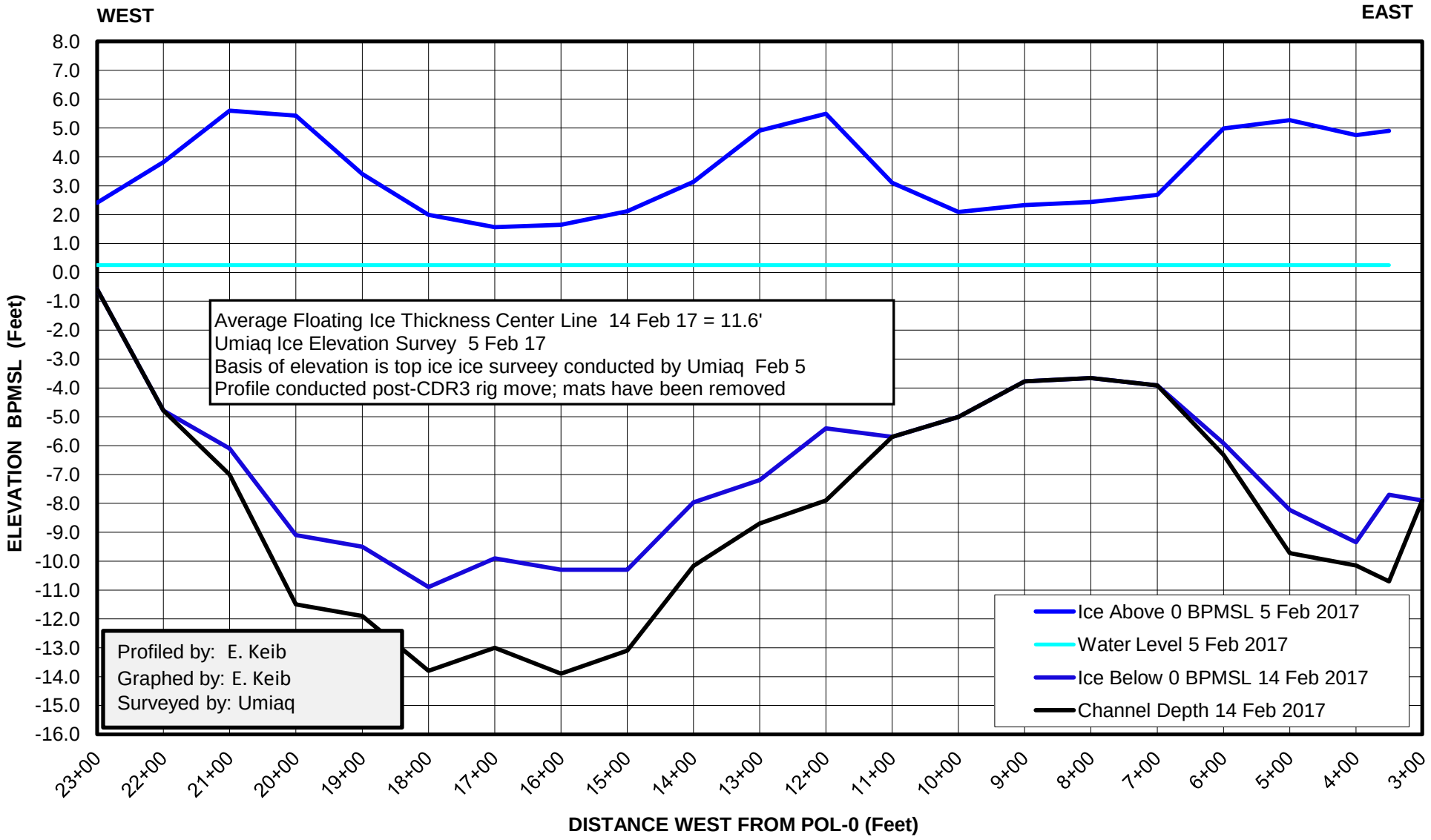


MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH EDGE OF MATS
Mats are along Centerline of Ice Bridge
11 FEB 17

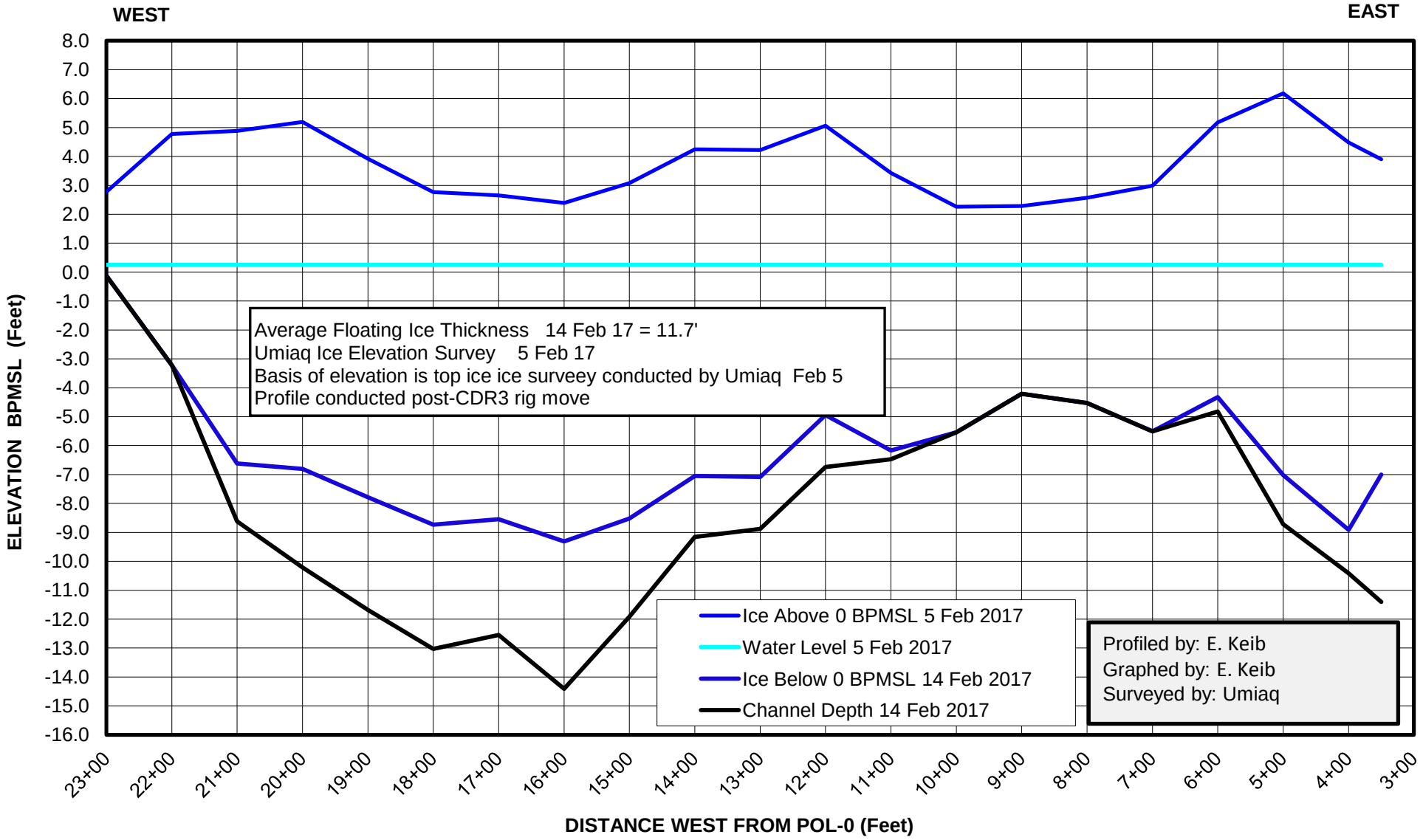



MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
14 FEB 17
WEST
EAST
ELEVATION BPMSL (Feet)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
-15.0
-16.0
Average Floating Ice Thickness North Shoulder 14 Feb 17 = 11.2'
Umiaq Ice Elevation Survey 5 Feb 17
Basis of elevation is top ice ice surveey conducted by Umiaq Feb 5
Profile conducted post-CDR3 rig move
Profiled by: E. Keib
Graphed by: E. Keib
Surveyed by: Umiaq
Ice Above 0 BPMSL 5 Feb 2017
Water Level 5 Feb 2017
Ice Below 0 BPMSL 14 Feb 2017
Channel Depth 14 Feb 2017
23+00
22+00
21+00
20+00
19+00
18+00
17+00
16+00
15+00
14+00
13+00
12+00
11+00
10+00
9+00
8+00
7+00
6+00
5+00
4+00
3+00
DISTANCE WEST FROM POL-0 (Feet)

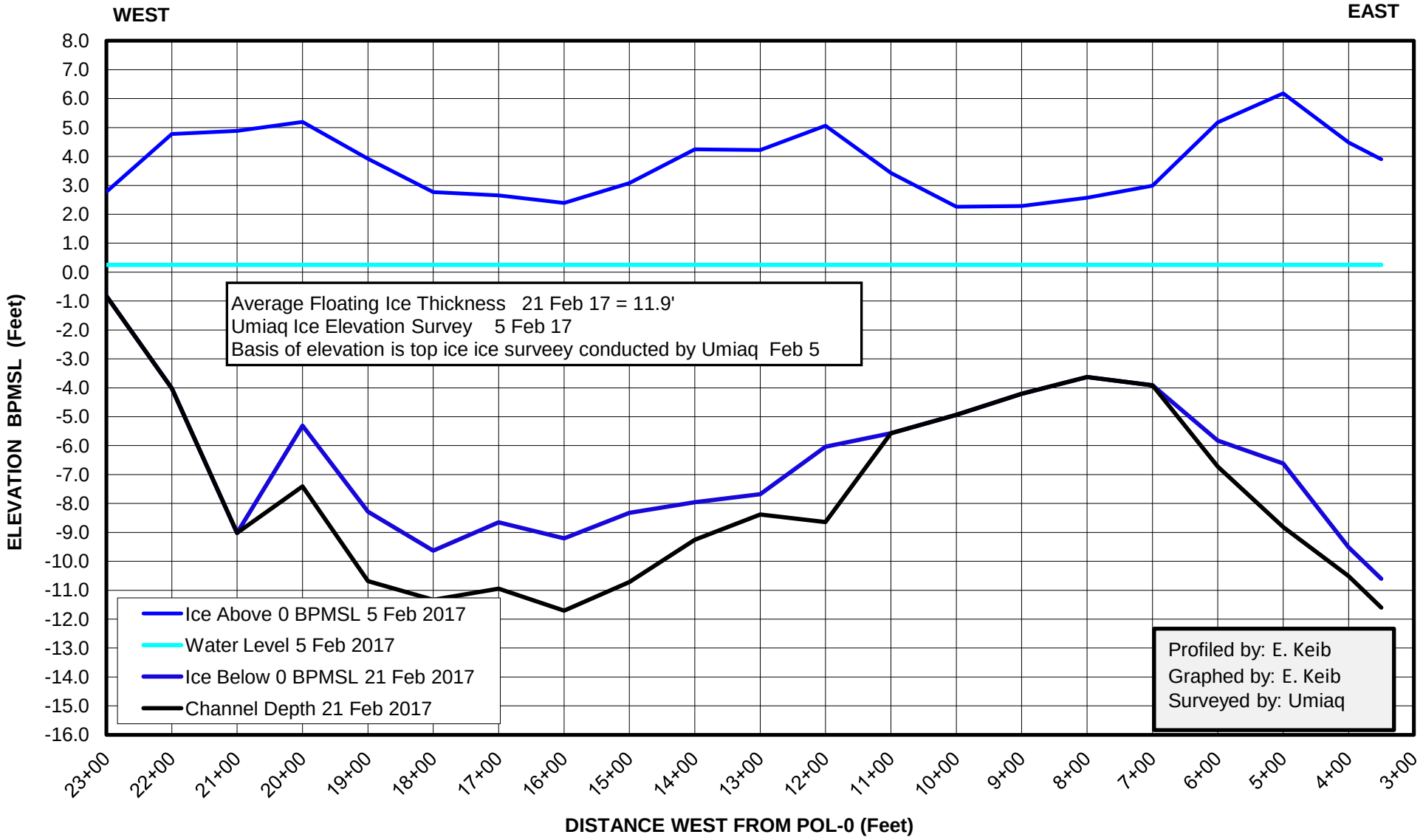
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
BRIDGE CENTERLINE
14 FEB 17



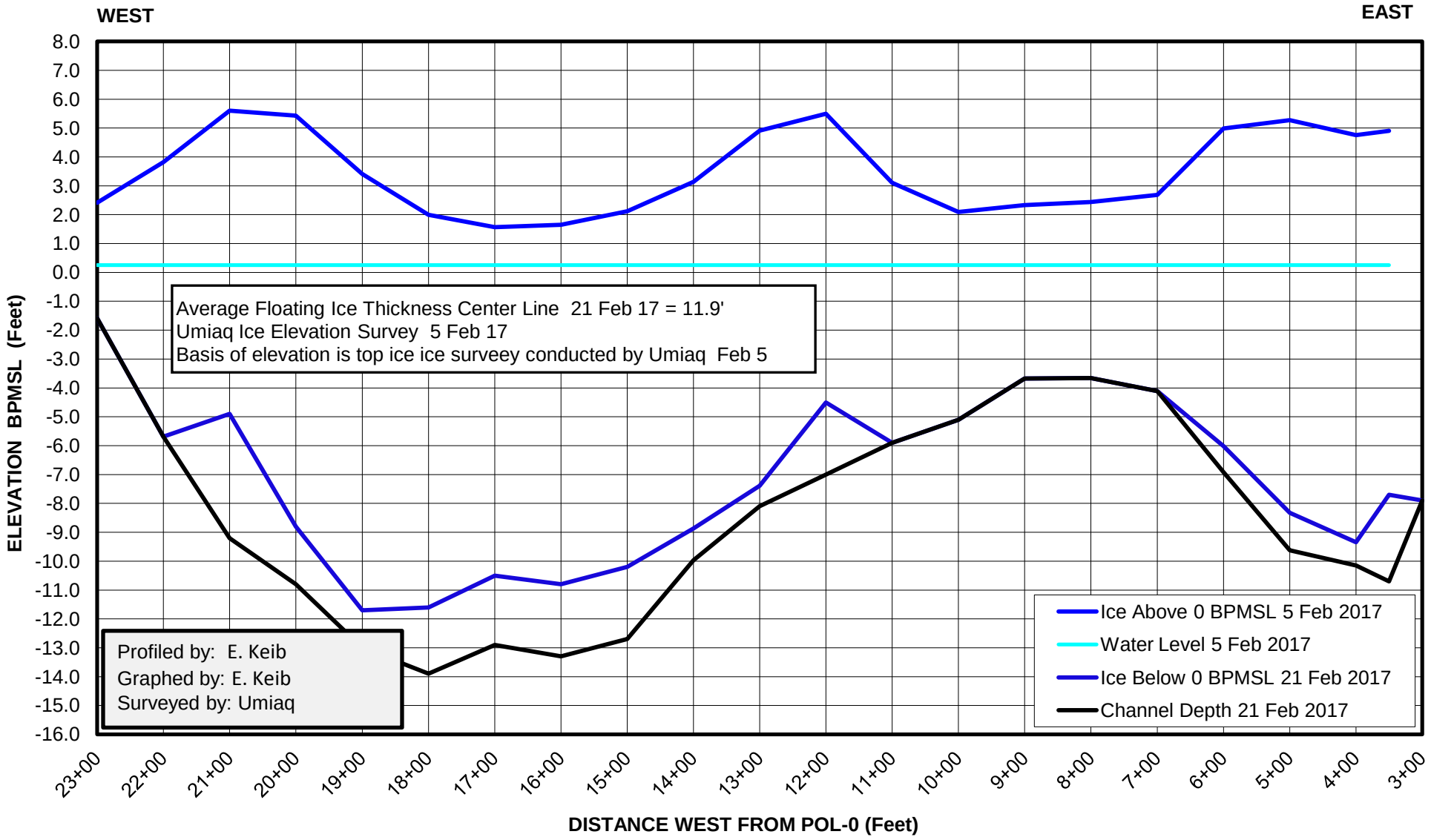
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Bridge Centerline
14 FEB 17



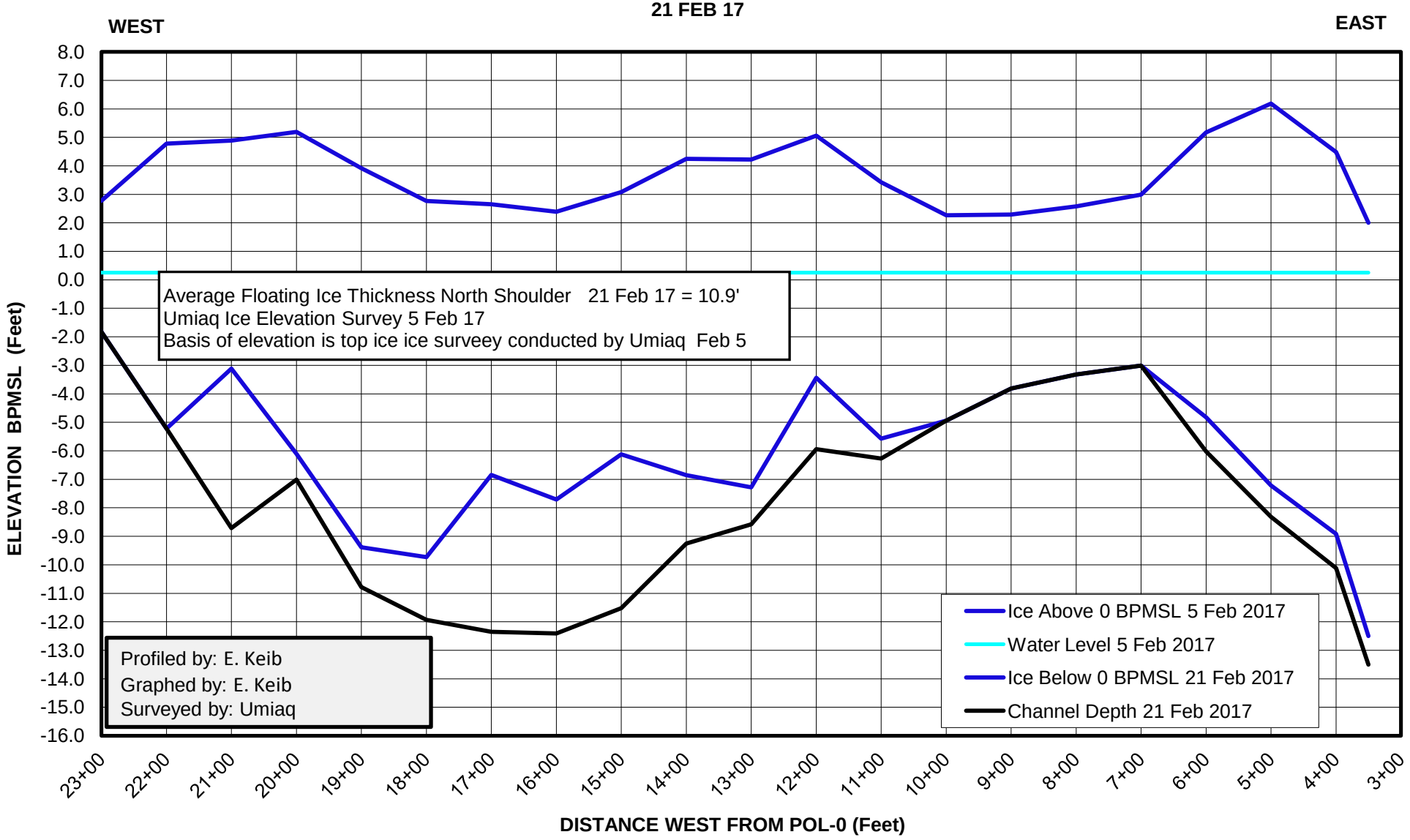
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER OF B70 LANES
67' South of Bridge Centerline
21 FEB 17



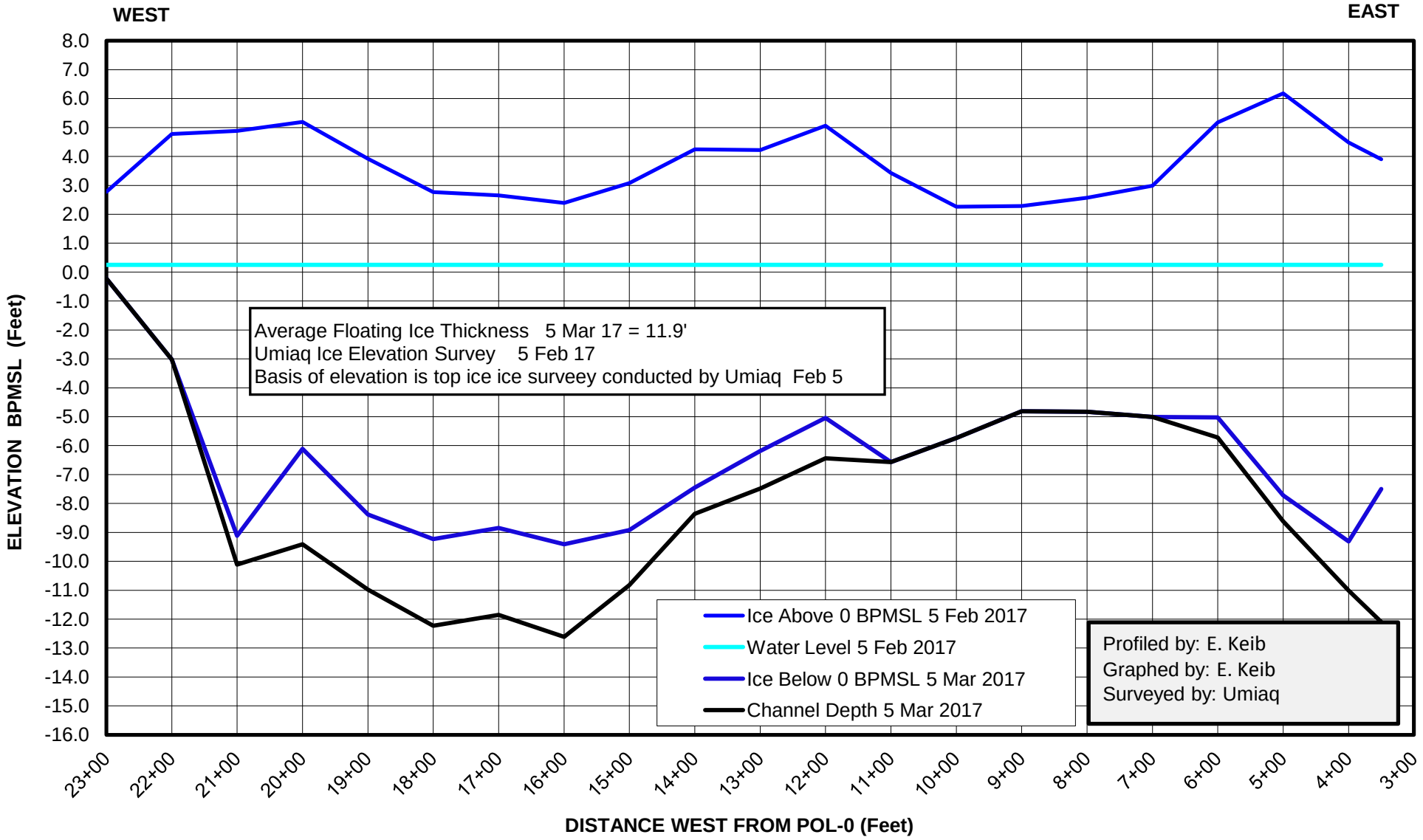
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
RESUPPLY SECTION CENTERLINE
21 FEB 17



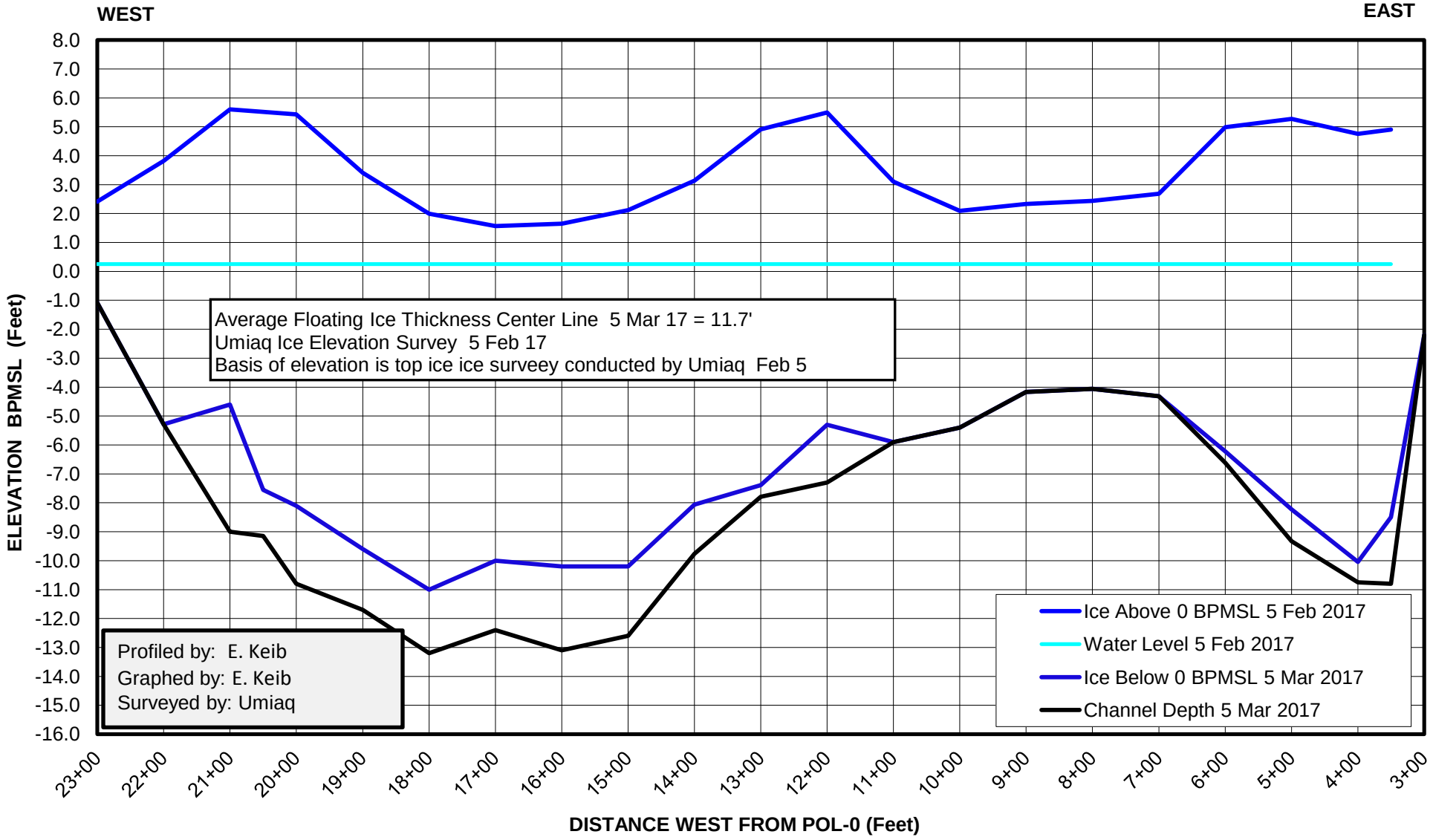
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
21 FEB 17



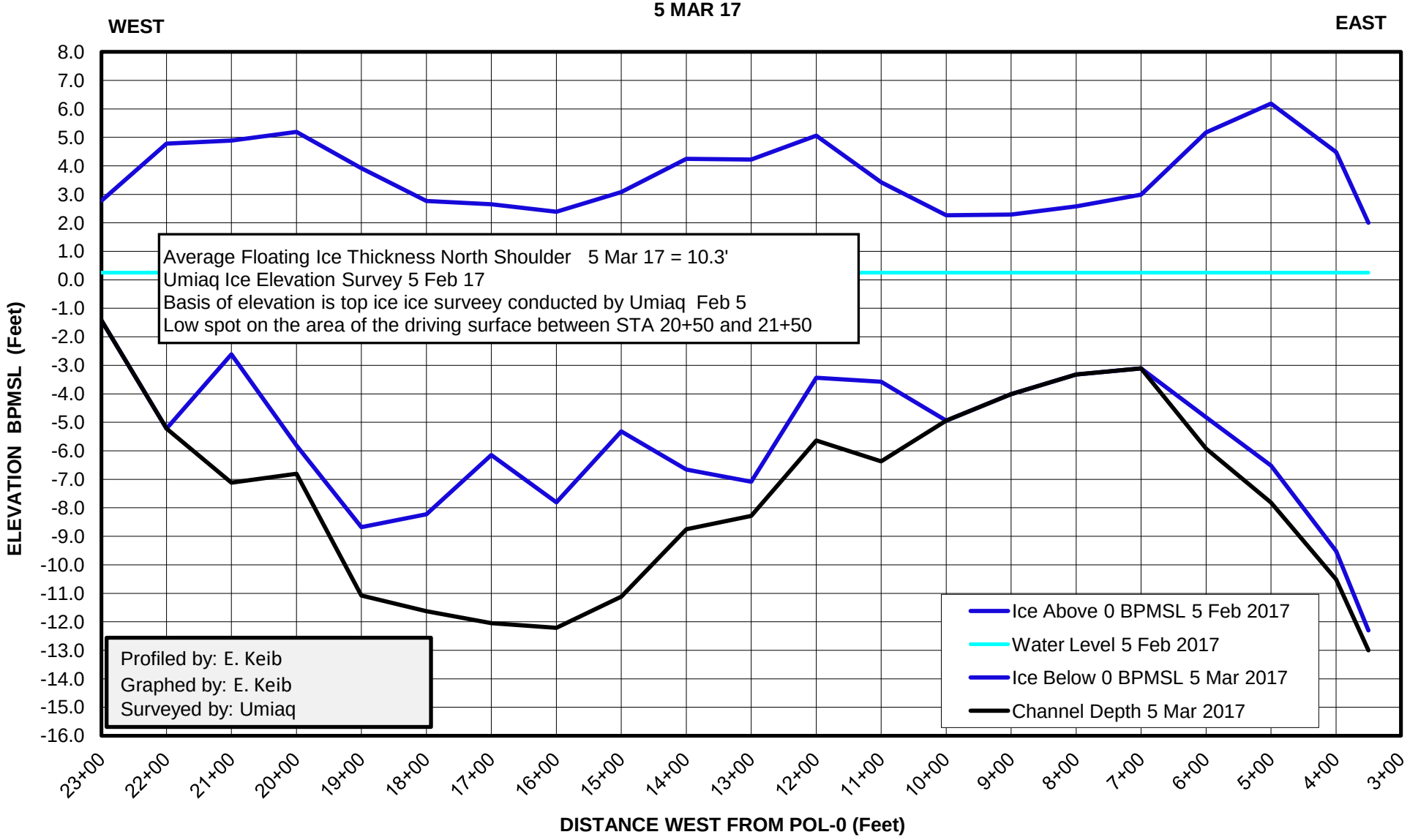
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER
100' South of Bridge Centerline
5 MAR 17



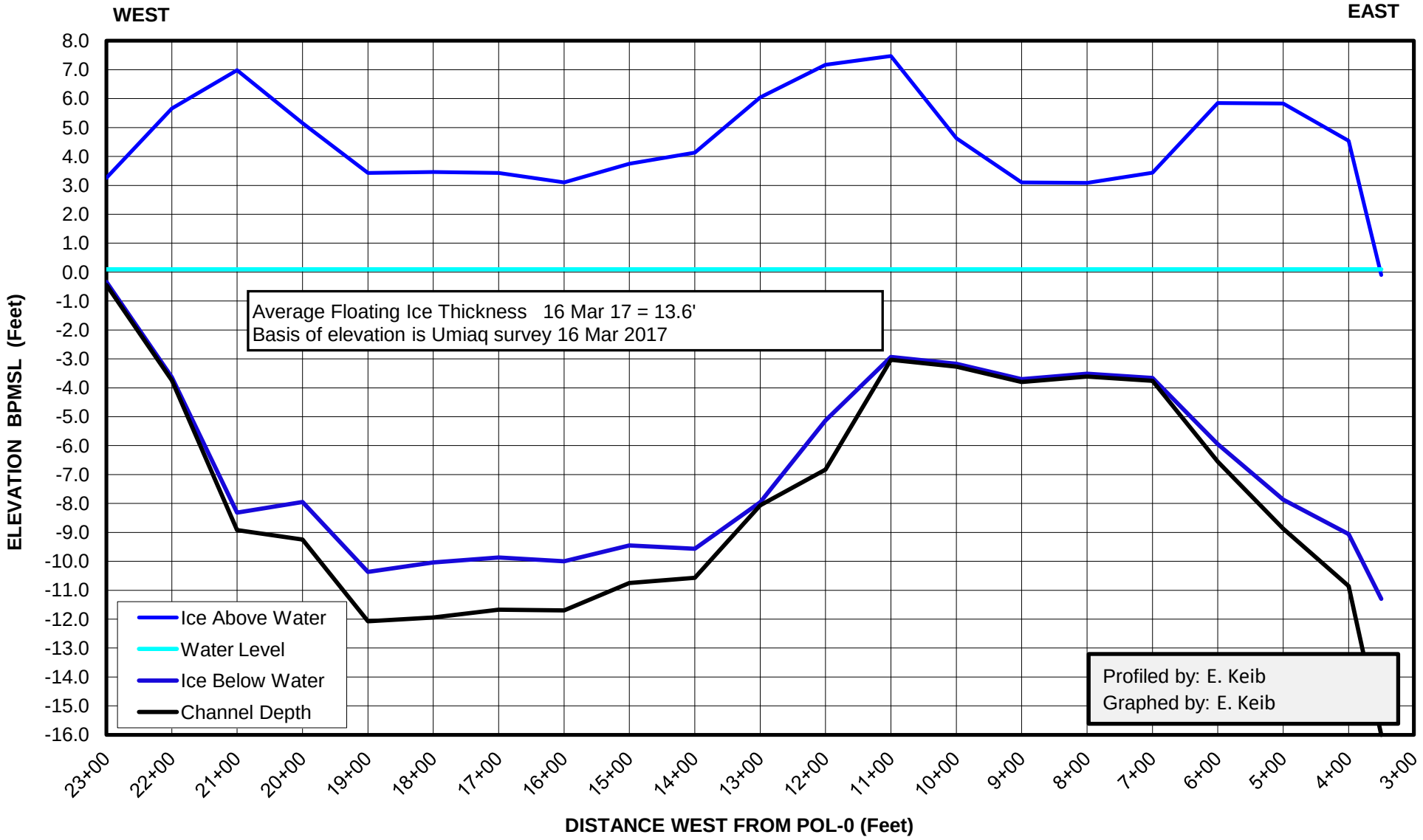
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
BRIDGE CENTERLINE
5 MAR 17



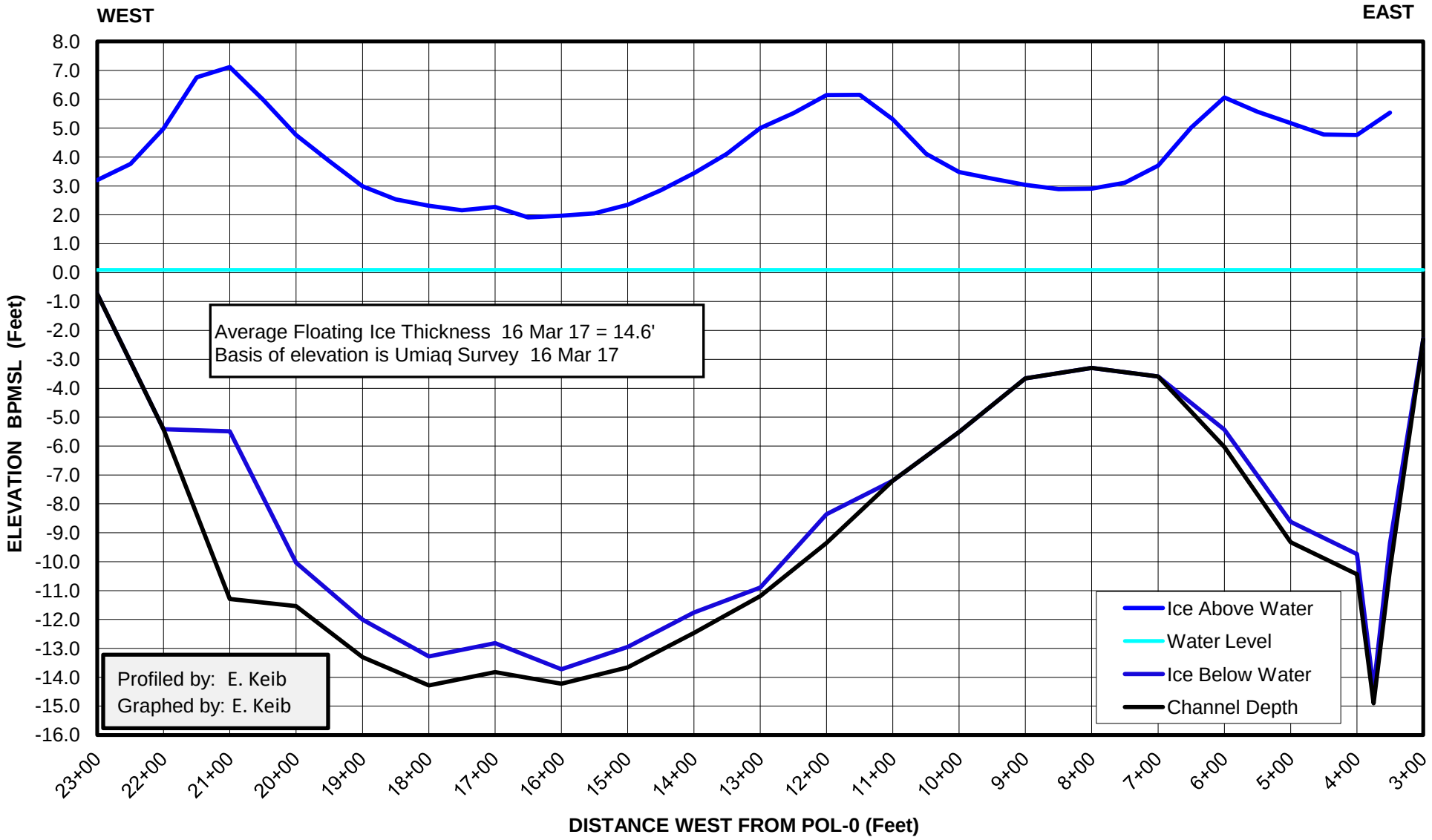
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
5 MAR 17



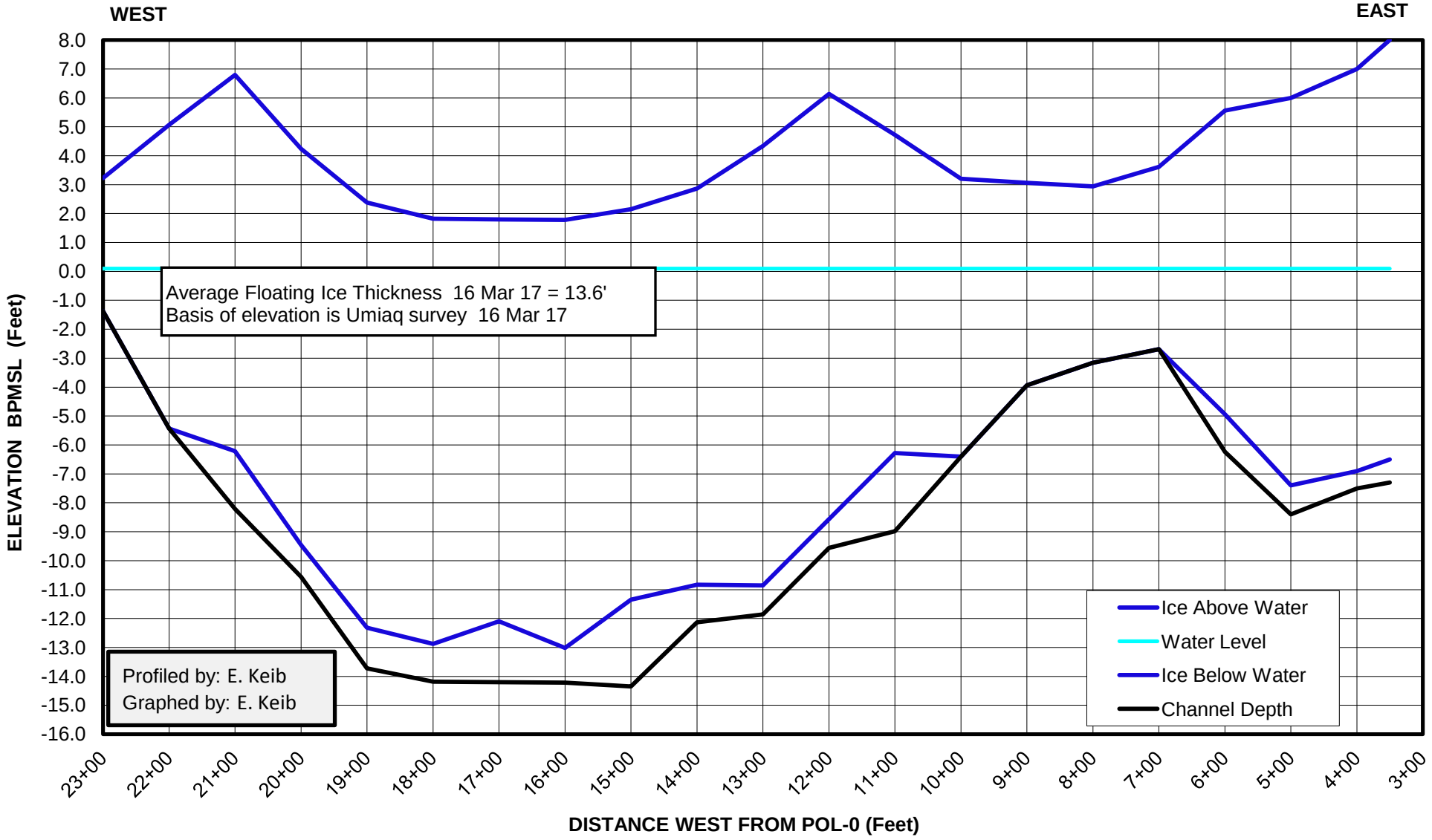
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER OF RESUPPLY LANES
67' South of Bridge Centerline
16 MAR 17



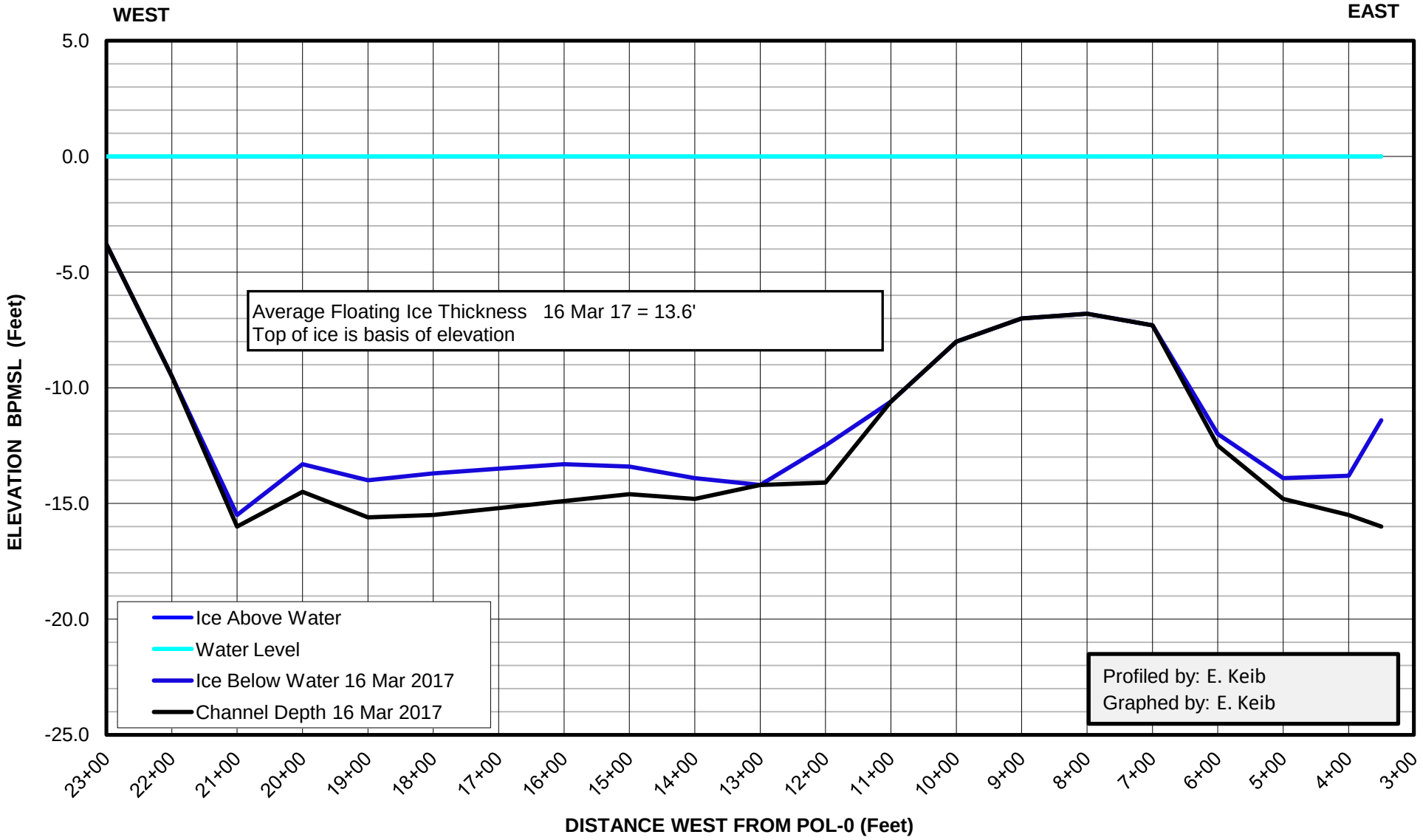
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER OF RESUPPLY LANES
32' North of Bridge Centerline
16 MAR 17



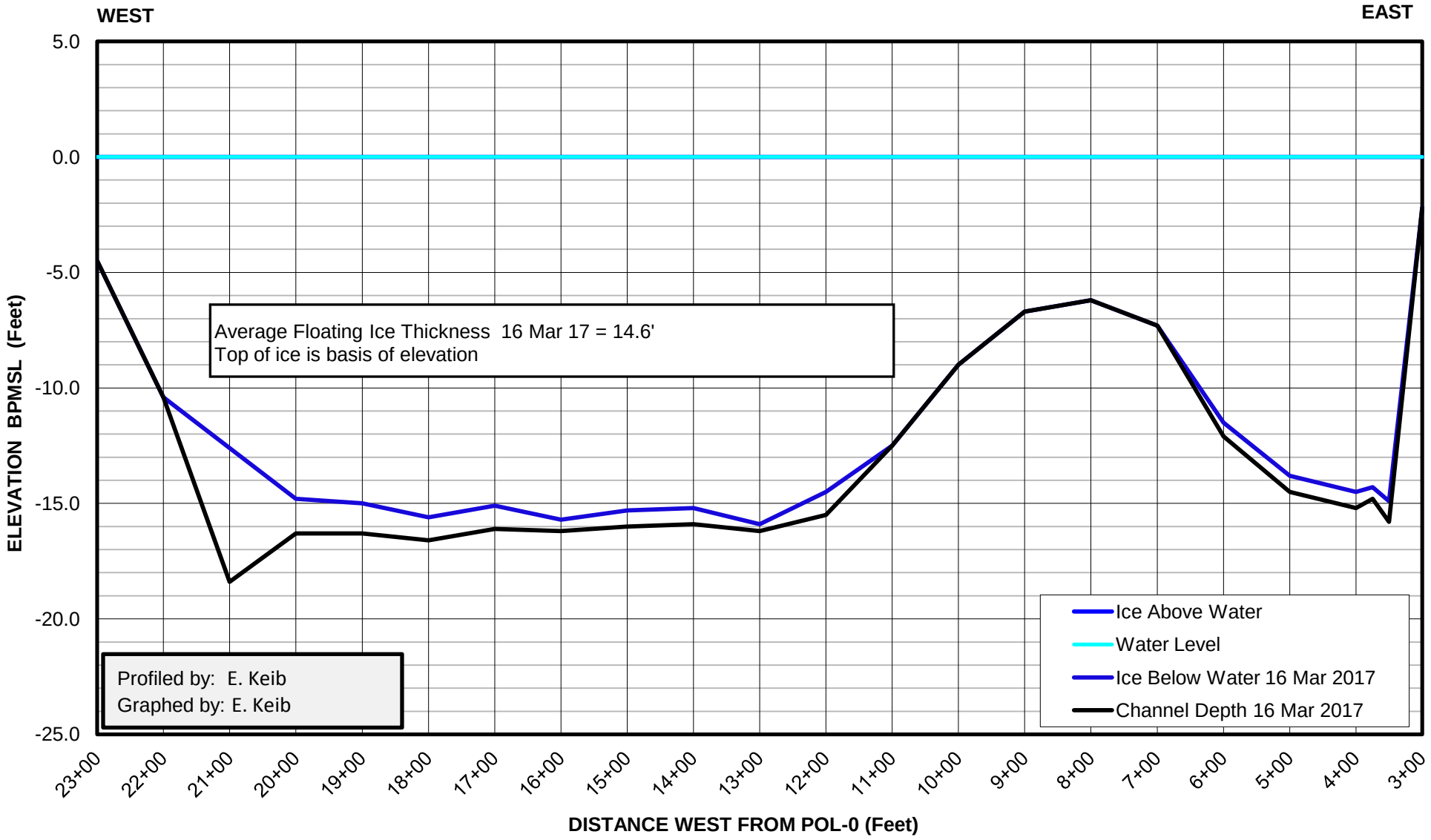
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
16 MAR 17



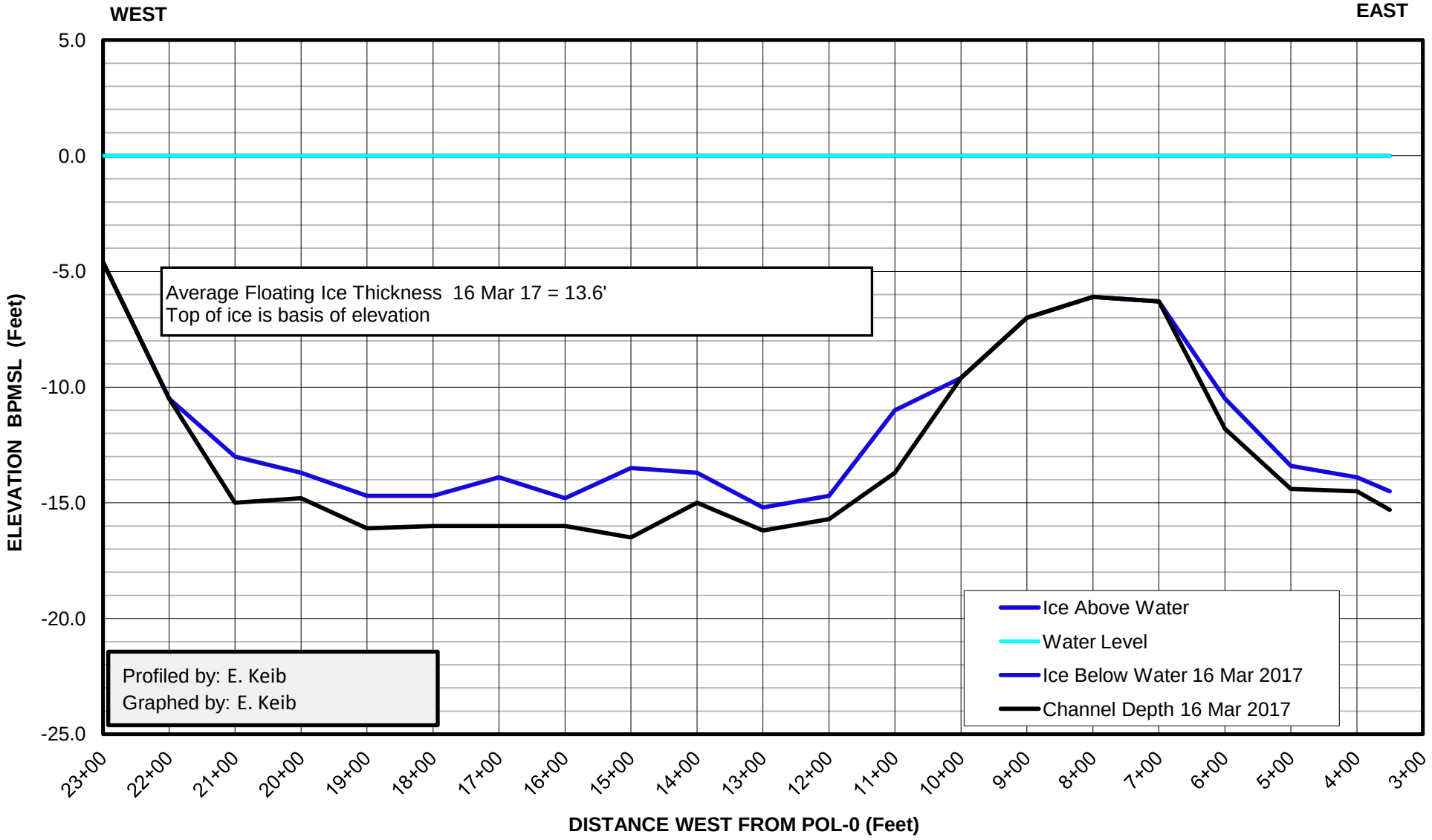
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER OF RESUPPLY LANES
67' South of Bridge Centerline
16 MAR 17



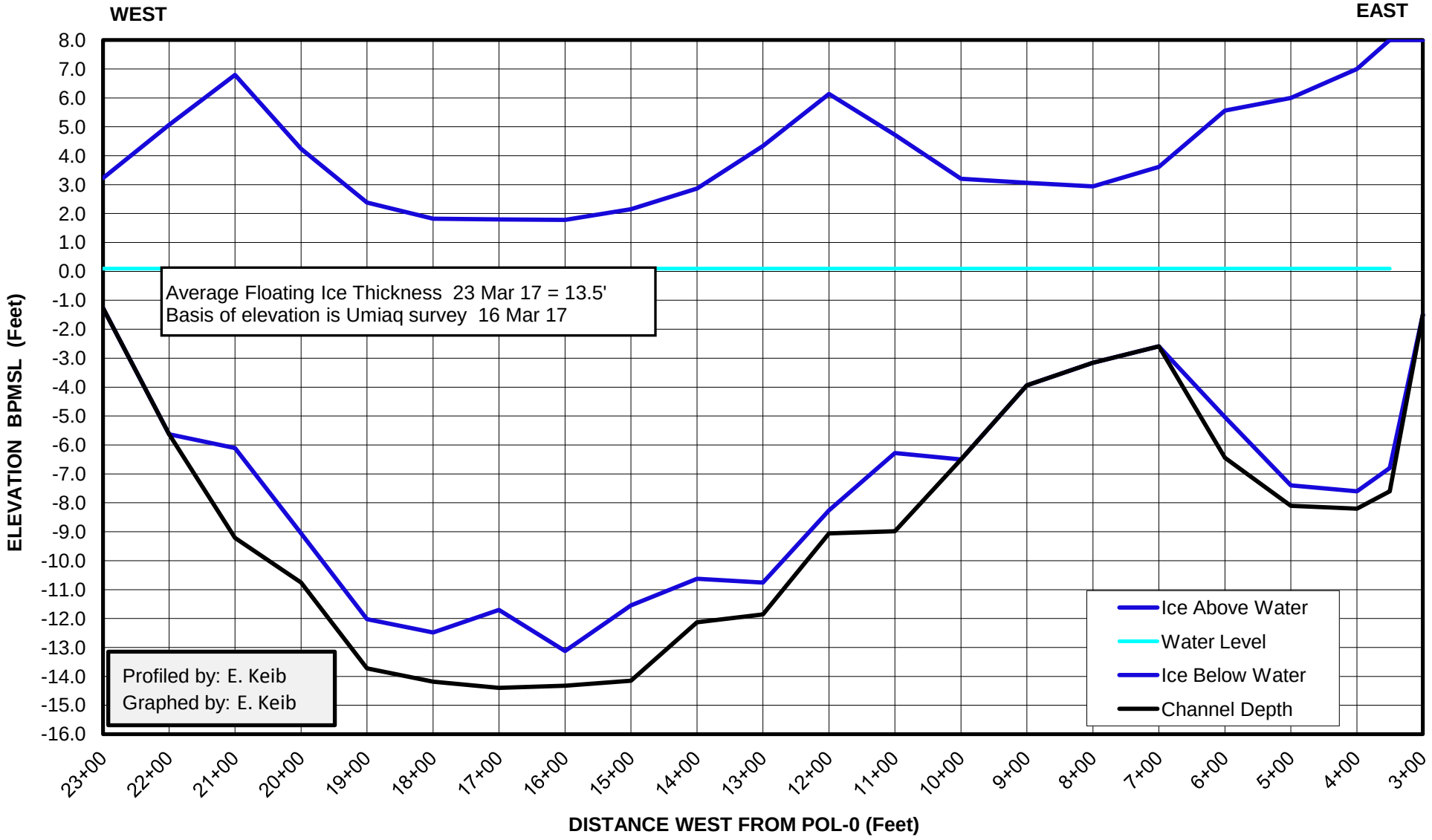
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER OF RESUPPLY LANES
32' North of Bridge Centerline
16 MAR 17



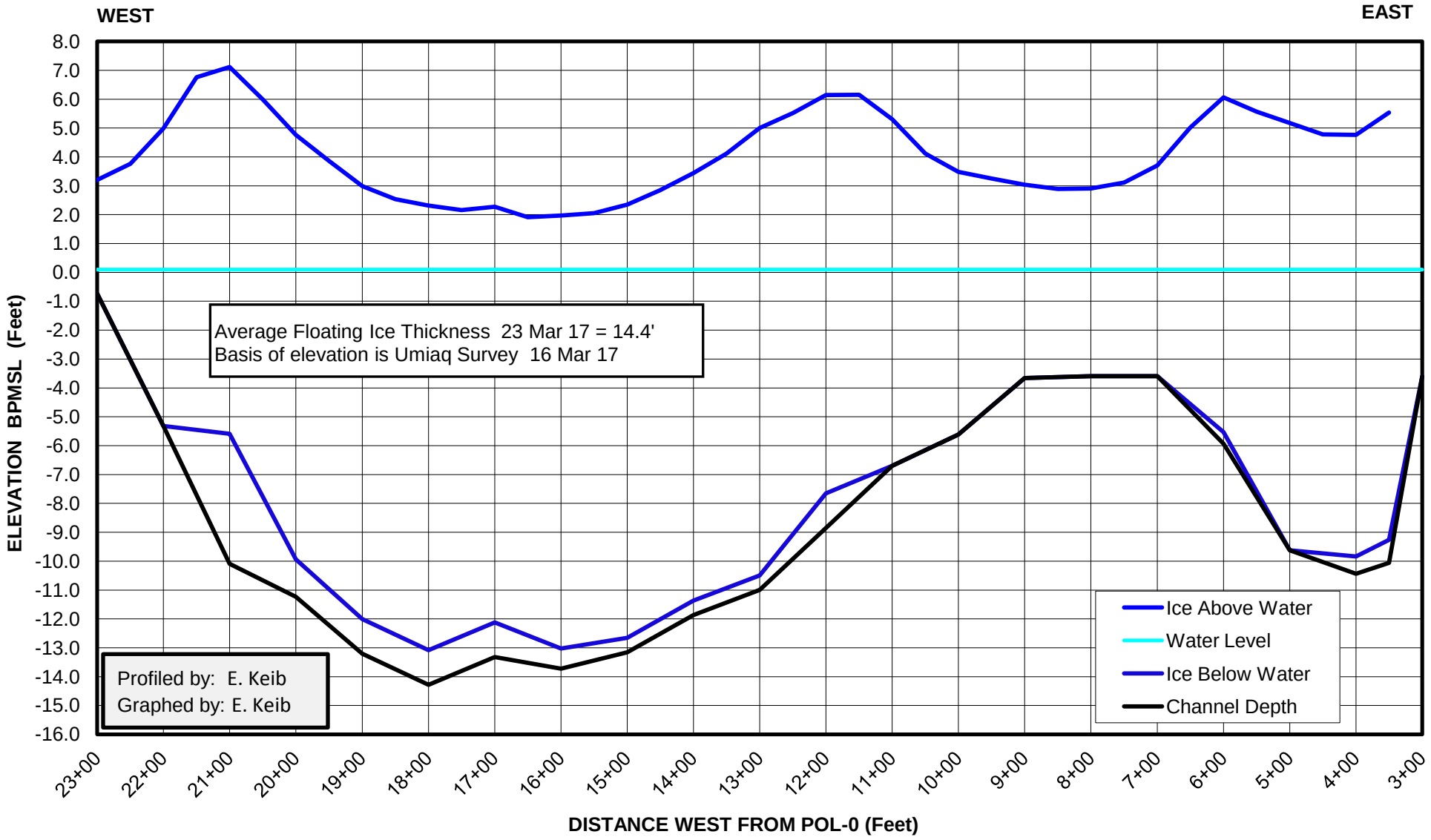
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
16 MAR 17



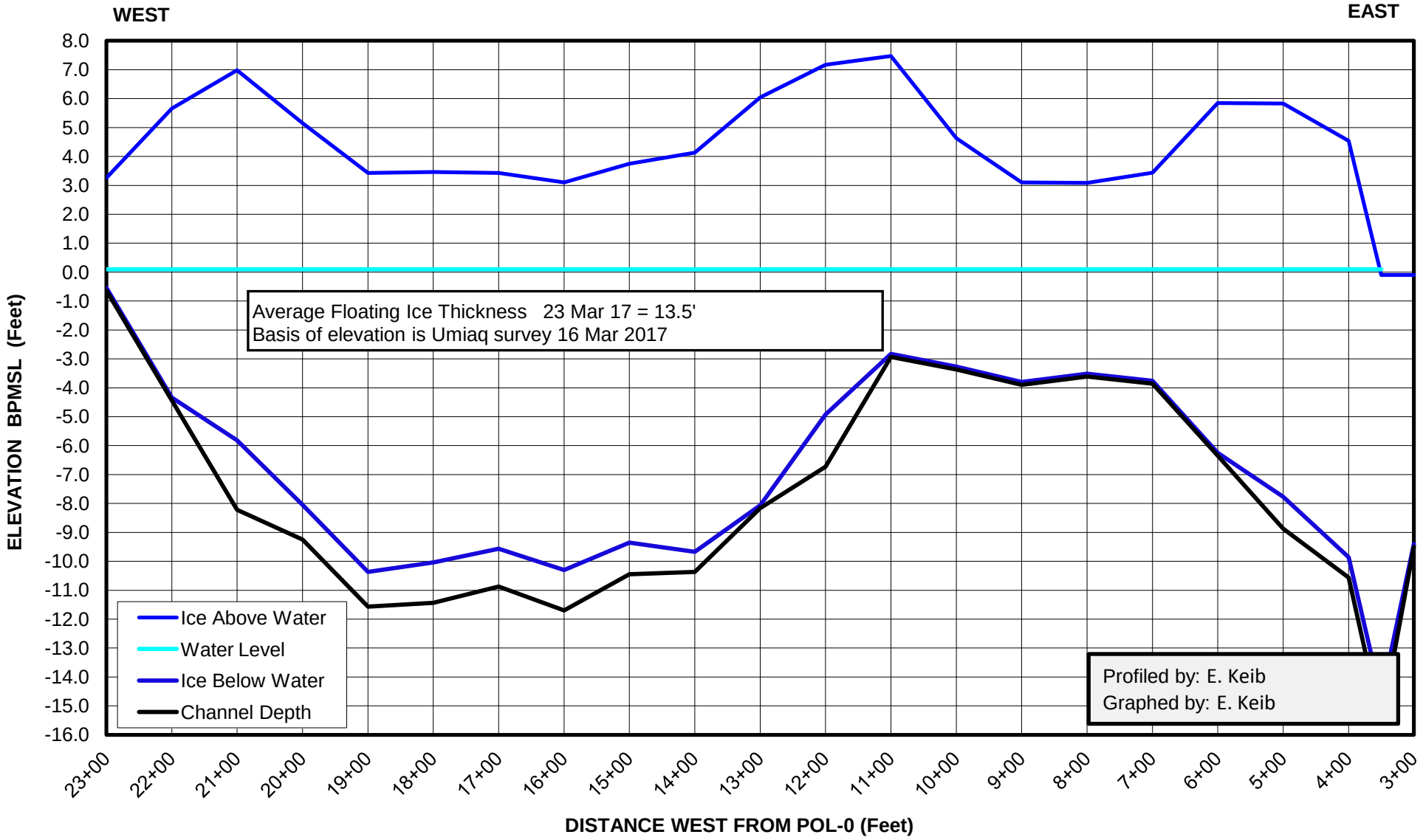
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
23 MAR 17



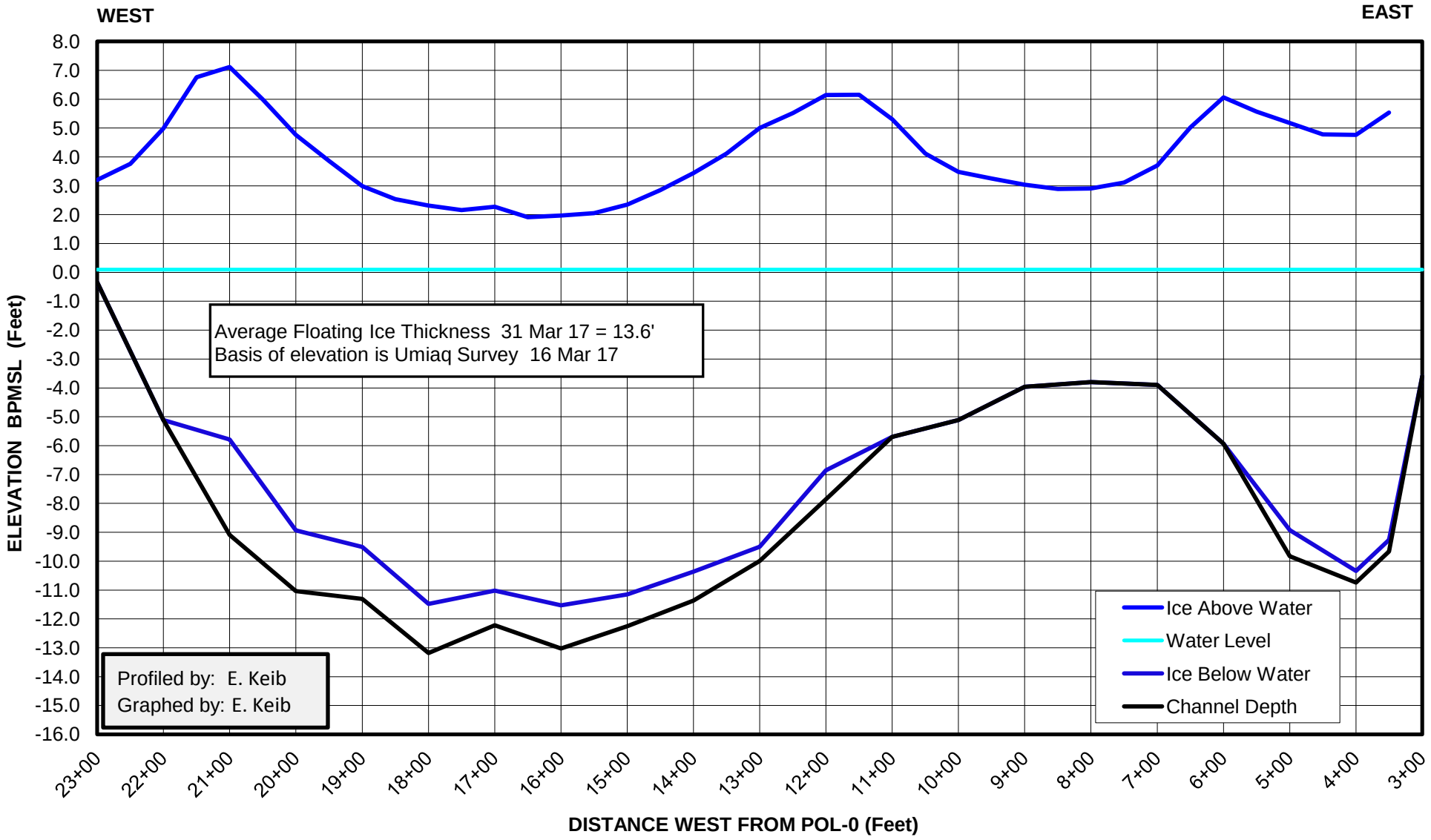
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTER OF RESUPPLY LANES
32' North of Bridge Centerline
23 MAR 17



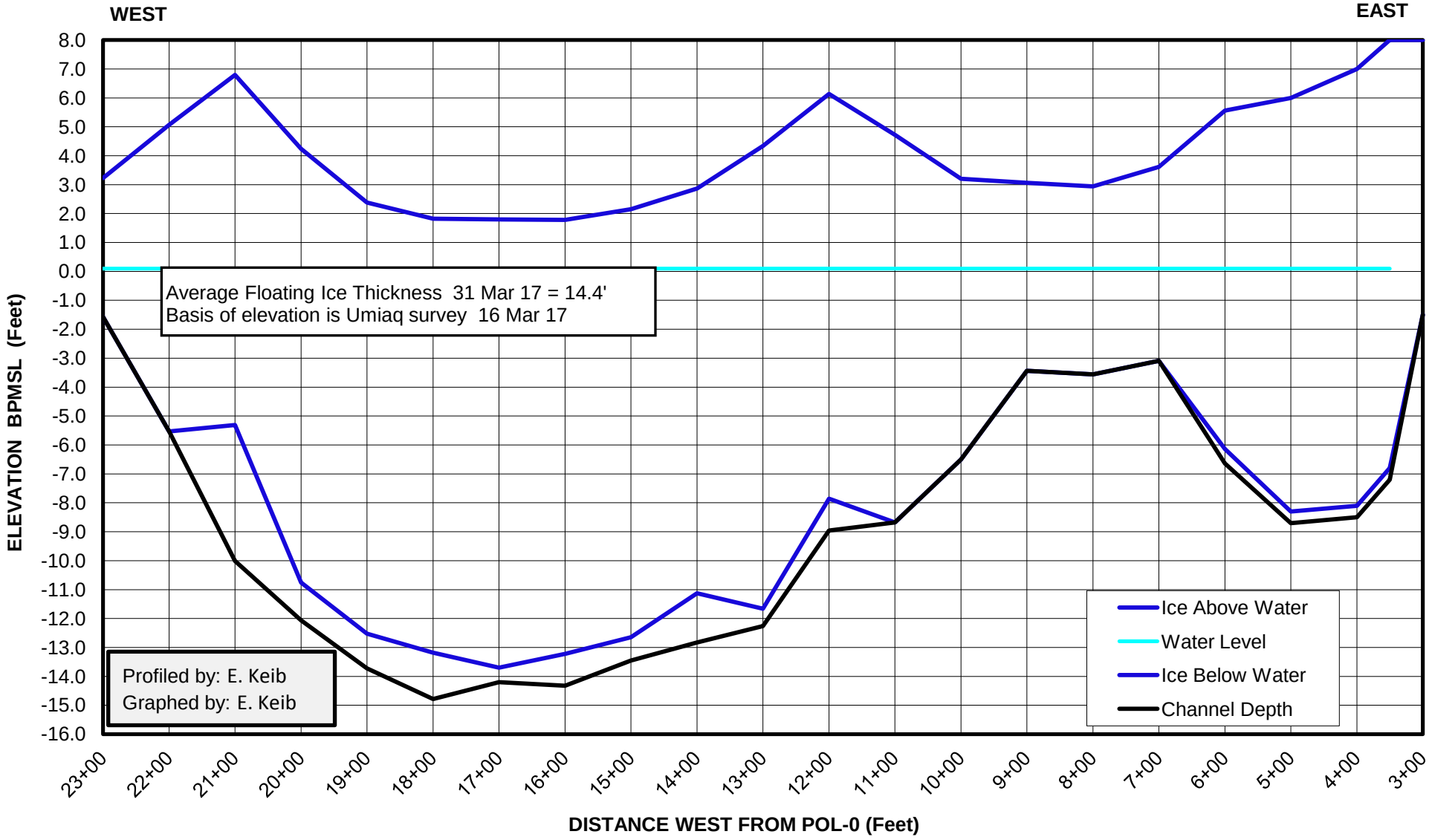
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER OF RESUPPLY LANES
67' South of Bridge Centerline
23 MAR 17



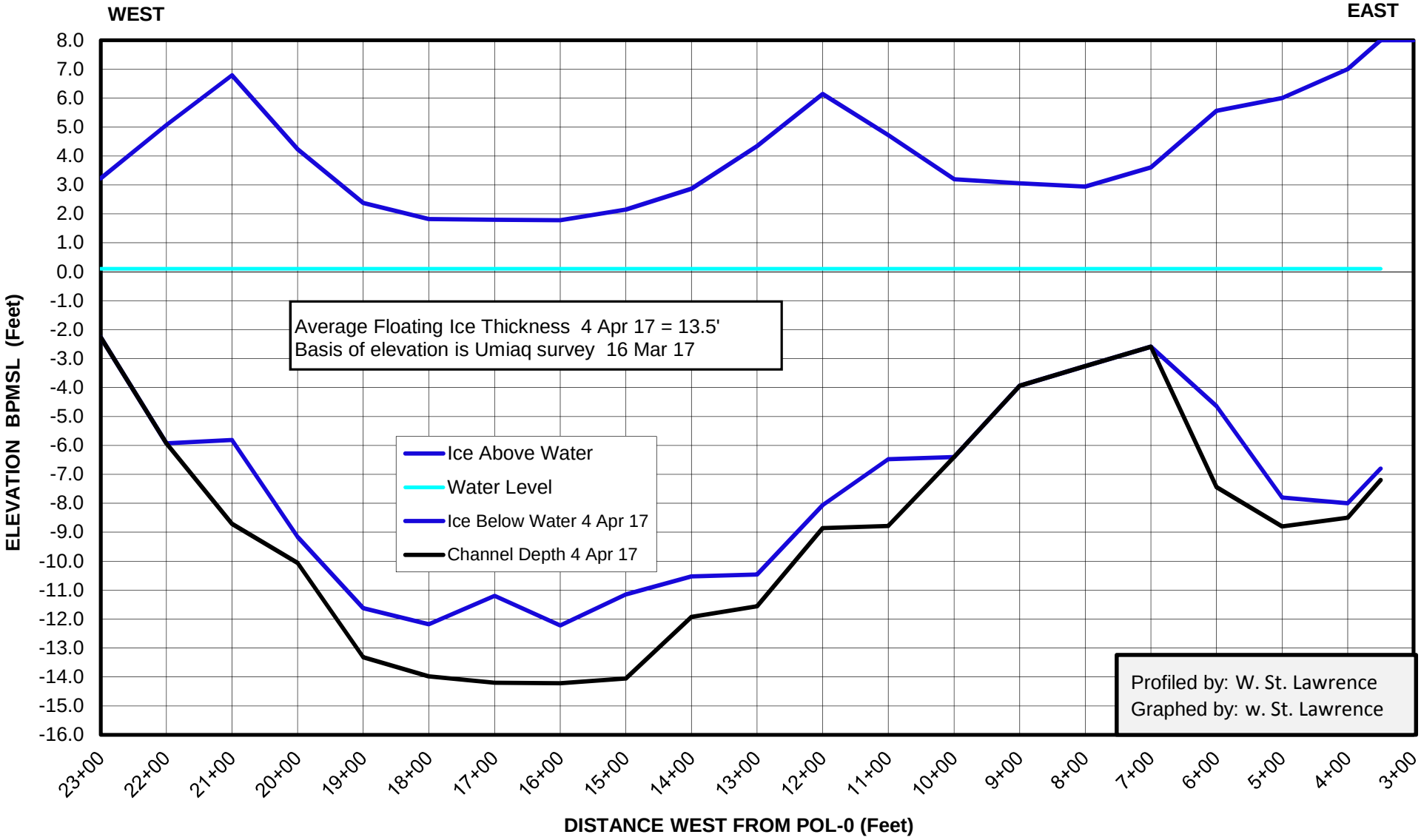
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTERLINE OF BRIDGE
31 MAR 17



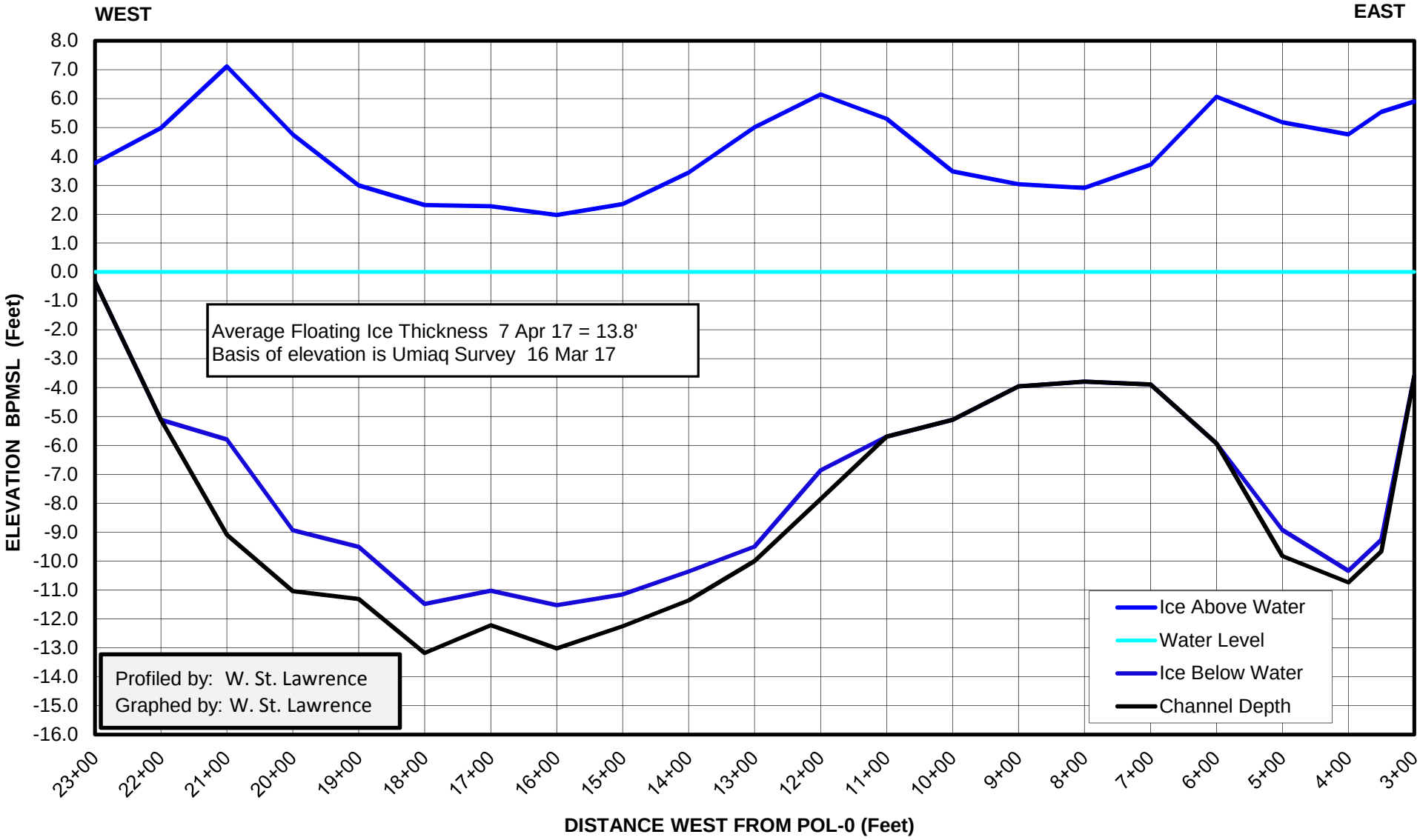
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTERLINE NORTH LANE
67.5' North of Bridge Centerline
31 MAR 17



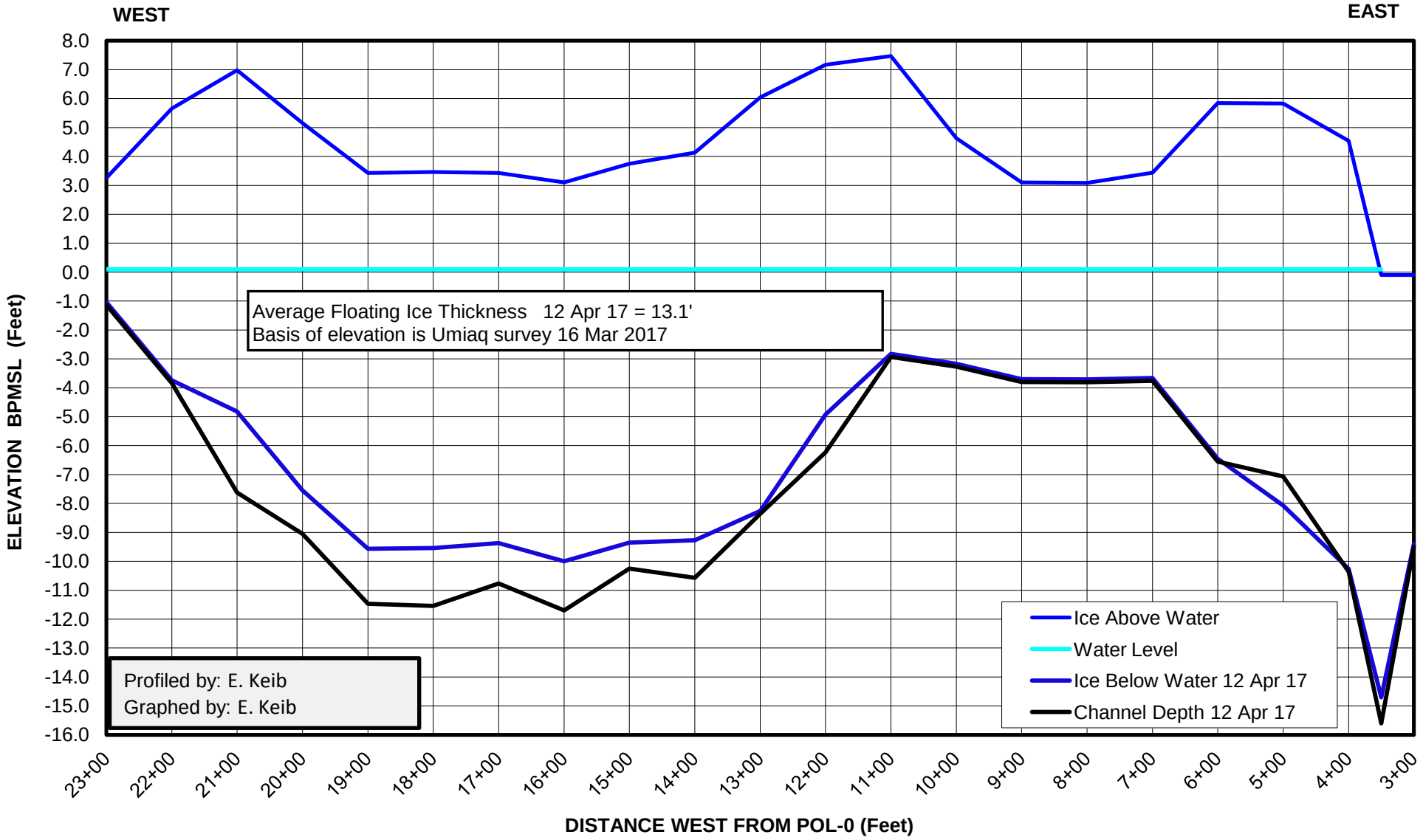
MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
4 April 17



MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
CENTERLINE OF BRIDGE
7 Apr 17



MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
SOUTH SHOULDER OF RESUPPLY LANES
67' South of Bridge Centerline
12 APR 17



MAIN CHANNEL COLVILLE RIVER
ICE ROAD CROSSING
NORTH SHOULDER
100' North of Bridge Centerline
12 April 17