BACK RIVER PROJECT
2023 Winter Ice Road Technical Memorandum

December 2022

1. Introduction

The Back River Project (the Project) is a proposed gold project owned by Sabina Gold & Silver Corp. (Sabina) within the West Kitikmeot region of southwestern Nunavut. The Project is comprised of two main areas with interconnecting winter ice roads (WIR) between the Goose Site and the Marine Laydown Area (MLA) (Figure 1) situated along the western shore of southern Bathurst Inlet. The majority of annual resupply will be completed using the MLA via sealift, and an approximately 160-km long WIR will interconnect these two sites.

The 2023 Winter Ice Road Technical Memo outlines the approach for construction, operations, and closure of the WIR for the 2023 season. This memo has been written to meet the requirements of Sabina's Project Certificate (No. 007), Sabina's Type A Water Licence (2AM-BRP1831), and Sabina's KIA Commercial Lease (KTCL-D18D003).

2. Winter Ice Road Alignment

The approximate routing of the 2023 Winter Ice Road is included in Appendix A. The WIR between the MLA and Goose Site will be approximately 160 km long, travelling over approximately 60-70% water and 30-40% land depending on the final route constructed. Sabina anticipates slight variations in routing to occur should construction or operational challenges exist.

3. Winter Ice Road Schedule

The 2023 Winter Ice Road construction is expected to take 45 to 60 days, beginning in late December or early January, and completing in late February of 2023. Once WIR construction is completed, the WIR route will be maintained during WIR operation as materials are hauled via tractor trailers from the MLA south to Goose site. Sabina anticipates approximately 1200 loads to be transported from the MLA to Goose. Once hauling is complete, Sabina will commence closure of this seasonal route which will only take a few days. Should any delays in construction or operations result in Sabina extending past the April 15 timeline, Sabina will provide written notice to the Kitikmeot Inuit Association and the Government of Nunavut in recognition of the requirements outlined in Sabina's Back River Project Wildlife Mitigation and Management Plan.

To support the above schedule, the MLA camp has remained open since the sealifts occurred to support the start up of Winter Ice Road equipment in advance of the WIR construction season. The Goose camp remains open to support the 2023 WIR activities as well.

4. Winter Ice Road Construction

Sabina intends to start the 2023 WIR construction from the MLA and Goose with two work fronts progressing forward. Sabina is assessing ice conditions along the route in late 2022 as ice continues to thicken in advance of WIR construction.

The WIR is anticipated to start construction in late December or early January 2032 when the subgrade is frozen to a sufficient depth and the ice can support light tracked vehicles. Construction of the WIR will take approximately 45 to 60 days depending on weather conditions at the time. Sabina has recently constructed initial portage sections described in Sabina's recent 12MN036 Modification Package which should aid in construction timelines.

The "Guidelines for Safe Ice Construction" published by the Northwest Territories Department of Transportation (2015), as well as the Land Use Guidelines published for Government of Northwest Territories and Nunavut (INAC 2010) will guide the construction and maintenance requirements of the WIR.

Like previous seasons, accommodations to support the 2023 WIR construction will utilize a combination of the MLA, a mobile Forward Camp, and the Goose Site. Sabina will also aim to construct up to three permanent emergency and service shelters along the WIR that will increase efficiencies and provide safety support along the 160-km WIR alignment.

5. Winter Ice Road Operations

Hauling operations on the 2023 WIR is expected to take 30-45 days in February and March 2022. Sabina anticipates up to 1200 loads of materials, equipment, and consumables to be transferred down the WIR in this period. Freight hauling is expected to average 25 tonnes per load including double or triple-axle flat-deck trailers.

Based on the ice thickness measured, load calculations will be conducted to verify that the ice will support the weight of operations equipment. Regular ice profiling will be conducted throughout the WIR operations to monitor ice growth and to maximize the safe loading capacity of the ice.

6. Winter Ice Road Closure

Decommissioning of the Winter Ice Road will involve restoring natural drainage by removing potential obstructions to drainage paths in advance of the spring melt. Closure will also include recovery of any sand along the alignment that may have been transferred by hauling equipment to frozen lakes from adjacent portages; this sand would only be placed on portages if additional traction was required for hauling vehicles.

Any snow fencing or temporary supplies along the WIR route will be removed to the MLA or Goose site for the off season. Refer to the Interim Closure and Reclamation Plan for additional details on the closure of the Winter Ice Road.

7. Winter Ice Road Water Use

Water will be required for construction of overland sections, construction of ramps, and for maintenance of over-ice sections. All lakes and water sources along the route will be identified as suitable or not-suitable for water withdrawal, based on DFO water withdrawal limits and other environmental protocols.

Sabina has attached the Winter Ice Road Water Withdrawal Evaluation Memorandum (Appendix B). This attachment includes approximate 2023 projected routing, bathymetry, depth, potential water withdrawal locations, proposed extraction volumes, and anticipated water level decreases.

During WIR construction, Sabina will confirm lake water availability using ice augers; this information will confirm the necessary water depth below frozen ice layers which verifies the actual maximum water volume that can be withdrawn. The amounts of water withdrawn from approved sources will be monitored in accordance with Schedule I, Table 2 of the Type A Water Licence. Sabina is confident that, based on the current water withdrawal projections, sufficient water is available for the WIR construction while remaining within these the appropriate limits.

8. Supporting Documentation

Appended to this memo are supporting documents that provide additional information on Sabina's management of the 2022 Winter Ice Road, specifically:

- Appendix A: Winter Ice Road Route Overview 2023;
- Appendix B: Winter Ice Road Water Withdrawal Evaluation – Back River Project (Golder 2017);

9. References

GNWT DoT. 2015. Guidelines for Safe Ice Construction.

February 2015. INAC (Indigenous and Northern Affairs Canada). 2010. Northern Land Use Guidelines – Access: Roads and Trails. January 2010. ISBN: 978-1100-14743-7. Link.

NWB (Nunavut Water Board). 2017. Guide 9. Guide to the Approval for the Use of Water or Deposit of Waste Without a Licence. March 2017.

Appendix A

Winter Ice Road Route Overview 2023

W:\BackRiver\04_Exploration\BackRiverRegion\GIS_Products\ESRI_MXD\Permitting 2018\WIR_Construction_Figures\Overview.mxd

N

Marine Laydown Area

Bathurst Inlet

George Property Area

Goose Property Area

Legend

- Winter Ice Road
- Goose Property Area
- George Property Area
- Marine Laydown Area
- Waterbody
- Rivers

Inuit Owned Land

- Surface Rights
- Subsurface and Surface Rigths

NAD83 UTM Zone 13N

1:350,000

0 2.5 5 10 15

Kilometers

Overview Map

Sabina
GOLD & SILVER CORP.

Appendix B

Winter Ice Road Water Withdrawal Evaluation Memo

TECHNICAL MEMORANDUM

DATE November 8, 2018 **REFERENCE No.** 1776921_021_MEM_Rev0

TO Merle Keefe
Sabina Gold & Silver Corp.

CC Matthew Pickard, Dionne Filiatrault

FROM Cam Stevens **EMAIL** cameron_stevens@golder.com

WINTER ICE ROAD WATER WITHDRAWAL EVALUATION – BACK RIVER PROJECT

Golder Associates Ltd. (Golder) was retained by Sabina Gold & Silver Corp. (Sabina) to provide an evaluation of potential water sources for winter ice road construction along the proposed 160 km-long winter road corridor from the Goose Property at Goose Lake to the Marine Laydown Area at Bathurst Inlet. Potential water sources are waterbodies deeper than 3.5 m (i.e., lakes) and available water volumes in those waterbodies are no more than 10% of the under ice volume, as per the Fisheries and Oceans Canada (DFO) protocol for mitigating water withdrawal effects on fish in ice-covered waterbodies in the North (DFO 2010).

The information provided in this technical memorandum (memo) fulfills commitments made during the environmental review of the Back River Project (the Project) (see Addendum Appendix V6-6G in Sabina [2017]), and provides Sabina with the necessary information to minimize, if not eliminate, any potential effects to overwintering fish and fish habitat, including spawning shoal habitat, during the construction of the winter ice road. The current plan for the winter ice road requires 108,000 m^3 of water per season (675 m^3 per km) to maintain ice thickness as per the Project Description (Volume 2 in Sabina [2017]).

The following sections of the memo provide methods and results for the available under-ice water volumes, the volumes representing 10% of available under-ice water, and the reduction in water depth associated with withdrawals of 10% of the available under-ice water per each lake in the winter road corridor. The memo also evaluates changes in water depths in terms of risk to spawning shoal habitat loss in lakes as per methods outlined in Addendum Appendix V6-6G in Sabina (2017). Based on that evaluation, recommended volumes for water withdrawal that present negligible risk of habitat loss are provided.

1.0 METHODS

Bathymetric digital elevation models were generated by Aeroquest Mapcon (Aeroquest) for 118 waterbodies within the winter road corridor using stereo-photogrammetric interpretation methods of stereo, 8 band, 50 cm satellite imagery; imagery was collected in August 2017 by DigitalGlobe's Worldview-2 satellite (Legleiter et al. 2014; Dörnhöfer and Oppelt 2016). For each waterbody, surrounding terrain characteristics were used to interpret slopes entering the waterbody at the shorelines, where the slopes were then extrapolated into the waterbody to connect with the lake bottom topography visualized through 'coastal blue', 'blue' and 'green' (spectral) bands in the imagery in a Geographic Information System (GIS). These spectral bands allow the identification of detailed lakebed topography to a depth of 30 m.

Bathymetric models of each waterbody were provided to Golder in raster format for analyses of volume and area per depth in a GIS platform for each waterbody deeper than 3.5 m. Tables produced from the raster analysis (see Appendix A) were used to estimate available under-ice water volumes for ice road construction for each source lake (i.e., 10% of under ice volume); where it was assumed that the maximum ice thickness is 2 m (DFO 2010). Changes in water levels from water withdrawals were also estimated. As it was assumed that all waterbodies deeper than 3.5 m support large-bodied fish, predicted changes in water levels were assigned a level of risk for spawning habitat loss as per Addendum Appendix V6-6G in Sabina (2017) (Table 1). Waterbodies with a potential risk of spawning habitat loss from a 10% under-ice volume reduction were identified as sources where water withdrawals should be reduced, particularly during below-average precipitation years. Recommended volumes for water withdrawal that present negligible risk of habitat loss were then calculated for these waterbodies.

Table 1: Water Withdrawal Risk Level Framework for Spawning Shoal Habitat for Fall-Spawning Fish[(a)]

Risk of Spawning Habitat Loss	Change in Water Elevation Under Ice (m)	Rationale
Nil or negligible	Less than 0.22	The reduction in water level lies within the average change in ice thickness (i.e., within normal variation)
Low	0.22 to less than 0.42	The reduction in water level remains within 1 SD of the average
Medium	0.42 to 0.8	The reduction in water level remains between 1 and 2 SD of the average
High	Greater than 0.8	The reduction in water level is beyond 2 SD of average and there is less than a 5% chance for this occurring naturally

a) includes coregonid species, such as Lake Whitefish (*Coregonus clupeaformis*), and Lake Trout (*Salvelinus namaycush*); SD = standard deviation

A characterization of whether bathymetric data are representative of below-average, average, or above-average water level conditions was provided using precipitation statistics for the region. Statistics were derived for both 2017 and 30-year (1981-2010) 'normal' data, obtained from a representative monitoring station in west-central Nunavut (station name: Kugluktuk A; see Government of Canada 2017).

The evaluation of satellite imagery results (volumes) also included a comparison with results generated by bathymetric (sonar) surveys previously performed in the field for a subset of seven lakes (Appendix V6-3A in Sabina [2017]; Rescan 2014). The lakes with existing bathymetric data included five lakes surveyed in early July 2014 (Fold Lake, Winter Road Lake 01, Winter Road Lake 02, Winter Road Lake 05, and Winter Road Lake 06) and two lakes surveyed in August 2010 (Llama Lake and Chair Lake). All lakes were less than 30 m depth, the extent to which accurate detection of the spectral bands in the satellite imagery is known to be effective. It was assumed that the previously conducted surveys of each lake were performed consistent with methods described by DFO (2010), and included one longitudinal transect (connecting the two farthest shorelines) and a minimum of two perpendicular transects evenly spaced on the longitudinal transect at maximum intervals of 500 m. Project lakes with existing bathymetric data that were excluded from the comparison were either outside the boundary of the winter road corridor, or had insufficient data to provide a reliable volume estimate.

2.0 RESULTS AND DISCUSSION

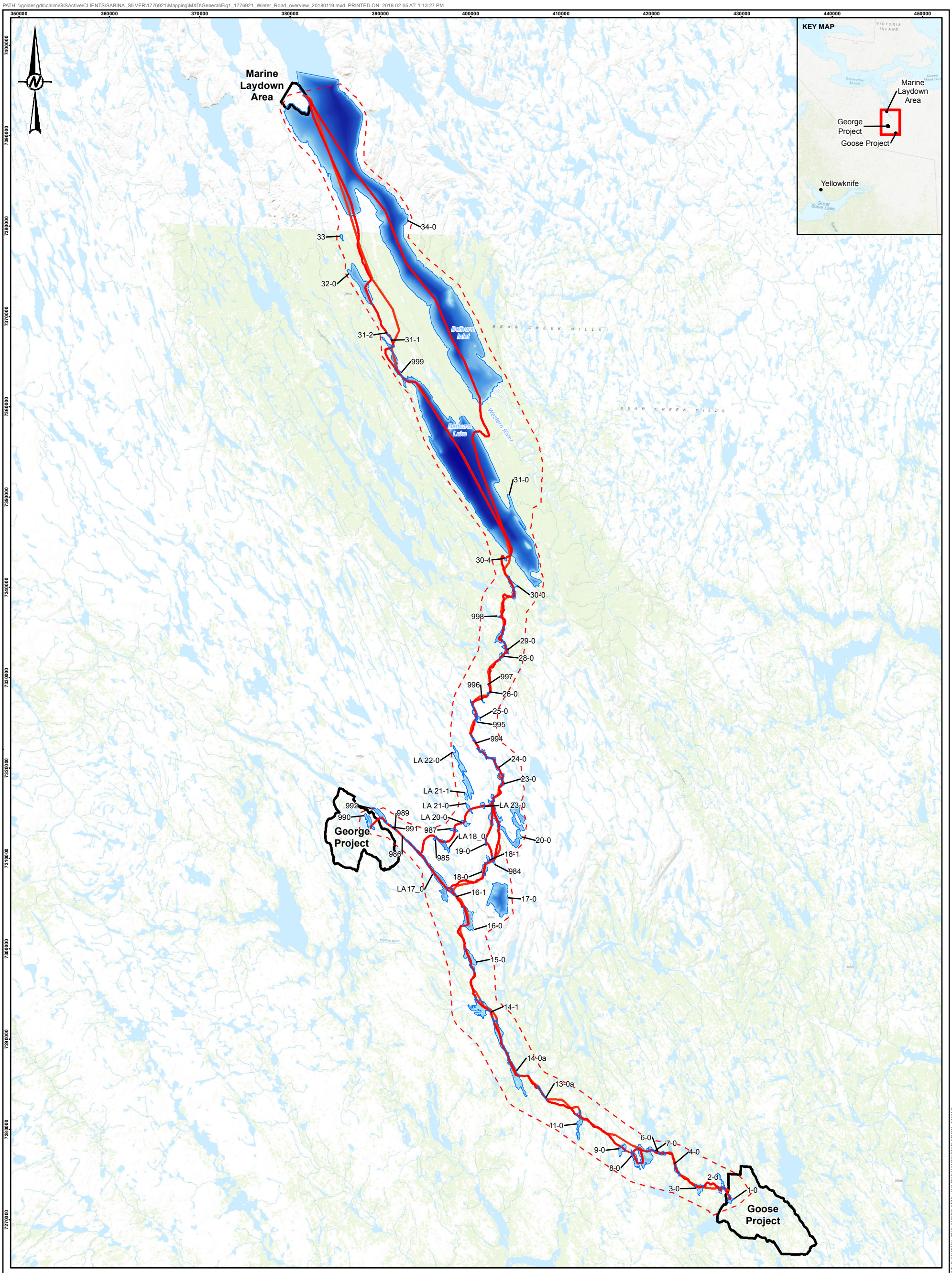
Of the 118 waterbodies examined for use for winter ice road construction, 55 lakes were identified as being deep enough (greater than 3.5 m) for under-ice water withdrawal (Table 2; Figure 1; Appendix B). Overall, source lakes were determined to provide a median capacity of 39,637 m^3 of water per lake for winter ice road construction, where available 10% under-ice volumes may range from 683 m^3 for Lake 996 to 301,075,442 m^3 for Lake 34-0 (i.e., lower Bathurst Inlet). The provided volume statistics for lakes in the winter road corridor are expected to represent average lake level conditions, given that cumulative precipitation levels in August 2017 totalled 208.4 mm, just 1 mm below normal totals for that time of the year when the imagery was acquired (Figure 2). It is expected that available water volumes for winter ice road construction is lower during below-average precipitation years and higher during above-average precipitation years.

Table 2: Water Sources, Bathymetry Statistics, and Available Volumes for Winter-Ice Road Construction for the Back River Project

Waterbody ID	North. UTM	East. UTM	Surface Area (SA) (m^2)	Volume (V) (m^3)	V:SA ratio (m)	Under Ice Volume Below 2 m Depth (m^3)	10% Volume Below 2 m Depth (m^3)	Predicted Water Level Change (m)	Risk of Habitat Loss For 10% Guideline	Calculated Volume for Nil Risk (m^3)
Lake 1-0	7272263	428691	348,021	951,009	2.7	396,025	39,603	0.19	Nil	39,603
Lake 2-0	7273318	427649	598,077	1,487,839	2.5	535,068	53,507	0.17	Nil	53,507
Lake 3-0	7273459	425284	557,865	1,738,708	3.1	793,748	79,375	0.21	Nil	79,375
Lake 4-0	7275521	422778	349,596	705,486	2.0	193,786	19,379	0.13	Nil	19,379
Lake 8-0	7276631	418218	765,711	2,427,790	3.2	1,137,977	113,798	0.20	Nil	113,798
Lake 7-0	7277136	419314	2,211,876	8,325,456	3.8	4,336,453	433,645	0.22	Low	424,972
Lake 6-0	7277346	421197	224,514	614,579	2.7	253,622	25,362	0.19	Nil	25,362
Lake 9-0	7277741	416761	620,172	1,581,371	2.5	537,030	53,703	0.14	Nil	53,703
Lake 11-0	7280643	411983	885,771	2,406,329	2.7	981,876	98,188	0.19	Nil	98,188
Lake 13-0a	7284074	407857	290,376	597,123	2.1	151,117	15,112	0.12	Nil	15,112
Lake 14-0a	7287885	404204	3,942,630	10,415,812	2.6	3,597,800	359,780	0.16	Nil	359,780
Lake 14-1	7293431	401036	2,221,497	4,779,159	2.2	881,912	88,191	0.08	Nil	88,191
Lake 15-0	7298909	399919	1,441,269	5,027,754	3.5	2,373,270	237,327	0.19	Nil	237,327
Lake 16-0	7303281	399696	2,068,272	12,016,309	5.8	8,139,725	813,973	0.40	Low	447,685
Lake 17-0	7305916	402441	5,913,261	61,932,318	10.5	50,372,624	5,037,262	0.90	High	1,239,167
Lake 16-1	7306279	398021	319,815	812,512	2.5	260,311	26,031	0.14	Nil	26,031
Lake LA17-0	7308172	395986	3,193,056	18,907,975	5.9	12,865,851	1,286,585	0.43	Med.	643,293
Lake 18-0	7308843	401524	635,085	2,886,128	4.5	1,690,494	169,049	0.28	Low	128,478
Lake 984	7309759	402495	153,108	296,424	1.9	71,739	7,174	0.17	Nil	7,174
Lake 18-1	7310007	401912	161,253	426,414	2.6	150,589	15,059	0.15	Nil	15,059
Lake LA18-0a	7311590	396960	714,708	4,368,027	6.1	3,006,955	300,695	0.36	Low	128,478
Lake 19-0	7311911	401691	160,065	360,221	2.3	98,274	9,827	0.12	Nil	9,827
Lake 985	7312109	395983	40,914	106,234	2.6	35,130	3,513	0.13	Nil	3,513
Lake 986	7312574	392342	16,299	37,926	2.3	12,753	1,275	0.14	Nil	1,275
Lake 989	7313114	391719	29,322	62,690	2.1	17,580	1,758	0.13	Nil	1,758
Lake 987	7313141	398133	206,199	760,584	3.7	393,753	39,375	0.21	Nil	39,375
Lake 991	7313599	391191	36,702	76,595	2.1	21,030	2,103	0.13	Nil	2,103

Waterbody ID	North. UTM	East. UTM	Surface Area (SA) (m^2)	Volume (V) (m^3)	V:SA ratio (m)	Under Ice Volume Below 2 m Depth (m^3)	10% Volume Below 2 m Depth (m^3)	Predicted Water Level Change (m)	Risk of Habitat Loss For 10% Guideline	Calculated Volume for Nil Risk (m^3)
Lake LA20-0	7313887	399363	324,144	940,089	2.9	389,431	38,943	0.18	Nil	38,943
Lake 990	7314076	388751	761,706	3,456,788	4.5	2,130,011	213,001	0.41	Low	115,021
Lake 20-0	7314226	404075	5,757,903	24,053,493	4.2	14,139,389	1,413,939	0.29	Low	1,060,454
Lake 992	7314853	389975	893,646	3,525,249	3.9	1,938,558	193,856	0.24	Low	178,347
Lake LA21-0	7315592	399777	256,878	761,896	3.0	309,761	30,976	0.18	Nil	30,976
Lake LA23-0	7315882	401330	265,968	1,013,844	3.8	524,720	52,472	0.23	Low	51,947
Lake LA21-1	7316914	399454	204,606	406,055	2.0	129,313	12,931	0.16	Nil	12,931
Lake LA22-0	7317386	399995	2,393,802	5,635,137	2.4	1,697,105	169,711	0.16	Nil	169,711
Lake 23-0	7318800	403392	498,888	1,218,007	2.4	396,365	39,637	0.14	Nil	39,637
Lake 24-0	7321054	402094	876,762	2,011,377	2.3	599,951	59,995	0.13	Nil	59,995
Lake 994	7323246	400275	136,197	276,346	2.0	61,034	6,103	0.11	Nil	6,103
Lake 995	7325353	400617	103,959	233,491	2.2	75,975	7,597	0.17	Nil	7,597
Lake 25-0	7326281	400452	483,390	1,713,886	3.5	868,241	86,824	0.23	Low	80,746
Lake 996	7327338	401382	26,253	43,840	1.7	6,832	683	0.09	Nil	683
Lake 26-0	7328257	401915	59,454	181,351	3.1	97,110	9,711	0.30	Low	6,992
Lake 997	7329276	401911	17,280	41,763	2.4	15,122	1,512	0.17	Nil	1,512
Lake 28-0	7332392	403397	265,680	653,963	2.5	239,515	23,951	0.18	Nil	23,951
Lake 29-0	7334245	403433	1,174,887	5,393,491	4.6	3,246,825	324,682	0.34	Low	211,044
Lake 998	7336793	403071	46,809	125,763	2.7	53,343	5,334	0.20	Nil	5,334
Lake 30-0	7340003	404631	927,360	1,683,771	1.8	566,741	56,674	0.21	Nil	56,674
Lake 30-4	7343073	403851	48,825	101,926	2.1	28,590	2,859	0.15	Nil	2,859
Lake 31-0	7351852	400718	82,758,231	2,779,474,304	33.6	2,616,978,541	261,697,854	3.39	High	17,010,361
Lake 999	7364930	391663	1,645,029	13,130,162	8.0	10,124,845	1,012,485	0.76	Med.	293,621
Lake 31-1	7367584	391134	34,803	70,470	2.0	16,035	1,604	0.12	Nil	1,604
Lake 31-2	7367973	390840	55,377	137,368	2.5	52,909	5,291	0.22	Low	5,185
Lake 32-0	7373635	387860	3,747,375	21,976,529	5.9	14,966,675	1,496,668	0.37	Low	868,067
Lake 33-0	7378706	385690	124,371	270,935	2.2	86,426	8,643	0.17	Nil	8,643
Lake 34-0	7380542	390639	157,216,248	3,320,662,011	21.1	3,010,754,419	301,075,442	2.03	High	32,516,148

PATH: \\golder.gds\calim\GISActive\CLIENTS\SABINA_SILVER\1776921\Mapping\MXD\General\Fig1_1776921_Winter_Road_overview_20180119.mxd PRINTED ON: 2018-02-05 AT: 1:13:27 PM



LEGEND

- WINTER ROAD
- PROJECT AREA
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

0 10 20

1:400,000 KILOMETRES

REFERENCE(S)

SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: UTM ZONE 13 DATUM: NAD 83

CLIENT
SABINA GOLD & SILVER CORP.

PROJECT
BACK RIVER PROJECT

TITLE
OVERVIEW OF WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-02-05
DESIGNED	BW
PREPARED	JG
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
1776921	1300/1320	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

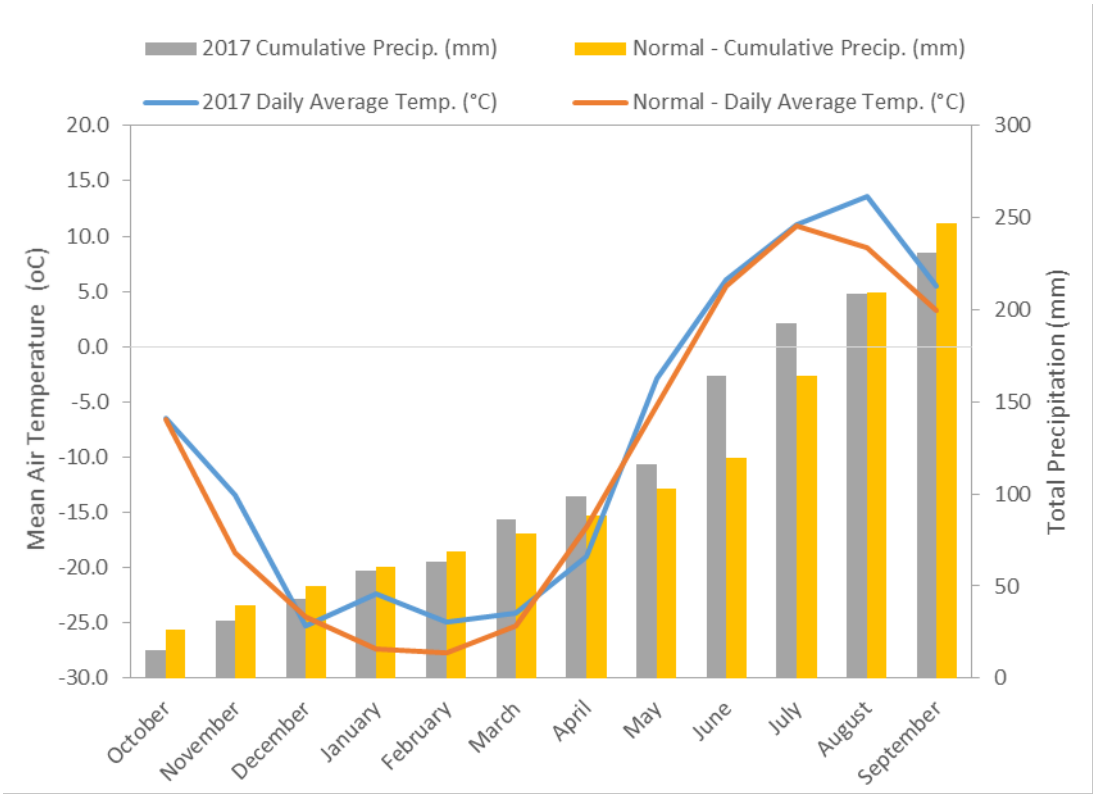


Figure 2: A Comparison of Monthly Total Precipitation and Mean Air Temperature for 2017 versus 'Normals' (1981-2010)

No measurable effects are predicted for fish and fish habitat for most of the identified source lakes if using the 10% under-ice volume guideline for water withdrawal (Table 2). However, potential effects to fish and fish habitat may result for some lakes with large volumes of water relative to the surface area of the lake (i.e., lakebeds profiled as a deep 'bathtub' or 'bowl' shape). For example, minor effects to fish habitat may result in Lake LA17-0 and Lake 999 where predicted water levels may be reduced by 0.43 m, and 0.76 m, respectively, during water withdrawal. To avoid effects to fish and fish habitat (e.g., exposing incubating eggs on shoals) in these two lakes, it is recommended that volumes less than the 10% under ice volume be withdrawn (e.g., approximately 5% for Lake LA17-0, and 3% for Lake 999). A similar recommendation is made for Lake 31-0 (Bathurst Lake) where moderate to major effects to fish habitat may result from water withdrawals unless reduced below the DFO guideline. Given that predicted water levels may drop by 3.39 m if extracted volumes are 10% the under-ice volume, it is recommended that approximately 1% of the under ice volume be withdrawn from Lake 31-0 for road construction. Although the available under ice volume for Lake 34-0 (i.e., lower Bathurst Inlet) for winter ice road construction may be larger than that reported in Table 2 because of receiving under-ice flows from the Western River, the reported under ice volume is recommended without additional hydrological study as a protective measure for fish and fish habitat.

The lake volume statistics generated by the satellite imagery interpretation method were similar to those generated from a field-based sonar survey of lakes. Lake volumes generated by the satellite imagery interpretation method were only marginally higher (by 9.2%) than the previously estimated volumes (Table 3). Differences may be a result of annual or seasonal changes in lake conditions, and also a result of differences underlying the two methods. Although a field-based sonar survey can collect accurate elevation details using a depth sounder, coverage is often limited in spatial extent due to time or logistical constraints. Furthermore, DFO's protocol

recommends only one longitudinal transect (connecting the two farthest shorelines) and a minimum of two perpendicular transects evenly spaced on the longitudinal transect at maximum intervals of 500 m (DFO 2010). The spatial extent of topographic detail collected in the field can clearly be much less than what can be provided by satellite imagery, and recent studies suggest that accurate elevation data (within 0.2 m) can be achieved using high-quality imagery and stereo-photogrammetry interpretation methods (Ehses and Rooney 2015; Mohamed et al. 2016).

Table 3: Comparison of Volume Estimates for Field Survey-Derived Bathymetry versus Satellite Imagery-Derived Bathymetry

Analysis ID	Existing ID	Maximum Depth (m)	Field-Derived Volume (m^3)	Satellite-Derived Volume (m^3)	Volume % Difference
Lake 990	Fold Lake	15.4	2,970,486[(a)]	3,456,788	16.4
Lake 4-0	Winter Road Lake 01	8.5	664,318[(a)]	705,486	6.2
Lake 13-0a	Winter Road Lake 02	5.4	435,046[(a)]	597,123	37.3
Lake 25-0	Winter Road Lake 05	11.3	1,482,102[(a)]	1,713,886	15.6
Lake 26-0	Winter Road Lake 06	10.5	190,557[(a)]	181,351	-4.8
Lake 1-0	Llama Lake	13.6	1,130,613[(b)]	951,009	-15.9
Lake 2-0	Chair Lake	10.3	1,355,660[(b)]	1,487,839	9.8
				Mean Difference	9.2

a) Rescan (2014)
b) Appendix V6-3A in Sabina (2017)

In summary, the recommended (negligible risk to fish habitat) under-ice water volumes to be withdrawn for the construction of the winter ice road (in Table 2) are expected to be more protective of fish and fish habitat than the DFO 10% under-ice volume guideline. Furthermore, actual volumes of water to be withdrawn from each lake during construction are expected to be much less than the recommended volumes. The current plan for the winter ice road requires only 108,000 m^3 of water in total, which is lower than the recommend volume for some of the individual source lakes and is considerably lower than the combined recommended volumes in Table 2-1. However, water withdrawal targets should be re-evaluated annually for lakes if and when climate-related changes influence lake conditions beyond the baseline characterization described in this memo.

3.0 CLOSURE

We trust the above meets your needs, if you have any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely,

Cam Stevens
Associate, Fisheries Biologist

Nathan Schmidt
Principal, Senior Water Resources Engineer

CS/NS/jr

REFERENCES

Dörnhöfer K, N Oppelt. 2016. Remote sensing for lake research and monitoring–Recent advances. Ecological Indicators, 64:105-22.

DFO (Fisheries and Oceans Canada) 2010. DFO protocol for winter water withdrawal from ice-covered waterbodies in the Northwest Territories and Nunavut. Prepared June 20, 2010. 3 pp.

Ehses JS, JJ Rooney. 2015. Depth derivation using multispectral WorldView-2 satellite imagery. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-46, 24p.

Government of Canada 2017. Historical Climate Data. See http://climate.weather.gc.ca/. Visited December 2017.

Legleiter CJ, M Tedesco, LC Smith, AE Behar, BT Overstreet. 2014. Mapping the bathymetry of supraglacial lakes and streams on the Greenland ice sheet using field measurements and high-resolution satellite images. The Cryosphere, 8:215-28.

Mohamed H, A Negm, M Zahran, OC Saavedra. 2016. Bathymetry Determination from High Resolution Satellite Imagery Using Ensemble Learning Algorithms in Shallow Lakes: Case Study El-Burullus Lake. International Journal of Environmental Science and Development, Vol. 7, No. 4.

Rescan. 2014. Back River Project: 2014 Bathymetric Survey Data Report. Prepared for Sabina Gold & Silver Corp. by Rescan Environmental Services Ltd., an ERM company.

Sabina (Sabina Gold & Silver Corp.). 2017. Final Environmental Impact Statement Addendum. Submitted to Nunavut Impact Review Board. February 2017.

APPENDIX A

Bathymetry Results for Source Lakes for Winter Ice Road Construction

APPENDIX A

LIST OF TABLES

Table 1: Lake 1-0 (Llama Lake)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	951,009	348,021
-0.5	786,774	311,913
-1	638,670	270,801
-1.5	510,448	242,370
-2	396,025	214,992
-2.5	295,643	186,885
-3	208,840	155,556
-3.5	138,458	126,351
-4	82,119	96,138
-4.5	39,609	74,187
-5	7,540	11,493
-5.5	2,876	7,317

Table 2: Lake 2-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	1,487,839	598,077
-0.5	1,206,147	536,076
-1	950,662	482,616
-1.5	726,548	414,567
-2	535,068	343,089
-2.5	378,487	284,283
-3	250,032	213,183
-3.5	156,529	162,261
-4	86,311	83,394
-4.5	49,066	65,880
-5	20,279	29,286
-5.5	8,028	20,043

Table 3: Lake 3-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	1,738,708	557,865
-0.5	1,471,400	515,466
-1	1,222,799	476,883
-1.5	996,480	428,517
-2	793,748	372,249
-2.5	618,754	328,077
-3	465,410	282,915
-3.5	334,237	242,181
-4	222,877	186,147
-4.5	139,473	148,266
-5	73,867	108,693
-5.5	28,801	72,639

Table 4: Lake 4-0 (Winter Road Lake 01)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	705,486	349,596
-0.5	543,299	302,454
-1	402,231	248,976
-1.5	288,067	208,080
-2	193,786	155,061
-2.5	123,756	125,640
-3	67,658	90,612
-3.5	28,424	66,951

Table 5: Lake 8-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	2,427,790	765,711
-0.5	2,062,180	704,376
-1	1,722,511	639,504
-1.5	1,416,714	584,028
-2	1,137,977	505,422
-2.5	896,624	460,161
-3	677,996	390,681
-3.5	498,982	325,350
-4	352,629	232,290
-4.5	247,406	188,874
-5	163,374	136,503
-5.5	102,089	109,107
-6	53,617	70,497
-6.5	22,787	53,226

Table 6: Lake 7-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	8,325,456	2,211,876
-0.5	7,247,255	2,110,995
-1	6,213,087	2,021,373
-1.5	5,238,844	1,876,698
-2	4,336,453	1,730,376
-2.5	3,503,990	1,599,210
-3	2,737,090	1,432,809
-3.5	2,067,760	1,242,540
-4	1,496,684	974,259
-4.5	1,053,454	800,208
-5	694,516	599,229
-5.5	427,598	469,224
-6	224,290	284,922
-6.5	101,840	206,397
-7	15,882	24,579
-7.5	5,966	15,507

Table 7: Lake 6-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	614,579	224,514
-0.5	508,726	201,150
-1	413,116	181,332
-1.5	327,974	159,327
-2	253,622	137,583
-2.5	189,913	117,333
-3	136,266	94,599
-3.5	93,626	76,032
-4	60,191	56,196
-4.5	35,098	44,199
-5	15,937	25,083
-5.5	5,842	15,588

Table 8: Lake 9-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	1,581,371	620,172
-0.5	1,283,776	574,164
-1	1,006,749	525,564
-1.5	757,986	469,674
-2	537,030	405,927
-2.5	348,525	348,795
-3	187,488	260,631
-3.5	77,135	184,167

Table 9: Lake 11-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	2,406,329	885,771
-0.5	1,986,081	803,664
-1	1,602,079	709,965
-1.5	1,270,068	619,065
-2	981,876	521,703
-2.5	738,637	452,313
-3	528,555	382,608
-3.5	353,075	319,824
-4	208,294	199,395
-4.5	120,846	151,551
-5	55,599	80,262
-5.5	22,085	54,639

Table 10: Lake 13-0a (Winter Road Lake 02)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	597,123	290,376
-0.5	462,061	254,862
-1	342,054	215,253
-1.5	240,406	191,115
-2	151,117	156,141
-2.5	81,631	122,094
-3	28,802	37,107
-3.5	13,126	26,073
-4	2,450	3,024
-4.5	1,081	2,412

Table 11: Lake 14-0a

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	10,415,812	3,942,630
-0.5	8,508,701	3,706,839
-1	6,707,236	3,413,583
-1.5	5,076,385	3,109,680
-2	3,597,800	2,447,298
-2.5	2,465,903	2,080,647
-3	1,517,173	1,296,630
-3.5	925,510	1,073,889
-4	439,353	581,913
-4.5	186,010	435,573

Table 12: Lake 14-1 (Winter Road Lake 03)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	4,779,159	2,221,497
-0.5	3,696,902	2,121,723
-1	2,656,345	1,995,939
-1.5	1,713,762	1,775,016
-2	881,912	1,167,093
-2.5	391,958	793,134
-3	87,827	148,545
-3.5	30,358	84,393

Table 13: Lake 15-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	5,027,754	1,441,269
-0.5	4,320,561	1,395,918
-1	3,631,480	1,355,472
-1.5	2,978,026	1,258,470
-2	2,373,270	1,149,336
-2.5	1,834,521	1,003,284
-3	1,372,339	795,123
-3.5	1,001,136	690,291
-4	681,553	501,993
-4.5	452,038	416,331
-5	265,208	302,211
-5.5	132,056	231,246
-6	33,062	53,973
-6.5	11,835	32,049

Table 14: Lake 16-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	12,016,309	2,068,272
-0.5	10,997,464	2,014,488
-1	10,001,007	1,967,616
-1.5	9,044,365	1,860,210
-2	8,139,725	1,742,535
-2.5	7,289,399	1,658,664
-3	6,480,762	1,575,414
-3.5	5,717,933	1,476,243
-4	5,004,215	1,375,101
-4.5	4,341,201	1,277,172
-5	3,726,880	1,167,093
-5.5	3,169,045	1,065,015
-6	2,661,580	959,958
-6.5	2,202,731	875,907
-7	1,785,082	786,681
-7.5	1,413,523	700,362
-8	1,084,083	605,790
-8.5	799,103	534,645
-9	548,721	457,002
-9.5	345,505	357,075
-10	190,492	247,329
-10.5	81,526	189,459

Table 15: Lake 17-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	61,932,318	5,913,261
-0.5	58,988,355	5,863,014
-1	56,069,074	5,813,217
-1.5	53,191,478	5,696,244
-2	50,372,624	5,540,463
-2.5	47,635,707	5,406,192
-3	44,967,408	5,241,510
-3.5	42,391,708	5,060,475
-4	39,906,981	4,851,423
-4.5	37,526,172	4,672,242
-5	35,233,773	4,421,880
-5.5	33,077,330	4,204,242
-6	31,029,091	3,975,948
-6.5	29,091,298	3,775,158
-7	27,253,008	3,540,456
-7.5	25,520,934	3,388,428
-8	23,863,695	3,223,233
-8.5	22,287,815	3,080,664
-9	20,782,317	2,938,743
-9.5	19,345,963	2,806,947
-10	17,974,529	2,677,734
-10.5	16,665,221	2,559,897
-11	15,413,919	2,444,607
-11.5	14,219,600	2,332,719
-12	13,080,745	2,222,280
-12.5	11,997,651	2,110,113
-13	10,970,236	1,999,755
-13.5	9,998,631	1,886,976
-14	9,082,514	1,775,952
-14.5	8,221,505	1,668,375
-15	7,413,747	1,562,508
-15.5	6,656,587	1,466,451
-16	5,946,799	1,372,005
-16.5	5,284,027	1,279,431
-17	4,666,741	1,189,449
-17.5	4,093,761	1,102,932
-18	3,563,254	1,017,972
-18.5	3,075,495	933,507
-19	2,629,259	848,709
-19.5	2,225,377	767,574
-20	1,861,215	682,425

Table 15: Lake 17-0 (continued)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
-20.5	1,538,744	607,680
-21	1,252,962	524,637
-21.5	1,005,985	463,815
-22	788,650	398,403
-22.5	603,012	344,385
-23	443,520	277,704
-23.5	316,488	231,093
-24	211,662	181,017
-24.5	131,801	138,987
-25	71,788	97,299
-25.5	29,713	71,325

Table 16: Lake 16-1

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	812,512	319,815
-0.5	656,628	303,615
-1	508,692	286,110
-1.5	375,239	248,013
-2	260,311	207,252
-2.5	165,049	174,015
-3	86,367	90,900
-3.5	46,432	69,156
-4	16,902	25,299
-4.5	6,517	16,578

Table 17: Lake LA17-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	18,907,975	3,193,056
-0.5	17,331,869	3,111,678
-1	15,795,680	3,029,634
-1.5	14,305,839	2,929,986
-2	12,865,851	2,812,185
-2.5	11,491,012	2,686,905
-3	10,179,056	2,553,057
-3.5	8,937,258	2,414,124
-4	7,764,886	2,272,824
-4.5	6,660,229	2,145,879
-5	5,618,749	2,013,453
-5.5	4,657,451	1,832,022
-6	3,786,398	1,600,722
-6.5	3,030,687	1,422,720
-7	2,363,514	1,175,598
-7.5	1,816,893	1,011,708
-8	1,351,204	752,112
-8.5	1,004,902	634,284
-9	715,587	488,862
-9.5	494,721	395,442
-10	319,267	258,894
-10.5	204,715	200,232
-11	118,230	119,160
-11.5	67,019	86,382
-12	31,037	44,217
-12.5	12,445	30,618

Table 18: Lake 18-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	2,886,128	635,085
-0.5	2,571,908	622,143
-1	2,263,916	608,175
-1.5	1,968,603	573,255
-2	1,690,494	537,786
-2.5	1,432,519	494,226
-3	1,196,240	445,176
-3.5	983,789	404,523
-4	792,166	352,332
-4.5	627,040	308,979
-5	482,366	266,328
-5.5	357,855	232,326
-6	249,488	196,920
-6.5	160,328	160,461
-7	88,190	123,966
-7.5	35,648	87,174

Table 19: Lake 984

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	296,424	153,108
-0.5	222,837	141,282
-1	154,983	116,604
-1.5	105,469	82,350
-2	71,739	46,314
-2.5	50,654	38,205
-3	33,417	29,034
-3.5	20,565	22,446
-4	10,796	15,111
-4.5	4,391	10,665

Table 20: Lake 18-1

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	426,414	161,253
-0.5	347,889	152,856
-1	273,423	144,927
-1.5	206,642	122,508
-2	150,589	101,844
-2.5	103,121	88,371
-3	62,127	74,511
-3.5	28,085	61,884

Table 21: Lake LA18-0a

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	4,368,027	714,708
-0.5	4,014,611	699,075
-1	3,668,821	682,677
-1.5	3,332,711	661,842
-2	3,006,955	640,116
-2.5	2,693,523	613,575
-3	2,393,308	579,033
-3.5	2,112,672	543,897
-4	1,849,433	507,033
-4.5	1,606,085	466,578
-5	1,382,725	425,655
-5.5	1,179,964	385,632
-6	996,976	336,573
-6.5	835,437	309,663
-7	687,154	277,686
-7.5	556,205	246,411
-8	440,264	209,835
-8.5	341,992	183,456
-9	256,581	156,249
-9.5	184,461	132,399
-10	123,961	107,064
-10.5	75,973	85,185
-11	38,628	51,327
-11.5	16,249	38,412

Table 22: Lake 19-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	360,221	160,065
-0.5	283,395	147,330
-1	212,794	133,866
-1.5	150,823	114,210
-2	98,274	94,680
-2.5	55,599	76,140
-3	21,703	31,635
-3.5	8,554	21,276

Table 23: Lake 985

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	106,234	40,914
-0.5	86,360	38,592
-1	67,644	36,297
-1.5	50,480	32,436
-2	35,130	28,764
-2.5	22,038	23,598
-3	11,445	17,559
-3.5	4,342	11,160

Table 24: Lake 986

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	37,926	16,299
-0.5	30,295	14,220
-1	23,650	12,348
-1.5	17,841	10,917
-2	12,753	9,513
-2.5	8,385	8,046
-3	4,704	6,048
-3.5	2,032	4,653

Table 25: Lake 989

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	62,690	29,322
-0.5	48,842	26,073
-1	36,561	22,338
-1.5	26,256	18,891
-2	17,580	14,976
-2.5	10,895	11,817
-3	5,699	8,595
-3.5	2,181	5,616

Table 26: Lake 987

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	760,584	206,199
-0.5	660,430	194,562
-1	565,753	183,537
-1.5	476,918	171,882
-2	393,753	160,596
-2.5	318,065	142,254
-3	251,463	116,433
-3.5	197,446	100,071
-4	150,792	83,763
-4.5	112,205	70,776
-5	79,776	58,113
-5.5	53,942	45,423
-6	34,115	32,454
-6.5	20,002	24,156
-7	9,785	14,814
-7.5	3,695	9,630

Table 27: Lake 991

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	76,595	36,702
-0.5	59,409	32,085
-1	44,450	27,594
-1.5	31,736	23,274
-2	21,030	19,152
-2.5	12,573	14,697
-3	6,223	9,414
-3.5	2,372	6,093

Table 28: Lake LA20-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	940,089	324,144
-0.5	783,490	302,679
-1	637,283	271,242
-1.5	507,698	247,482
-2	389,431	222,093
-2.5	284,596	197,334
-3	192,027	157,527
-3.5	120,826	127,575
-4	64,244	90,423
-4.5	25,810	63,693

Table 29: Lake 990 (Fold Lake)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	3,456,788	761,706
-0.5	3,087,385	716,427
-1	2,739,717	656,919
-1.5	2,423,106	609,525
-2	2,130,011	545,661
-2.5	1,870,827	491,571
-3	1,638,121	400,167
-3.5	1,453,581	339,399
-4	1,297,348	285,903
-4.5	1,158,719	268,677
-5	1,028,661	251,361
-5.5	907,323	233,991
-6	794,532	216,981
-6.5	689,551	202,869
-7	591,575	188,604
-7.5	500,912	173,979
-8	417,561	159,345
-8.5	341,565	144,666
-9	272,818	129,204
-9.5	213,107	109,845
-10	162,911	87,579
-10.5	122,816	72,927
-11	89,990	56,997
-11.5	64,197	46,296
-12	43,700	33,516
-12.5	28,675	26,550
-13	17,063	17,811
-13.5	9,378	13,059
-14	3,909	6,435
-14.5	1,383	3,843

Table 30: Lake 20-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	24,053,493	5,757,903
-0.5	21,274,098	5,359,257
-1	18,694,202	4,914,081
-1.5	16,327,151	4,554,369
-2	14,139,389	4,160,286
-2.5	12,143,103	3,824,901
-3	10,313,817	3,444,399
-3.5	8,671,863	3,124,656
-4	7,188,577	2,734,920
-4.5	5,892,489	2,450,403
-5	4,736,646	2,011,113
-5.5	3,800,296	1,737,054
-6	2,996,722	1,430,307
-6.5	2,332,005	1,230,615
-7	1,764,101	958,626
-7.5	1,324,398	802,566
-8	958,983	612,387
-8.5	682,383	495,297
-9	462,115	355,122
-9.5	303,961	279,081
-10	181,373	194,058
-10.5	96,468	146,736
-11	33,608	44,649
-11.5	14,164	33,363

Table 31: Lake 992 (Lower Long Lake)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	3,525,249	893,646
-0.5	3,090,884	843,894
-1	2,681,132	794,889
-1.5	2,296,727	742,455
-2	1,938,558	684,441
-2.5	1,609,868	630,351
-3	1,308,061	570,294
-3.5	1,037,696	511,290
-4	796,388	428,427
-4.5	600,504	355,113
-5	441,327	242,514
-5.5	331,443	197,631
-6	243,202	131,913
-6.5	183,033	109,143
-7	133,905	84,798
-7.5	95,742	68,004
-8	65,674	49,887
-8.5	43,530	38,835
-9	26,637	26,559
-9.5	14,968	20,178
-10	6,340	9,612
-10.5	2,417	6,255

Note: results represent approximately half of the lake

Table 32: Lake LA21-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	761,896	256,878
-0.5	636,798	243,540
-1	518,164	230,571
-1.5	408,466	208,323
-2	309,761	184,896
-2.5	223,571	160,011
-3	149,502	131,949
-3.5	90,275	105,246
-4	43,945	61,821
-4.5	17,741	43,488

Table 33: Lake LA23-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	1,013,844	265,968
-0.5	883,593	255,177
-1	758,619	244,926
-1.5	638,981	233,838
-2	524,720	223,182
-2.5	417,547	205,551
-3	319,059	188,469
-3.5	231,584	161,847
-4	156,958	135,342
-4.5	97,169	104,409
-5	51,964	72,063
-5.5	21,204	51,399

Table 34: Lake LA21-1

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	406,055	204,606
-0.5	313,083	167,463
-1	238,330	125,316
-1.5	179,826	108,810
-2	129,313	92,871
-2.5	87,933	72,837
-3	56,168	50,058
-3.5	33,938	39,006
-4	17,084	25,722
-4.5	6,464	16,857

Table 35: Lake LA22-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	5,635,137	2,393,802
-0.5	4,482,867	2,216,070
-1	3,417,646	2,004,201
-1.5	2,486,972	1,719,324
-2	1,697,105	1,305,063
-2.5	1,119,971	1,006,281
-3	687,345	499,131
-3.5	461,891	403,263
-4	283,219	234,945
-4.5	178,423	184,986
-5	97,282	137,520
-5.5	38,910	96,624

Table 36: Lake 23-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	1,218,007	498,888
-0.5	978,980	457,965
-1	759,688	413,127
-1.5	565,653	363,042
-2	396,365	304,857
-2.5	255,928	256,743
-3	139,356	190,107
-3.5	57,778	137,799

Table 37: Lake 24-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	2,011,377	876,762
-0.5	1,593,705	794,241
-1	1,216,306	707,499
-1.5	885,350	616,248
-2	599,951	502,839
-2.5	370,232	417,114
-3	182,194	251,559
-3.5	74,529	180,648

Table 38: Lake 994

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	276,346	136,197
-0.5	211,157	124,704
-1	151,661	108,810
-1.5	101,855	90,432
-2	61,034	64,206
-2.5	33,180	47,628
-3	13,069	19,656
-3.5	4,999	12,825

Table 39: Lake 995

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	233,491	103,959
-0.5	184,607	91,971
-1	141,616	80,118
-1.5	105,172	65,538
-2	75,975	49,248
-2.5	53,340	41,301
-3	34,509	32,976
-3.5	19,729	26,199
-4	8,207	12,276
-4.5	3,137	8,127

Table 40: Lake 25-0 (Winter Road Lake 05)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	1,713,886	483,390
-0.5	1,479,292	454,887
-1	1,258,717	423,630
-1.5	1,055,229	390,429
-2	868,241	330,912
-2.5	712,176	293,499
-3	574,202	257,418
-3.5	451,816	232,380
-4	341,796	204,354
-4.5	246,870	175,221
-5	166,488	126,810
-5.5	109,103	103,149
-6	63,042	61,848
-6.5	36,204	45,756
-7	16,933	11,070
-7.5	12,052	8,469
-8	8,414	6,066
-8.5	5,663	4,896
-9	3,483	3,753
-9.5	1,874	2,709
-10	757	1,224
-10.5	278	765

Table 41: Lake 996

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	43,840	26,253
-0.5	31,678	22,446
-1	21,286	18,900
-1.5	12,971	14,409
-2	6,832	8,010
-2.5	3,481	5,508
-3	1,240	2,079
-3.5	436	1,233

Table 42: Lake 26-0 (Winter Road Lake 06)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	181,351	59,454
-0.5	154,336	48,852
-1	132,265	39,654
-1.5	113,597	35,064
-2	97,110	30,897
-2.5	82,370	28,089
-3	69,005	25,425
-3.5	57,094	22,320
-4	46,686	19,287
-4.5	37,659	16,812
-5	29,834	14,472
-5.5	23,043	12,771
-6	17,092	10,998
-6.5	12,014	9,297
-7	7,753	5,436
-7.5	5,320	4,320
-8	3,393	3,141
-8.5	2,024	2,358
-9	1,010	1,593
-9.5	372	1,017

Table 43: Lake 997

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	41,763	17,280
-0.5	33,611	15,246
-1	26,461	13,284
-1.5	20,335	11,277
-2	15,122	9,513
-2.5	10,772	7,875
-3	7,193	6,390
-3.5	4,381	4,842
-4	2,264	3,240
-4.5	911	2,214

Table 44: Lake 28-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	653,963	265,680
-0.5	528,349	236,736
-1	417,104	207,198
-1.5	321,078	177,165
-2	239,515	140,265
-2.5	174,734	119,358
-3	119,751	93,681
-3.5	77,451	75,375
-4	44,548	49,707
-4.5	23,042	36,387
-5	8,010	11,835
-5.5	3,093	7,965

Table 45: Lake 29-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	5,393,491	1,174,887
-0.5	4,817,050	1,131,201
-1	4,262,173	1,080,720
-1.5	3,737,917	1,015,686
-2	3,246,825	921,393
-2.5	2,804,519	847,629
-3	2,399,386	757,305
-3.5	2,039,176	683,649
-4	1,715,040	594,387
-4.5	1,432,061	537,903
-5	1,176,592	472,086
-5.5	955,205	414,081
-6	761,770	348,588
-6.5	600,293	298,143
-7	462,858	233,271
-7.5	355,325	197,280
-8	264,767	151,047
-8.5	195,440	126,801
-9	137,826	102,753
-9.5	92,119	80,523
-10	56,906	52,065
-10.5	34,308	38,700
-11	17,925	26,217
-11.5	7,001	17,721

Table 46: Lake 998

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	125,763	46,809
-0.5	103,848	40,851
-1	84,747	35,496
-1.5	68,045	31,401
-2	53,343	27,126
-2.5	40,766	23,247
-3	30,037	19,116
-3.5	21,351	15,615
-4	14,376	12,312
-4.5	8,942	9,630
-5	4,748	6,426
-5.5	1,948	4,725

Table 47: Lake 30-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	1,683,771	927,360
-0.5	1,258,362	778,509
-1	900,580	370,440
-1.5	724,696	333,720
-2	566,741	294,957
-2.5	429,027	256,815
-3	309,111	201,456
-3.5	216,433	169,920
-4	138,546	127,656
-4.5	81,453	101,151
-5	36,825	50,634
-5.5	15,061	36,639

Table 48: Lake 30-4

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	101,926	48,825
-0.5	79,011	42,921
-1	58,908	37,179
-1.5	42,092	30,240
-2	28,590	23,796
-2.5	18,087	18,225
-3	10,211	10,035
-3.5	5,873	7,398
-4	2,787	4,374
-4.5	1,021	2,718

Table 49: Lake 31-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	2,779,474,304	82,758,231
-0.5	2,738,286,322	81,993,276
-1	2,697,479,161	81,173,871
-1.5	2,657,060,478	80,500,122
-2	2,616,978,541	79,766,712
-2.5	2,577,275,942	79,043,760
-3	2,537,934,427	78,270,867
-3.5	2,498,976,729	77,559,606
-4	2,460,374,524	76,781,853
-4.5	2,422,167,580	76,045,545
-5	2,384,328,503	75,273,336
-5.5	2,346,852,319	74,632,995
-6	2,309,694,851	73,976,832
-6.5	2,272,843,941	73,428,219
-7	2,236,266,110	72,845,262
-7.5	2,199,978,270	72,306,963
-8	2,163,957,904	71,748,549
-8.5	2,128,208,323	71,249,652
-9	2,092,707,373	70,744,662
-9.5	2,057,462,312	70,235,793
-10	2,022,471,385	69,723,927
-10.5	1,987,739,440	69,204,159
-11	1,953,266,573	68,684,013
-11.5	1,919,046,272	68,198,400
-12	1,885,068,199	67,705,983
-12.5	1,851,334,569	67,228,920

Table 49: Lake 31-0 (continued)

Lake Volume and Surface Area Per Depth		
-13	1,817,838,881	66,697,659
-13.5	1,784,611,758	66,210,417
-14	1,751,627,867	65,717,829
-14.5	1,718,882,776	65,263,140
-15	1,686,364,164	64,808,766
-15.5	1,654,084,897	64,309,302
-16	1,622,054,442	63,761,085
-16.5	1,590,297,568	63,265,374
-17	1,558,788,025	62,746,614
-17.5	1,527,535,319	62,264,043
-18	1,496,522,874	61,762,707
-18.5	1,465,765,321	61,268,445
-19	1,435,253,763	60,769,143
-19.5	1,404,995,684	60,263,793
-20	1,374,989,744	59,751,288
-20.5	1,345,249,489	59,210,694
-21	1,315,778,729	58,660,461
-21.5	1,286,584,459	58,117,185
-22	1,257,661,383	57,566,655
-22.5	1,229,012,381	57,030,012
-23	1,200,631,288	56,477,808
-23.5	1,172,533,740	55,912,635
-24	1,144,717,715	55,346,733
-24.5	1,117,200,617	54,721,701
-25	1,089,995,211	54,093,960
-25.5	1,063,111,477	53,442,306
-26	1,036,552,135	52,792,983
-26.5	1,010,316,014	52,152,156
-27	984,399,486	51,509,538
-27.5	958,815,565	50,828,094
-28	933,570,502	50,145,750
-28.5	908,670,006	49,457,457
-29	884,111,981	48,772,368
-29.5	859,900,511	48,074,625
-30	836,036,328	47,279,367
-30.5	812,565,571	46,607,166
-31	789,426,176	45,925,938
-31.5	766,625,128	45,280,584
-32	744,143,346	44,571,042
-32.5	722,006,980	43,975,332
-33	700,167,379	43,382,241
-33.5	678,627,297	42,778,629

Table 49: Lake 31-0 (continued)

Lake Volume and Surface Area Per Depth		
-34	657,388,064	42,176,700
-34.5	636,455,412	41,554,566
-35	615,832,872	40,931,937
-35.5	595,521,309	40,315,581
-36	575,516,794	39,702,060
-36.5	555,810,028	39,125,016
-37	536,390,699	38,547,693
-37.5	517,270,174	37,934,649
-38	498,455,270	37,322,379
-38.5	479,949,509	36,701,775
-39	461,752,823	36,082,944
-39.5	443,862,015	35,480,250
-40	426,271,732	34,876,053
-40.5	408,991,697	34,243,875
-41	392,027,236	33,613,353
-41.5	375,357,554	33,065,784
-42	358,961,388	32,516,379
-42.5	342,841,389	31,964,148
-43	326,996,676	31,414,347
-43.5	311,425,290	30,871,422
-44	296,124,835	30,327,417
-44.5	281,090,826	29,809,215
-45	266,315,475	29,291,625
-45.5	251,799,364	28,772,748
-46	237,542,200	28,252,341
-46.5	223,568,690	27,641,682
-47	209,899,524	27,030,564
-47.5	196,562,608	26,317,629
-48	183,580,647	25,575,021
-48.5	171,007,519	24,720,444
-49	158,858,197	23,844,411
-49.5	147,142,961	23,019,183
-50	135,836,868	22,053,330
-50.5	125,044,753	21,117,474
-51	114,717,209	20,171,889
-51.5	104,882,606	19,168,425
-52	95,546,830	18,123,930
-52.5	86,725,970	17,161,929
-53	78,382,597	16,124,526
-53.5	70,550,222	15,209,154
-54	63,168,664	14,290,947
-54.5	56,242,766	13,416,732

Table 49: Lake 31-0 (continued)

Lake Volume and Surface Area Per Depth		
-55	49,748,780	12,454,083
-55.5	43,766,641	11,480,868
-56	38,262,036	9,984,519
-56.5	33,494,892	9,088,650
-57	29,168,416	8,002,602
-57.5	25,342,406	7,304,724
-58	21,860,302	6,573,060
-58.5	18,694,822	6,091,542
-59	15,766,101	5,604,417
-59.5	13,077,313	5,153,346
-60	10,610,749	4,659,732
-60.5	8,406,393	4,161,825
-61	6,444,473	3,645,792
-61.5	4,756,378	3,111,633
-62	3,327,705	2,489,598
-62.5	2,211,484	1,981,539
-63	1,340,252	1,264,635
-63.5	787,502	952,182
-64	382,210	551,313
-64.5	151,366	377,046

Table 50: Lake 999

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	13,130,162	1,645,029
-0.5	12,324,390	1,578,249
-1	11,551,678	1,504,566
-1.5	10,819,036	1,426,212
-2	10,124,845	1,342,953
-2.5	9,471,923	1,269,396
-3	8,855,337	1,192,131
-3.5	8,273,597	1,134,972
-4	7,720,226	1,074,447
-4.5	7,196,013	1,022,535
-5	6,697,821	965,898
-5.5	6,227,583	914,967
-6	5,782,681	855,180
-6.5	5,366,913	807,948
-7	4,974,531	749,808
-7.5	4,608,981	712,206
-8	4,261,919	667,332
-8.5	3,936,614	633,996
-9	3,627,776	599,787
-9.5	3,336,031	567,324
-10	3,060,269	515,619
-10.5	2,809,077	489,231
-11	2,571,030	460,863
-11.5	2,346,590	437,148
-12	2,133,688	397,755
-12.5	1,939,590	378,657
-13	1,754,894	358,821
-13.5	1,580,047	340,425
-14	1,414,333	322,128
-14.5	1,257,609	304,803
-15	1,109,556	287,262
-15.5	969,988	271,035
-16	838,528	254,754
-16.5	715,437	237,744
-17	600,816	219,321
-17.5	494,990	203,760
-18	396,851	188,118
-18.5	306,567	173,007
-19	223,659	112,086
-19.5	170,397	100,881
-20	122,628	81,927

Table 50: Lake 999 (continued)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
-20.5	84,113	72,216
-21	50,359	62,487
-21.5	22,284	50,175

Table 51: Lake 31-1

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	70,470	34,803
-0.5	53,923	31,437
-1	39,034	28,197
-1.5	26,274	22,941
-2	16,035	14,895
-2.5	9,540	11,124
-3	4,806	6,885
-3.5	1,913	4,752

Table 52: Lake 31-2

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	137,368	55,377
-0.5	111,092	49,734
-1	87,524	43,290
-1.5	68,169	34,299
-2	52,909	22,995
-2.5	42,007	20,646
-3	32,218	18,522
-3.5	23,705	15,561
-4	16,557	12,969
-4.5	10,708	10,467
-5	6,040	8,172
-5.5	2,505	5,985

Table 53: Lake 32-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	21,976,529	3,747,375
-0.5	20,130,753	3,636,045
-1	18,339,977	3,518,766
-1.5	16,617,299	3,372,615
-2	14,966,675	3,218,004
-2.5	13,385,314	3,107,889
-3	11,858,153	2,995,722
-3.5	10,405,325	2,816,910
-4	9,039,923	2,641,860
-4.5	7,770,292	2,437,587
-5	6,601,351	2,226,348
-5.5	5,542,465	2,010,033
-6	4,590,286	1,790,037
-6.5	3,742,287	1,602,801
-7	2,986,697	1,408,995
-7.5	2,329,723	1,219,779
-8	1,766,071	1,032,291
-8.5	1,282,680	901,386
-9	864,349	742,716
-9.5	533,637	582,318
-10	280,019	383,598
-10.5	114,906	278,631

Table 54: Lake 33-0

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	270,935	124,371
-0.5	212,600	108,945
-1	161,855	87,570
-1.5	121,111	75,402
-2	86,426	58,716
-2.5	59,865	47,709
-3	38,572	36,459
-3.5	22,604	27,396
-4	11,012	15,255
-4.5	4,521	10,881

Table 55: Lake 34-0 (Lower Bathurst Inlet)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
0	3,320,662,011	157,216,248
-0.5	3,242,285,412	156,296,529
-1	3,164,357,277	155,139,363
-1.5	3,087,175,952	153,595,260
-2	3,010,754,419	152,013,132
-2.5	2,935,337,834	149,661,963
-3	2,861,083,384	147,317,517
-3.5	2,787,866,353	145,558,773
-4	2,715,516,461	143,831,412
-4.5	2,644,168,880	141,559,281
-5	2,573,955,889	138,770,010
-5.5	2,505,117,971	136,589,616
-6	2,437,357,360	134,425,800
-6.5	2,370,739,815	132,051,222
-7	2,305,297,954	129,707,748
-7.5	2,241,084,611	127,158,525
-8	2,178,127,683	124,601,346
-8.5	2,116,626,591	121,407,669
-9	2,056,715,484	117,836,145
-9.5	1,998,611,273	114,569,469
-10	1,942,156,521	111,006,765
-10.5	1,887,443,003	107,868,915
-11	1,834,265,954	104,774,184
-11.5	1,782,515,939	102,239,658
-12	1,732,011,025	99,746,091
-12.5	1,682,747,632	97,322,355
-13	1,634,673,468	94,934,628
-13.5	1,587,841,099	92,418,390
-14	1,542,232,067	89,901,333
-14.5	1,497,855,760	87,615,594
-15	1,454,603,280	85,344,021
-15.5	1,412,437,213	83,337,822
-16	1,371,248,955	81,401,391
-16.5	1,330,951,001	79,797,096
-17	1,291,444,162	78,208,425
-17.5	1,252,743,067	76,603,950
-18	1,214,832,755	75,027,555
-18.5	1,177,719,168	73,436,157
-19	1,141,389,022	71,869,878
-19.5	1,105,835,767	70,359,318
-20	1,071,012,696	68,925,483

Table 55: Lake 34-0 (Lower Bathurst Inlet) (continued)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
-20.5	1,036,903,801	67,520,178
-21	1,003,484,304	66,104,001
-21.5	970,767,886	64,767,087
-22	938,711,950	63,413,928
-22.5	907,299,980	62,239,320
-23	876,467,854	61,008,156
-23.5	846,253,173	59,857,542
-24	816,602,873	58,743,063
-24.5	787,524,687	57,575,763
-25	759,021,754	56,434,914
-25.5	731,092,489	55,285,002
-26	703,733,181	54,154,953
-26.5	676,913,254	53,126,199
-27	650,604,821	52,108,326
-27.5	624,783,781	51,175,593
-28	599,428,816	50,244,048
-28.5	574,533,210	49,339,089
-29	550,088,651	48,440,565
-29.5	526,087,209	47,566,152
-30	502,521,118	46,698,912
-30.5	479,422,657	45,698,769
-31	456,818,707	44,721,144
-31.5	434,722,343	43,668,513
-32	413,149,392	42,626,592
-32.5	392,102,798	41,562,108
-33	371,585,866	40,507,344
-33.5	351,609,916	39,399,894
-34	332,180,732	38,242,395
-34.5	313,348,528	37,089,666
-35	295,088,704	35,925,381
-35.5	277,429,392	34,716,213
-36	260,368,854	33,488,091
-36.5	243,935,626	32,248,809
-37	228,116,039	31,007,007
-37.5	212,876,735	29,953,134
-38	198,160,274	28,905,912
-38.5	183,963,137	27,884,169
-39	170,275,692	26,857,386
-39.5	157,100,529	25,846,137
-40	144,428,510	24,823,413
-40.5	132,289,859	23,734,530

Table 55: Lake 34-0 (Lower Bathurst Inlet) (continued)

Lake Volume and Surface Area Per Depth

Elevation (m)	Cumulative Volume (m^3)	Cumulative Area (m^2)
-41	120,690,883	22,664,268
-41.5	109,614,224	21,645,522
-42	99,042,791	20,349,549
-42.5	89,120,186	19,343,151
-43	79,696,709	18,260,478
-43.5	70,870,760	17,047,413
-44	62,645,297	15,560,451
-44.5	55,193,891	14,252,175
-45	48,387,157	12,141,720
-45.5	42,569,731	11,134,899
-46	37,245,670	9,563,436
-46.5	32,665,660	8,762,805
-47	28,476,533	7,786,719
-47.5	24,748,249	7,133,058
-48	21,336,650	6,211,449
-48.5	18,354,386	5,719,374
-49	15,616,131	5,217,471
-49.5	13,113,823	4,793,148
-50	10,821,496	4,370,733
-50.5	8,744,070	3,940,920
-51	6,878,964	3,476,700
-51.5	5,234,537	3,103,515
-52	3,772,989	2,650,050
-52.5	2,559,532	2,208,681
-53	1,559,990	1,605,843
-53.5	840,334	1,277,856
-54	276,818	410,859
-54.5	107,940	270,522

APPENDIX B

Map of Water Sources for Ice Road Construction

Marine
Laydown
Area

34-0

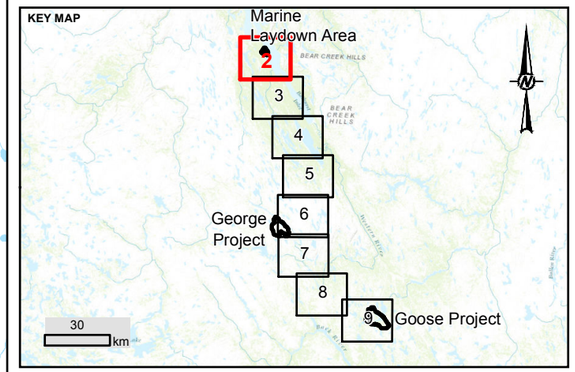
LEGEND

- MARINE LAYDOWN AREA
- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B2	A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: \\golder.gds\calm\GIS\Active\CLIENTS\SABINA_SILVER\1776921\Mapping\MXD\General\Fig2-9_1776921_Winter_Road_Mapbook_20180119.mxd PRINTED ON: 2018-02-05 AT: 1:13:24 PM

33

32-0

34-0

31-2

31-1

999

31-0

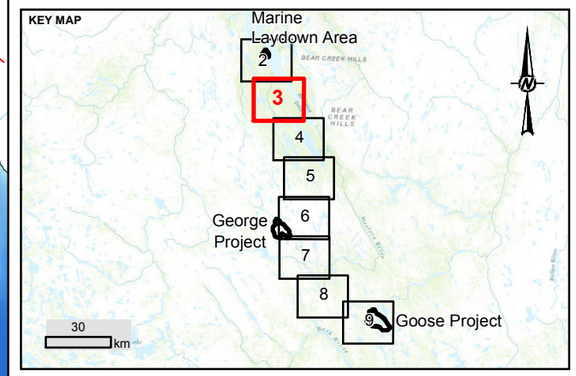
LEGEND

- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

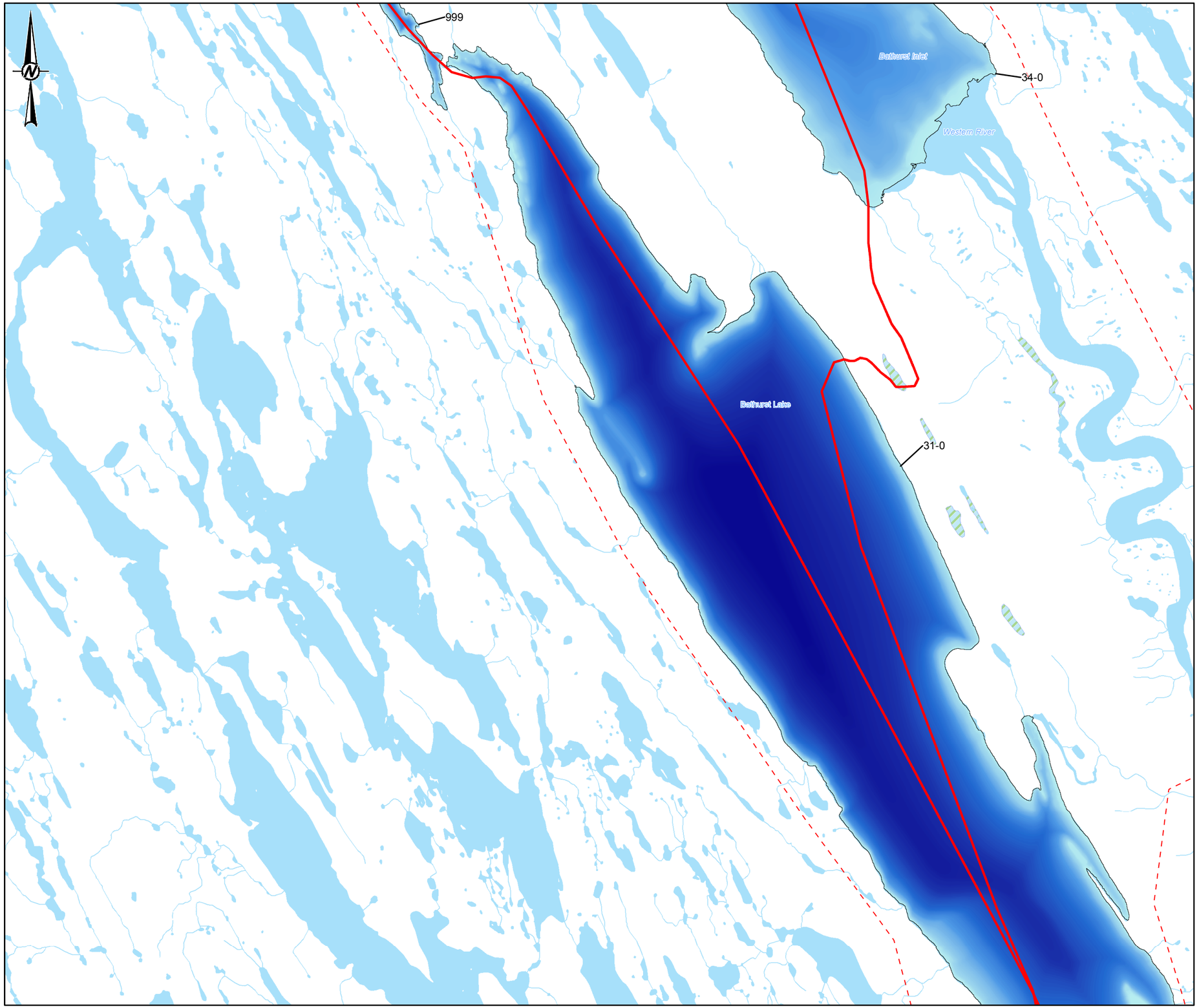
TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B3	A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: \\golder.gds\calmi\GIS\Active\CLIENTS\SABINA_SILVER\1776921\Mapping\MXD\General\Fig2-9_1776921_Winter_Road_Mapbook_20180119.mxd PRINTED ON: 2018-02-05 AT: 1:13:54 PM



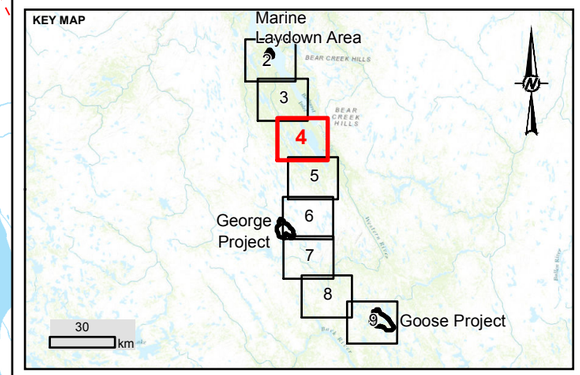
LEGEND

- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

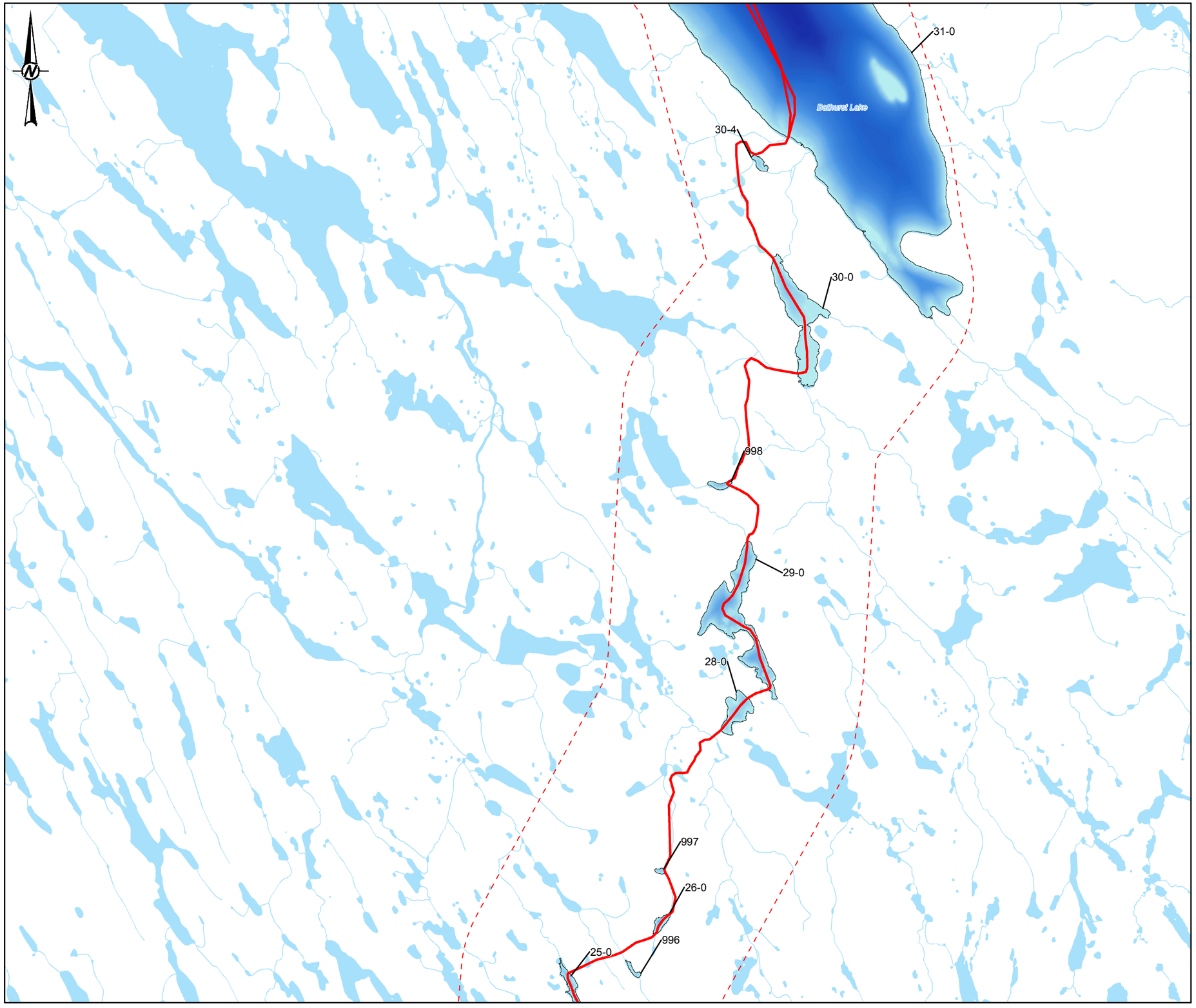
TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B4	A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

PATH: \\golder.gds\calm\GIS\Active\CLIENTS\SABINA_SILVER\1776921\Mapping\MXD\General\Fig2-9_1776921_Winter_Road_Mapbook_20180119.mxd PRINTED ON: 2018-02-05 AT: 1:14:23 PM



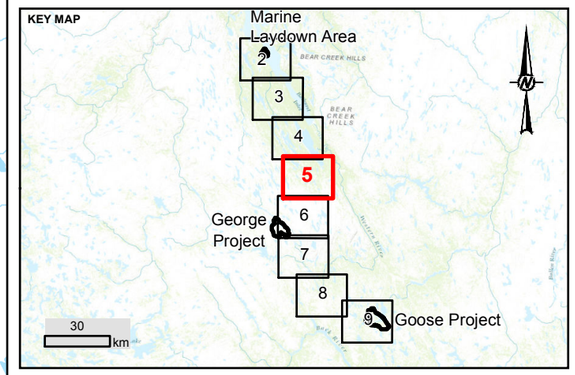
LEGEND

- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B5	A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

PATH: \\golder.gds\calgm\GIS\Active\CLIENTS\SABINA_SILVER\1776921\Mapping\MXD\General\Fig2-9_1776921_Winter_Road_Mapbook_20180119.mxd PRINTED ON: 2018-02-05 AT: 1:14:37 PM

996
25-0
995
994
24-0
LA 22-0
23-0
LA 21-1
LA 23-0
LA 21-0
20-0
990
992
LA 20-0
991
989
987
986
George
Project
985
LA 18_0
19-0
LA 17_0
18-1
984
18-0

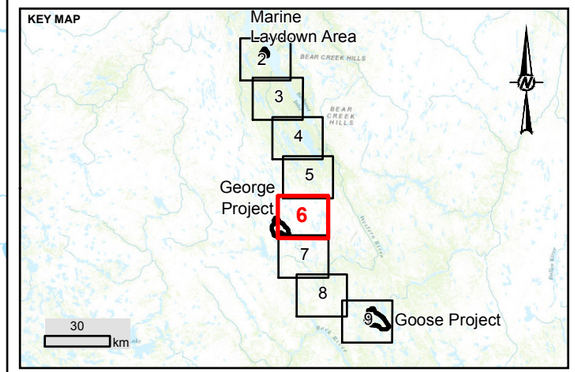
LEGEND

- GEORGE PROPERTY AREA
- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B6	A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0

PATH: \\golder.gds\calm\GIS\Active\CLIENT\SABINA_SILVER\1776921\Mapping\MXD\General\Fig2-9_1776921_Winter_Road_Mapbook_20180119.mxd PRINTED ON: 2018-02-05 AT: 1:14:51 PM

George Project

George Project

984

18-0

LA17_0

16-1

17-0

16-0

15-0

14-1

14-0a

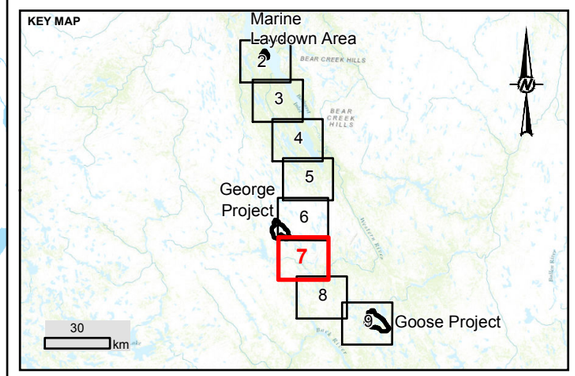
LEGEND

- GEORGE PROPERTY AREA
- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

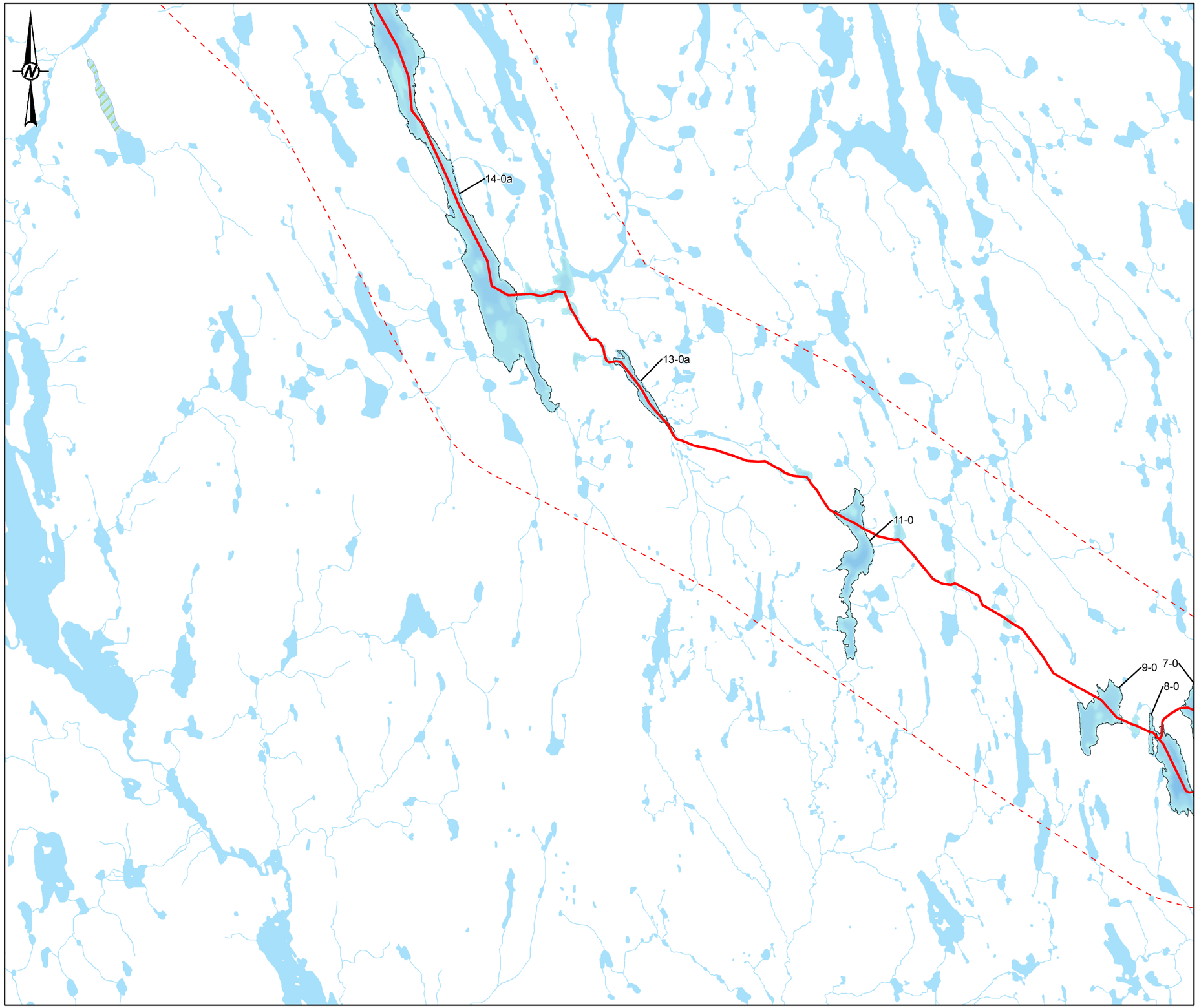
PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B7	A

PATH: \\golder.gds\calmin\GIS\Active\CLIENTS\SABINA_SILVER\1776921\Mapping\MXD\General\Fig2-9_1776921_Winter_Road_Mapbook_20180119.mxd PRINTED ON: 2018-02-05 AT: 1:15:05 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

0



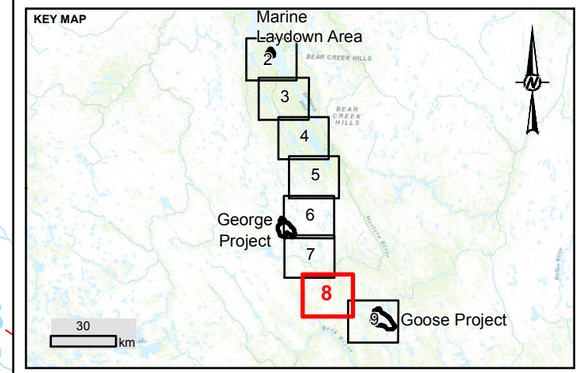
LEGEND

- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B8	A

9-0
8-0
7-0
6-0
4-0
3-0
2-0
1-0
Goose Project
Goose Lake
Gander Pond
Gosling Pond 2
Gosling Pond 1
Little Rascal Pond
Pond 4
Rascal Lake
Wolf Lake
WLA5
WLA4
RLA2
WLA3
RLA1
WLA1
WLA2
WLD4
WLD3
WLD1
WLD2
WLC5
WLC4
WLC1
WLC3
WLC2
RLB1
RLB3
RLB2
RLB4
RLB5
RLB7
RLB6
WLB1
WLB2

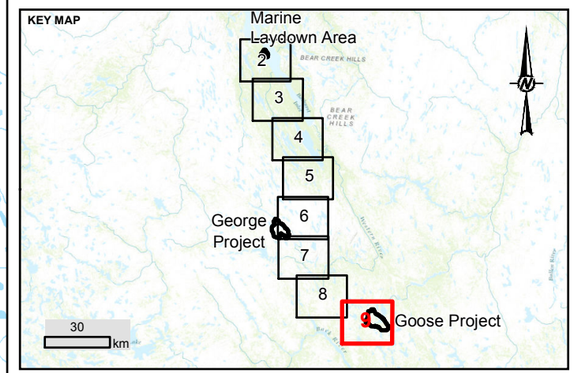
LEGEND

- GOOD PROPERTY AREA
- WINTER ROAD
- WATERCOURSE
- LAKE EXTENT (DEPTH > 3.5M)
- PROJECT BOUNDARY
- WATERBODY
- WETLAND

BATHYMETRY (1 M INTERVAL)

0
-13
-26
-39
-52
-65

KEY MAP



0 1.5 3
1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

BATHYMETRY DATA PROVIDED BY AEROQUEST. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY.

PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2018-02-05
DESIGNED	BDW
PREPARED	JG/RC
REVIEWED	
APPROVED	

CLIENT
SABINA GOLD & SILVER CORP.

CONSULTANT
Golder Associates

PROJECT
BACK RIVER PROJECT

TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B9	A

PATH: \\golder.gds\calim\GIS\Active\CLIENTS\SABINA_SILVER\1776921\Mapping\MXD\General\Fig2-9_1776921_Winter_Road_Maybook_20180119.mxd PRINTED ON: 2018-02-06 AT: 1:15:34 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm