BACK RIVER PROJECT
2019 Winter Ice Road Technical Memorandum

December 2018

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) 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 2019 Winter Ice Road Technical Memo outlines the approach for construction, operations, and closure of the WIR for the 2019 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-18D003). The information presented herein is current as of December 2018.

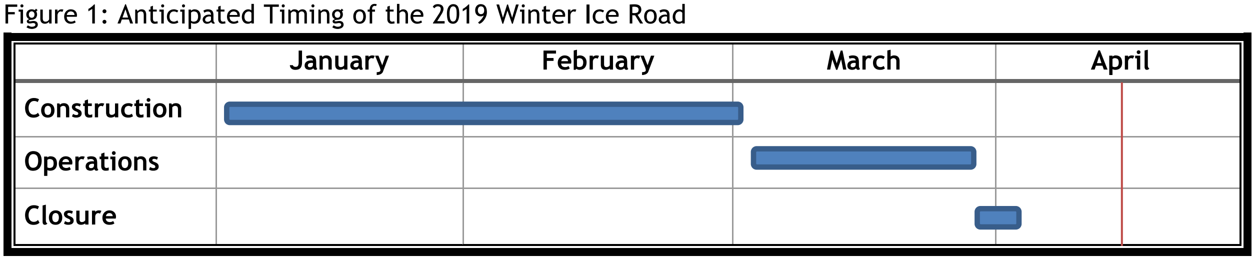
2. WINTER ICE ROAD ALIGNMENT

The approximate routing of the 2019 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 2019 Winter Ice Road construction is expected to take 45 to 60 days, beginning in early January and completing in late February or early March 2019. 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. Some material may also be backhauled to the MLA for shipments south (i.e. hazardous waste). Hauling on the 2019 WIR is expected to take 15 to 20 days and is estimated to be completed by late March. Sabina anticipates approximately 90 loads to be transported from the MLA to the Goose Site. Once hauling is complete, Sabina will commence closure of this seasonal route which will take only a few days. Sabina intends to close the 2019 WIR by early April and does not intend to exceed the April 15 cut-off in recognition of the commitment made in Sabina's Back River Project Wildlife Mitigation and Management Plan and in our KIA Commercial Lease. Should any delays in construction or operations result in Sabina extending past the April 15 cut-off date, Sabina will provide written notice to the Kitikmeot Inuit Association and the Government of Nunavut.

Figure 1: Anticipated Timing of the 2019 Winter Ice Road



To support the above schedule, the MLA camp will be opened in mid-December 2018 or early January 2019 to support the mobilization and start up of WIR equipment in advance of the construction season.

The Goose camp will be opened as needed to support the 2019 WIR activities; timing will depend on construction progression and other Project requirements for this camp.

Due to a failed sealift in late 2018 Sabina anticipates that an airlift program will be required to support the start up of the 2019 WIR construction efforts. To that end, Sabina requires an ice airstrip at the MLA to support the 2019 WIR season; this effort could begin as early as late December 2018.

4. WINTER ICE ROAD CONSTRUCTION

Sabina intends to start the 2019 WIR construction from the MLA and progress as a single work front towards Goose Site. Sabina has assessed ice conditions at the MLA in late November 2018 and Bathurst Inlet ice conditions are favourable to support the airlift program required to start up of the 2019 WIR construction efforts.

The WIR is anticipated to commence construction in early January 2019 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, ice and snow conditions at the time.

Sabina will adhere to 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), which will guide the construction and maintenance requirements of the WIR. These guidelines are outlined in the Road Management Plan (Appendix B).

Accommodations to support the 2019 WIR construction will utilize a combination of the MLA, a mobile Forward Camp, and the Goose Site. The 2019 WIR efforts will be supported by a mobile Forward Camp on sleighs that will progressively advance with the construction front to increase efficiencies and provide safety support along the 160-km WIR alignment. This Forward Camp will spend approximately 1 week at each location as the WIR construction front advances. Sabina anticipates placing this Forward Camp on Inuit Owned Land under the KIA Commercial Lease. This Forward Camp will house approximately 12 people at any one time and will utilize fresh water under the Type A Water License. Waste management practices at the Forward Camp will adhere to Sabina's Waste Management Plan. The Forward Camp will utilize a Pacto waste systems for human waste which will be removed and incinerated at either the MLA or Goose Site. Similarly, all combustible, non-hazardous waste will be backhauled to either the MLA or Goose Site for incineration. All other waste materials, including hazardous waste, waste oil and non-combustible waste, will be backhauled to the MLA or Goose Site for storage prior to being shipped off site to an approved waste management facility for disposal. Greywater from the kitchen and shower facilities will be disposed of in accordance with the Conditions for the Use of Waters and/or the Deposit of Waste Without A Licence (NWB 2017). Greywater disposal will be located in a sump or natural depression a minimum distance of thirty-one (31) metres from the ordinary high-water mark of any waterbody. Sabina will provide GPS co-ordinates of all locations where greywater waste associated with the Forward Camp are deposited in the NWB and KIA Annual Reports.

5. WINTER ICE ROAD OPERATIONS

Hauling operations on the 2019 WIR is expected to take 15-20 days in March 2019. Sabina anticipates up to 90 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.

Sabina currently does not intend to haul fuel along the WIR in 2019 except to support construction and maintenance activities; however, if this effort is required, Sabina will utilize the onsite fuel truck or fuel cubes. Any vessel used would be certified for this purpose and have an estimated capacity of 20,000 L per load.

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 materials 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 2019 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 2019 Winter Ice Road, specifically:

- Appendix A: Winter Ice Road Route Overview 2019
- Appendix B: Winter Ice Road Water Withdrawal Evaluation – Back River Project (Golder 2017)
- Appendix C: Road Management Plan (October 2017);

9. REFERENCES

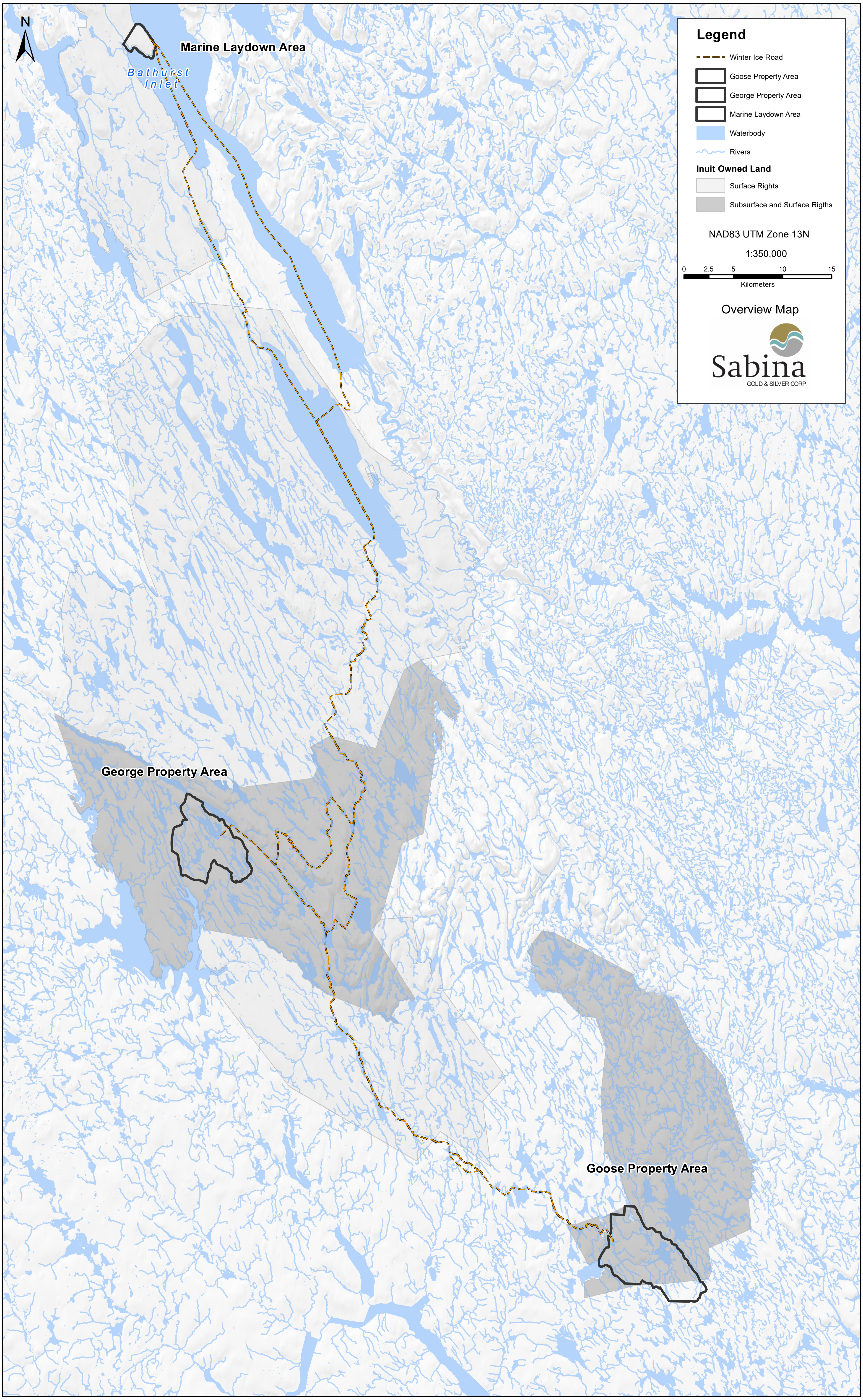
GNWT DoT. 2015. Guidelines for Safe Ice Construction. February 2015.

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 2019


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

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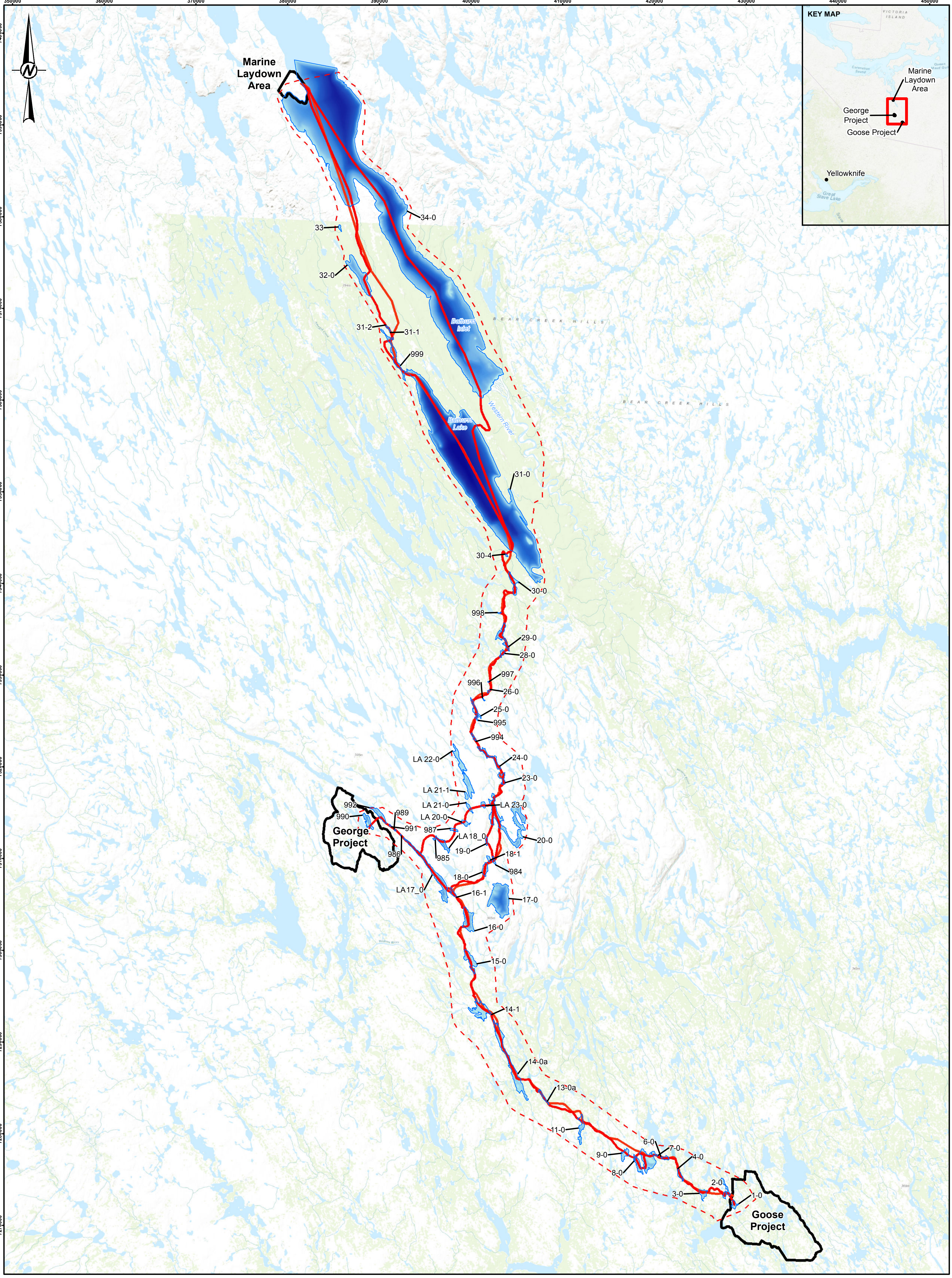

LEGEND

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
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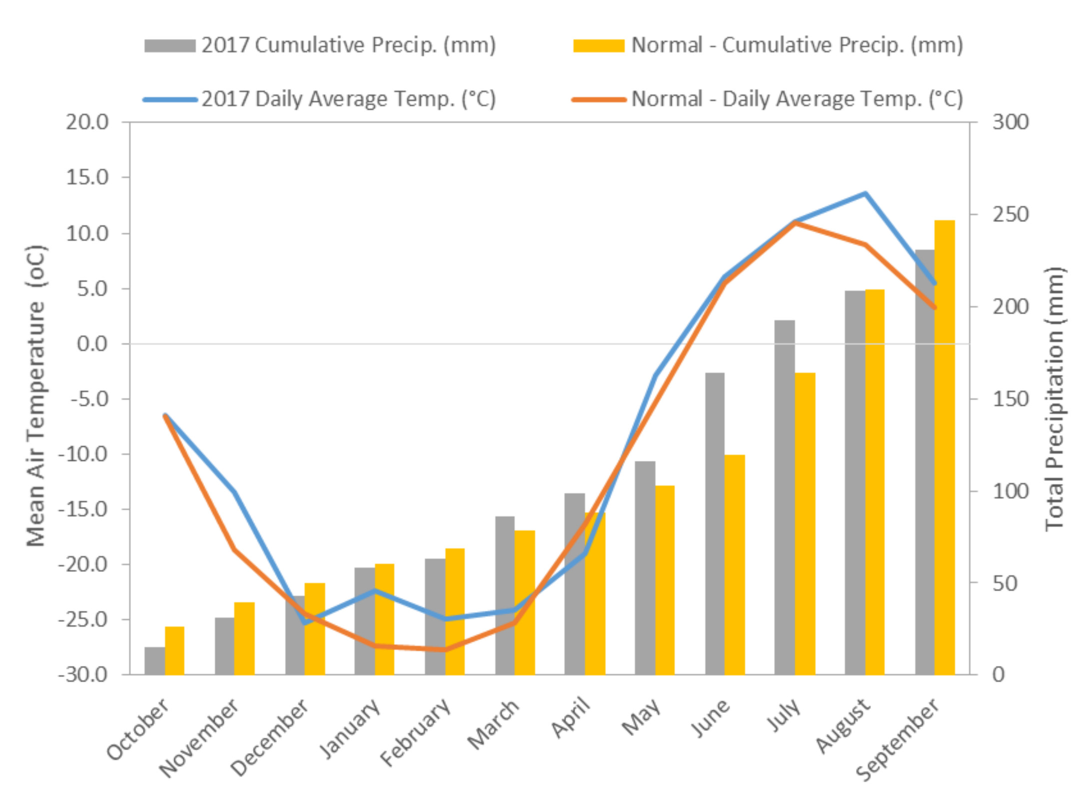

Figure 2: A Comparison of Monthly Total Precipitation and Mean Air Temperature for 2017 versus 'Normals' (1981-2010)

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

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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

LIST OF TABLES

Table 1: Lake 1-0 (Llama Lake)

Lake Volume and Surface Area Per Depth		
Elevation (m)	Cumulative Volume (m³)	Cumulative Area (m²)
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 (m³)	Cumulative Area (m²)
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 (m³)**	**Cumulative Area (m²)**
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 (m³)**	**Cumulative Area (m²)**
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

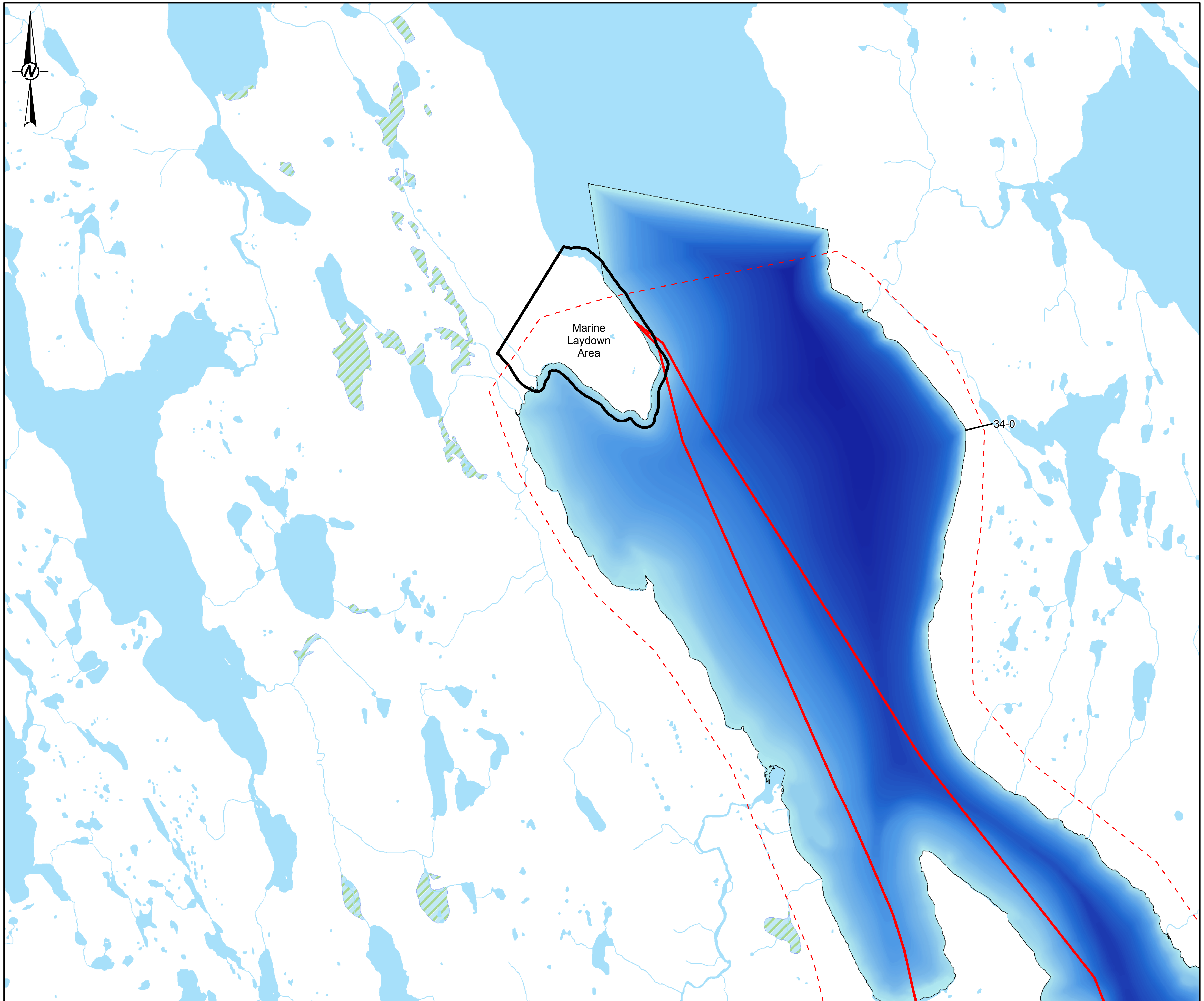
Table 55: Lake 34-0 (Lower Bathurst Inlet) (continued)

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



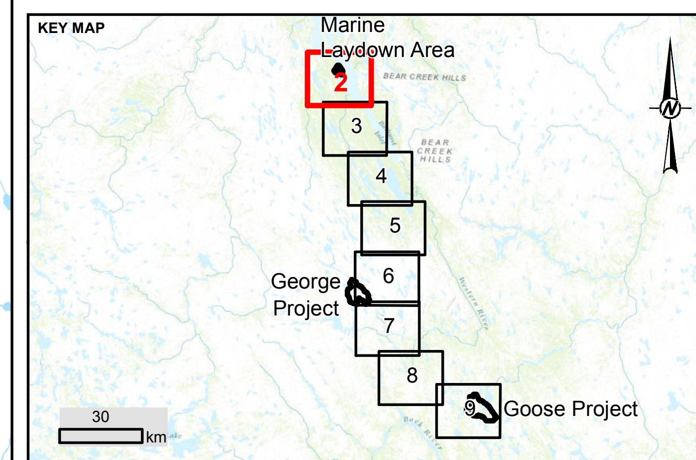
LEGEND

- 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)

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PROJECTION: UTM ZONE 13N DATUM: NAD 83

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

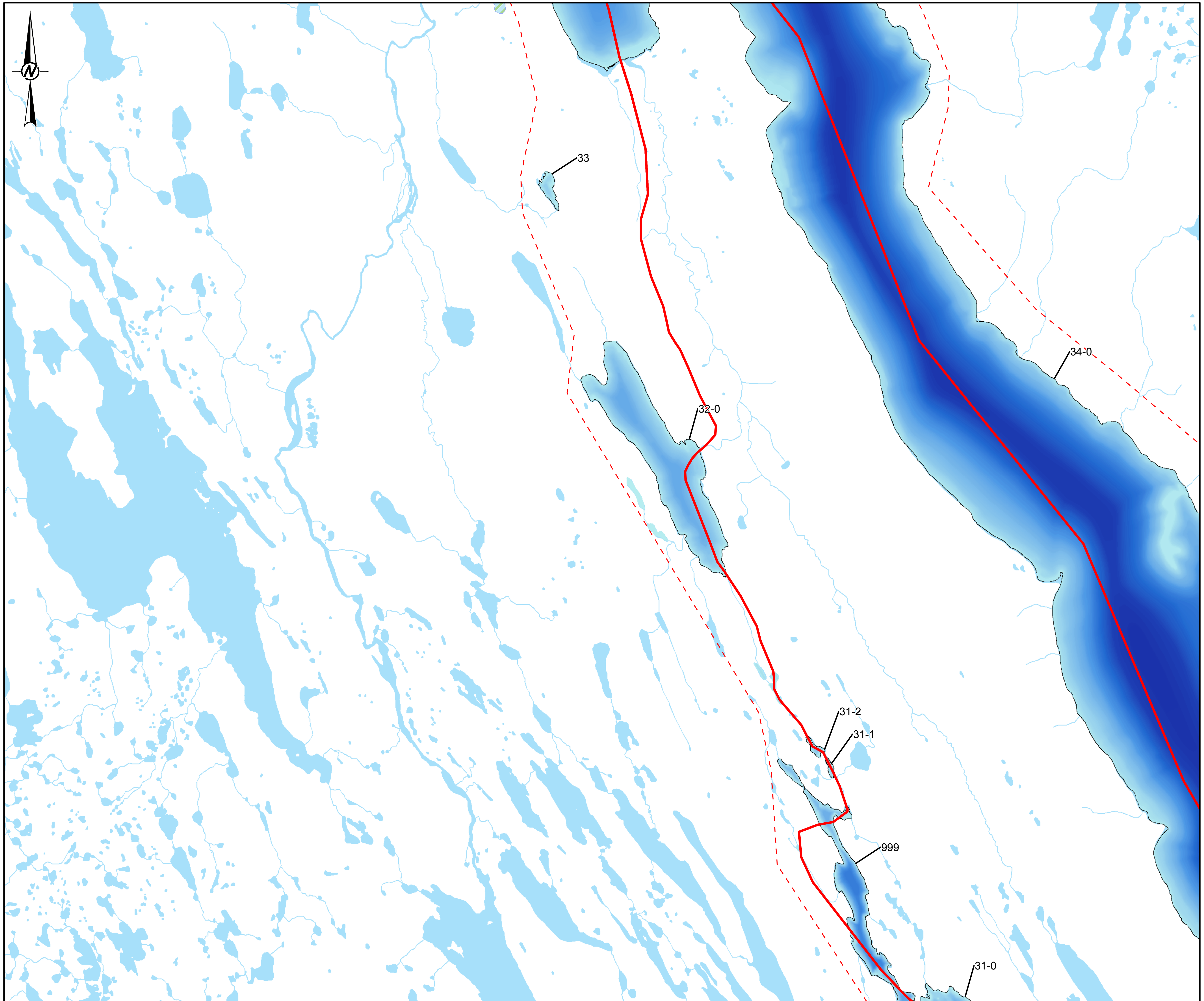
CLIENT
SABINA GOLD & SILVER CORP.

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



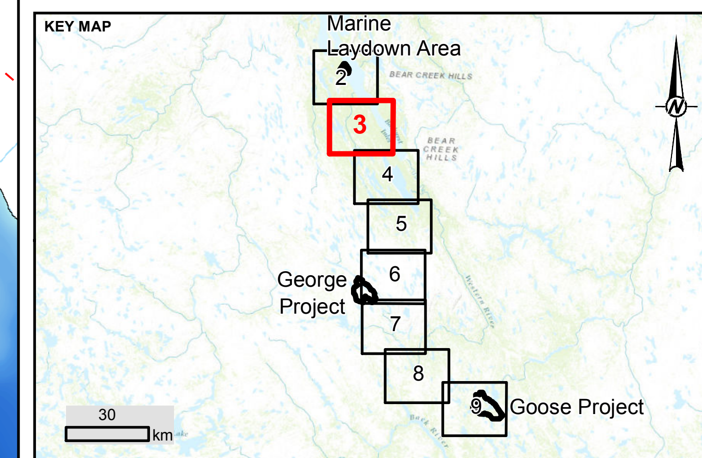
LEGEND

- 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)

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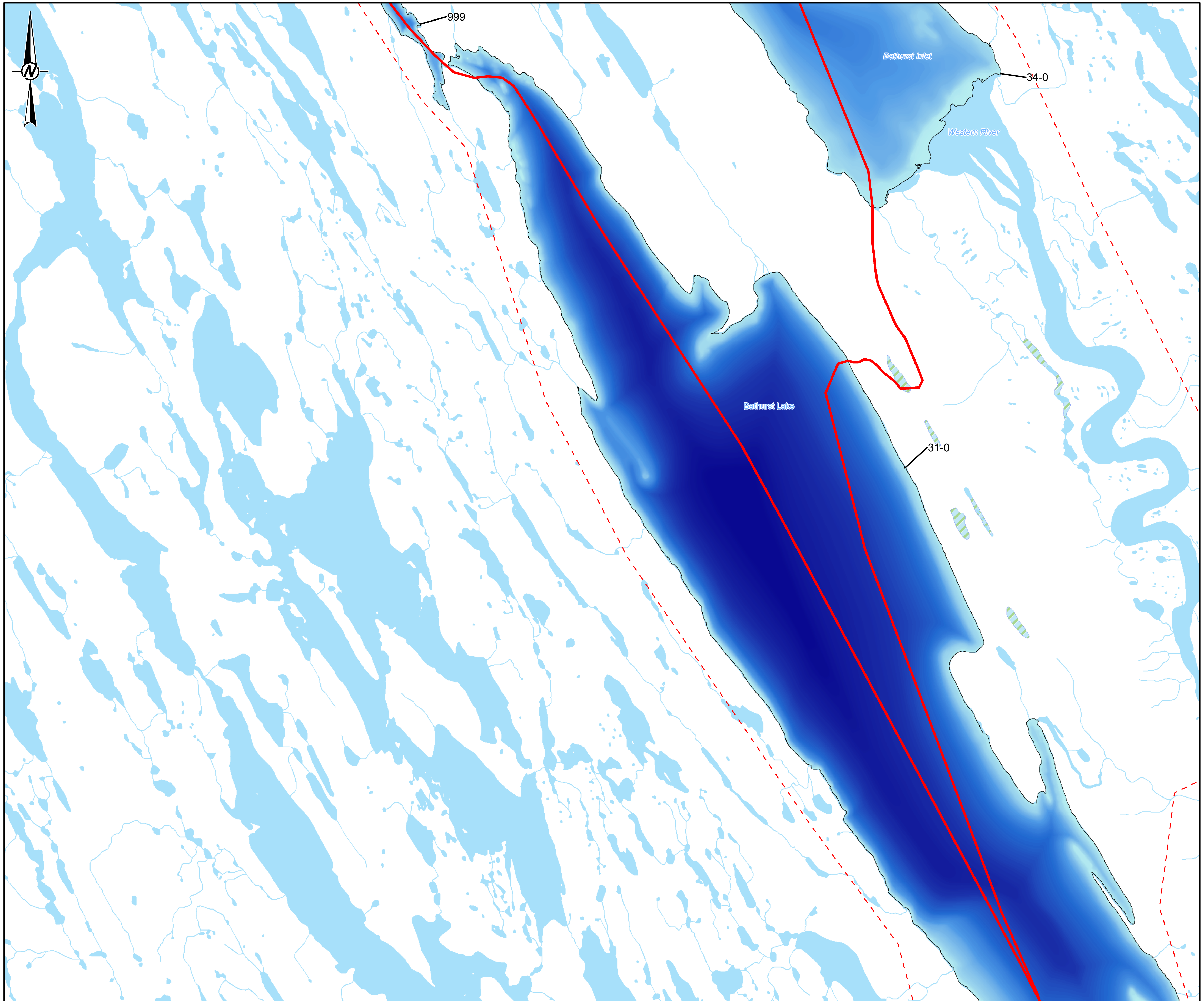
TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

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



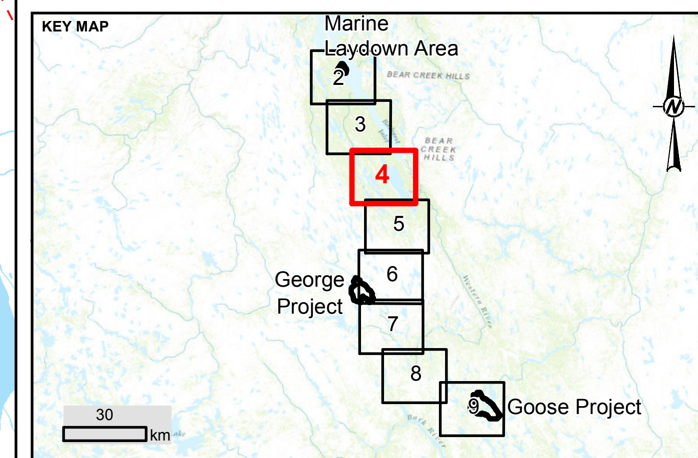
LEGEND

- 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)

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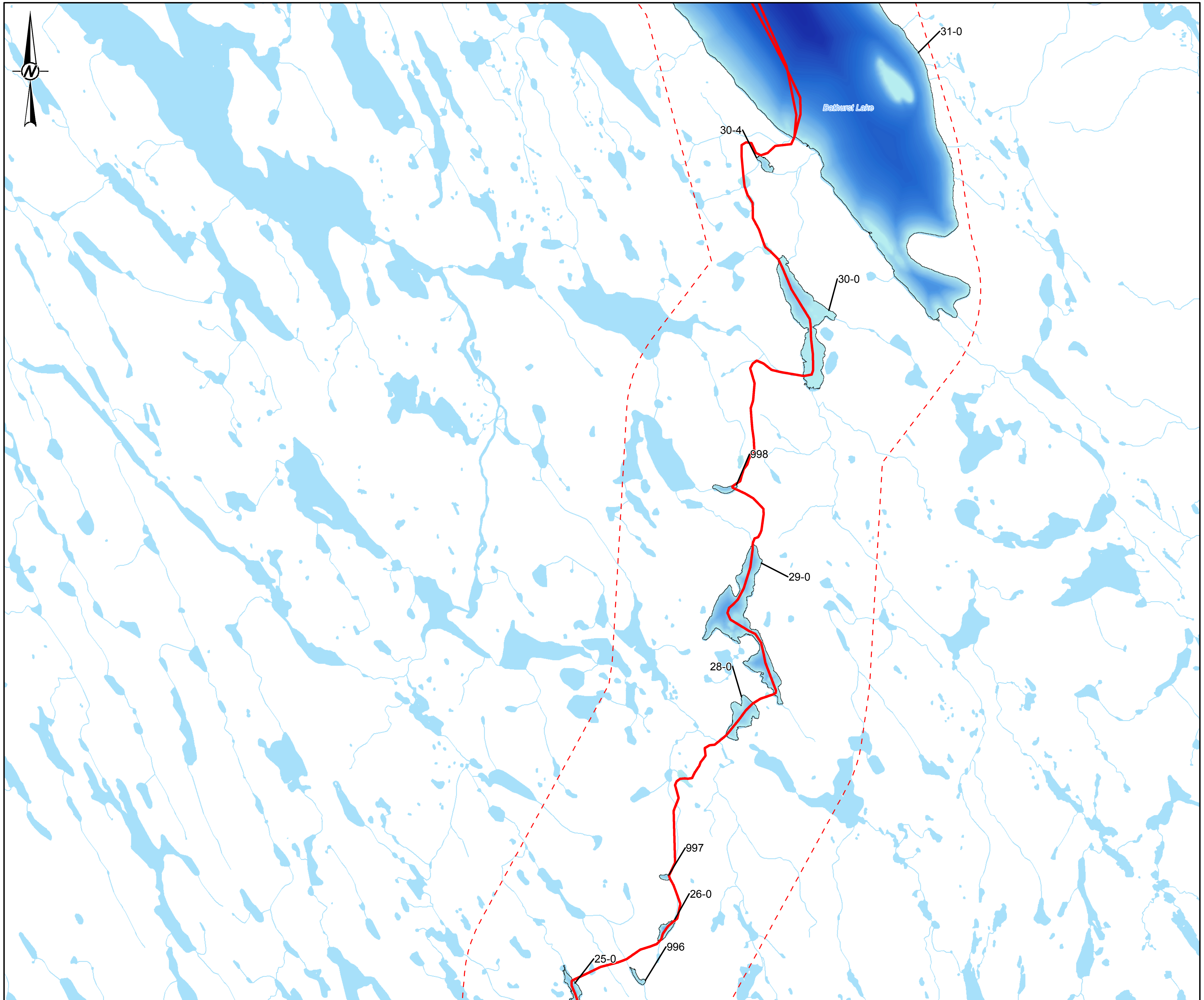
TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

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

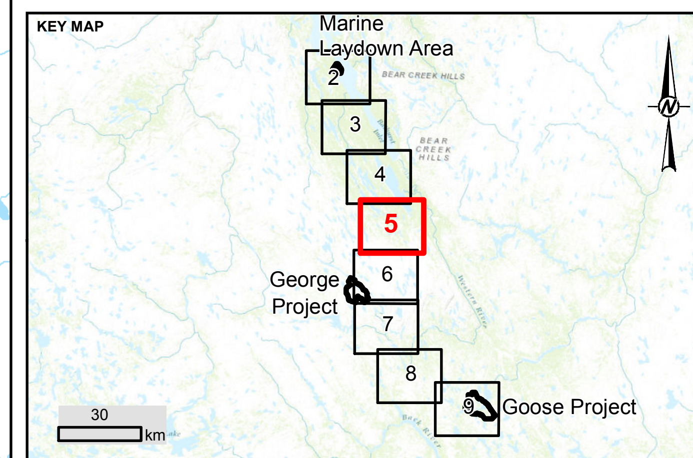


LEGEND

- 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)

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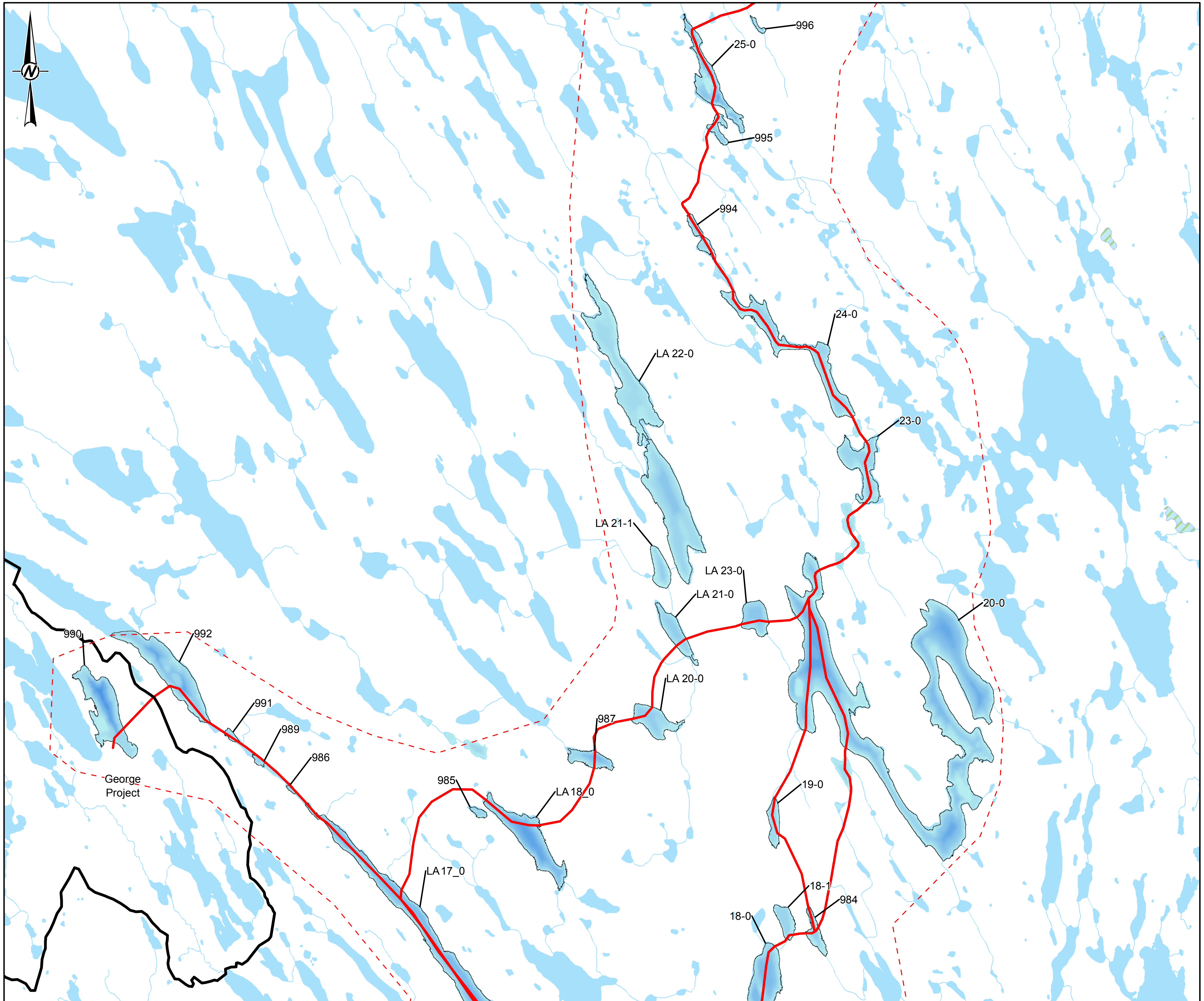
TITLE
WATER SOURCES FOR WINTER ICE ROAD CONSTRUCTION FOR THE BACK RIVER PROJECT

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



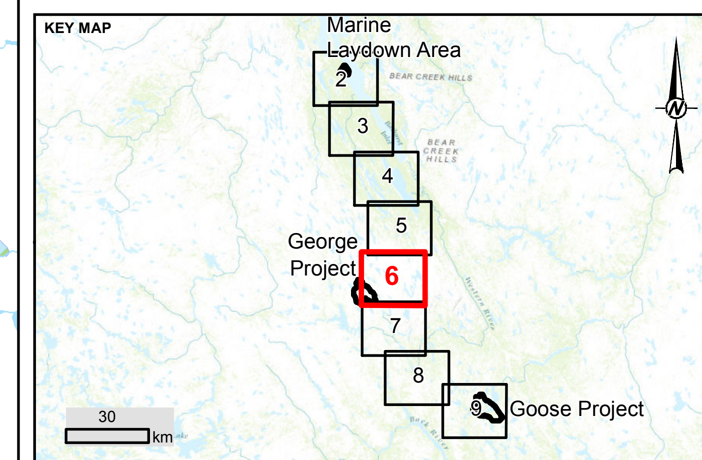
LEGEND

- 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)

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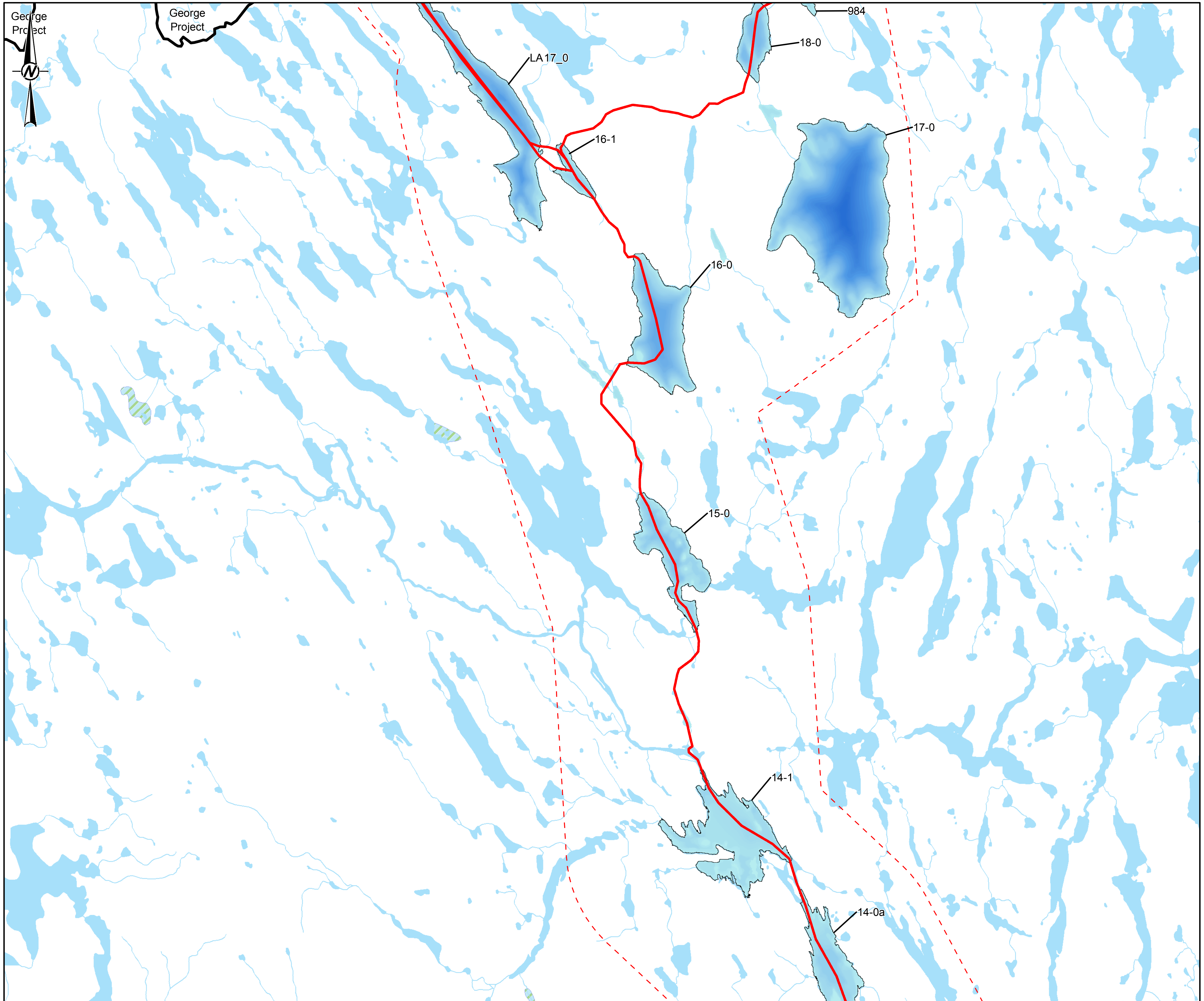
TITLE

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

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

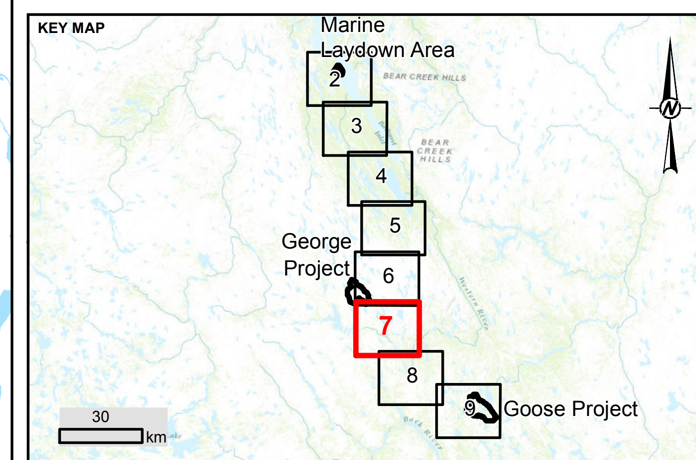


LEGEND

- 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



0 1.5 3

1:75,000 KILOMETRES

NOTE(S)

1. TSF WRSA POND BREACHED TO GOOSE MAIN TF.

REFERENCE(S)

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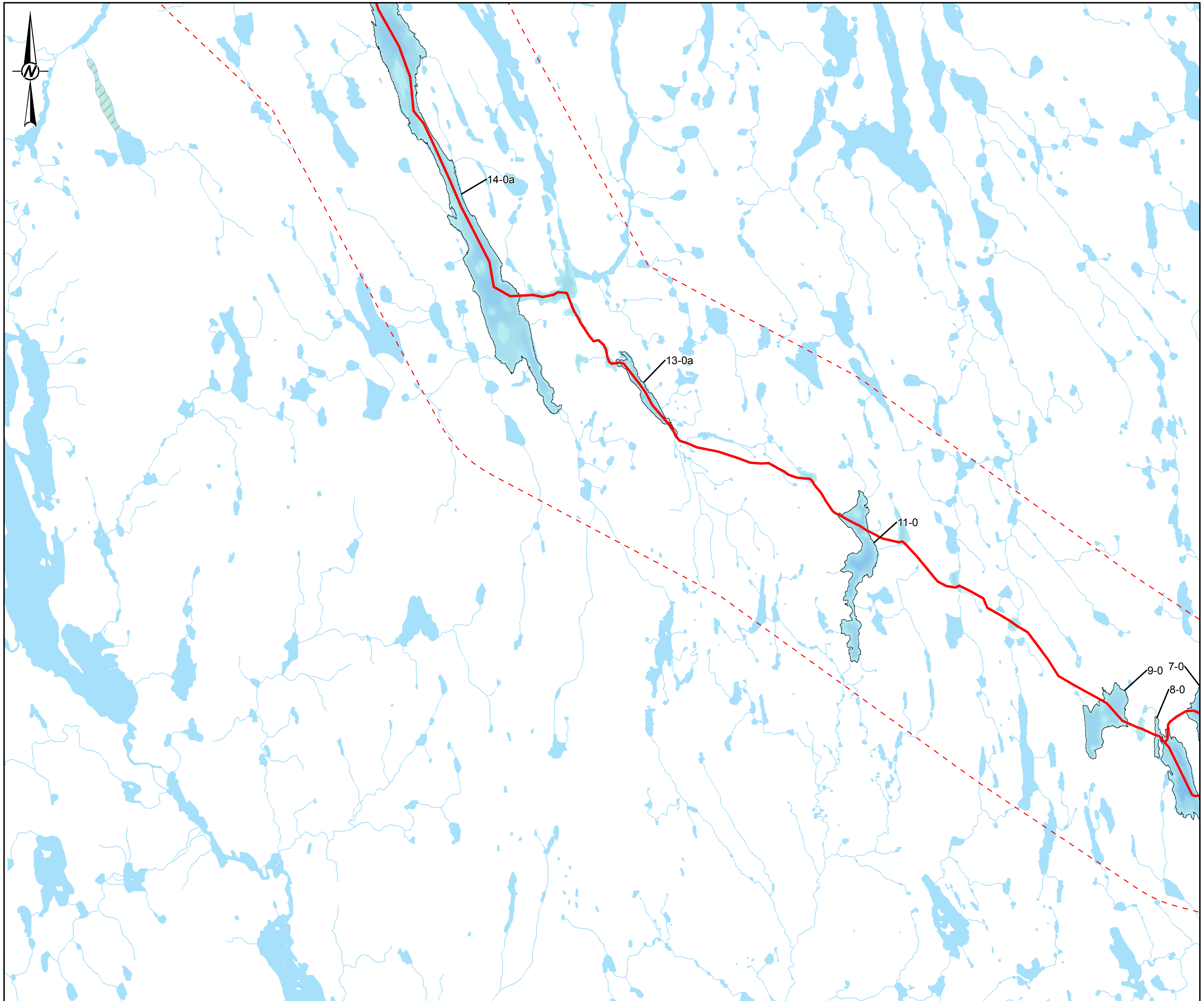
PROJECT NO.	FIGURE	REV.
1776921/1300/1320	B7	A

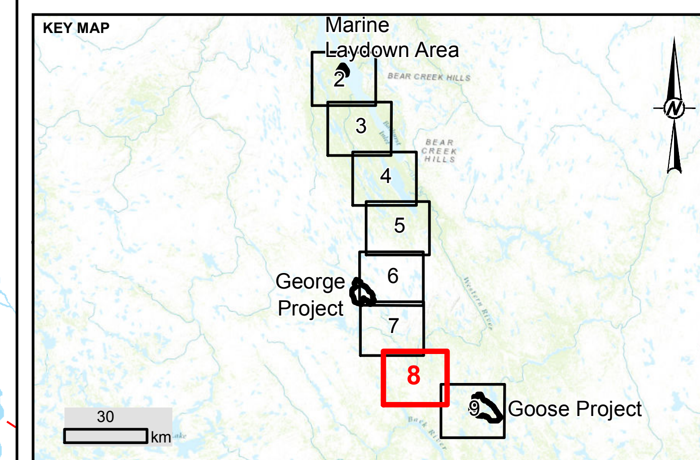


LEGEND

- 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)

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PROJECTION: UTM ZONE 13N DATUM: NAD 83

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

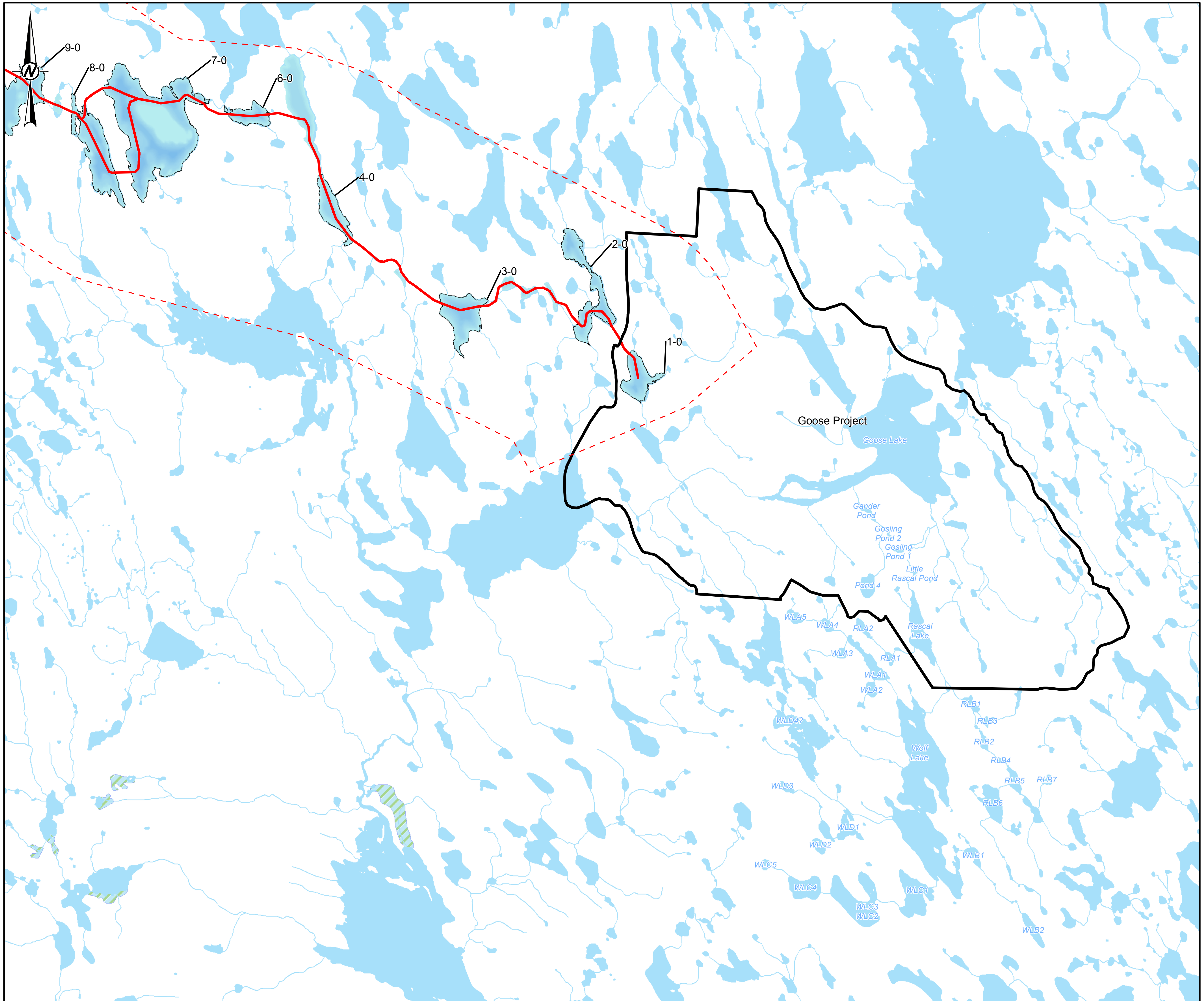
CLIENT
SABINA GOLD & SILVER CORP.

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

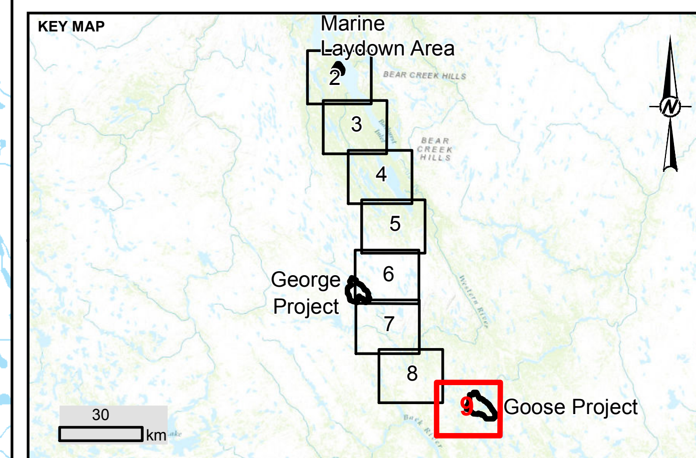


LEGEND

- 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)
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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

Appendix C

Road Management Plan

BACK RIVER PROJECT
Road Management Plan

October 2017

BACK RIVER PROJECT
ROAD MANAGEMENT PLAN

Table of Contents

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Revision Log

Version	Date	Section	Page	Revision
1	October 2017	All	All	Supporting Document for Type A Water Licence Application, submitted to Nunavut Water Board for review and approval

Acronyms

DFO	Fisheries and Oceans Canada
FEIS	Final Environmental Impact Statement
GNWT	Government of Northwest Territories
GPR	Ground Penetrating Radar
INAC	Indigenous and Northern Affairs Canada
KIA	Kitikmeot Inuit Association
MAD	Main Application Document
MLA	Marine Laydown Area
NWB	Nunavut Water Board
Project	Back River Project
RMP or Plan	Road Management Plan
Sabina	Sabina Gold & Silver Corp.
WIR	Winter Ice Road

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. It is situated approximately 400 kilometres (km) southwest of Cambridge Bay, 95 km southeast of the southern end of Bathurst Inlet (Kingaok), and 520 km northeast of Yellowknife, Northwest Territories. The Project is located predominantly within the Queen Maud Gulf Watershed (Nunavut Water Regulations, Schedule 4).

The Project is comprised of two main areas with interconnecting winter ice roads (WIR) (Main Application Document [MAD] Appendix A, base Figure 2): Goose Property (MAD Appendix A, base Figure 3) and the Marine Laydown Area (MLA) (MAD Appendix A, base Figure 4) situated along the western shore of southern Bathurst Inlet. The majority of annual resupply will be completed using the MLA, and an approximately 160 km long WIR will interconnect these sites. Refer to the MAD Appendix A, base Figures 1 to 5 for general site layout and locations. A detailed Project description is provided in the MAD.

The Road Management Plan (RMP or Plan) outlines the approach for construction, operations, and reclamation of transportation infrastructure, such as all-weather roads, WIRs, and airstrips. This plan includes provisions for the MLA in southern Bathurst Inlet and the Goose Property. The RMP and other management plans are intended to support the Type A Water Licence Application for the Project.

The Plan was prepared following the requirements of the Supplementary Information Guidelines (SIG) for Mining and Milling MM3 and Water Works M1, issued by Nunavut Water Board (NWB 2010 a, b), the Environmental Impact Statement Guidelines issued by the Nunavut Impact Review Board to Sabina (NIRB 2013), and in conformance with current Federal and Territorial statutory requirements.

This is a living document to be updated upon changes in related regulatory requirements, management reviews, changes to facility operation or maintenance, and environmental monitoring results, best practice updates or other Project specific protocols once Construction starts through to Project closure activities. Any updates will be filed with the Annual Report submitted under the Type A Water Licence.

The information presented herein is current as of September 2017. At this stage, certain aspects of the Plan remain conceptual. The next update will likely be based on detailed engineering design prior to the start of Construction. The RMP will be reviewed as needed for changes in operation and technology and as directed by the Nunavut Water Board (NWB) in the Type A Water Licence or other regulatory authorization where appropriate. Completion of the updated Plan will be documented through signatures of the personnel responsible for reviewing, updating, and approving the Plan.

A record will document all significant changes that have been incorporated in the Road Management Plan subsequent to the latest review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Sabina will maintain a distribution list providing contact details for all parties to receive the Plan including key personnel, contractors, organizations, and external agencies.

2. Scope and Objectives

The Plan is one of the documents that forms part of Sabina's overall Infrastructure and Access Management Program for the Project. This plan has been written to meet requirements of a Type A Water Licence and applies to all Sabina projects in the Kitikmeot region.

This plan is divided into the following components:

- Applicable Legislation and Guidelines (Section 3);
- Planning and Implementation (Section 4);
- Roles and Responsibilities (Section 5);
- Traffic Management and Road Safety (Section 6);
- Inspection, Maintenance, and Monitoring of Roads (Section 7);
- Wildlife Protection Measures (Section 8);
- Adaptive Management (Section 9); and
- Reclamation (Section 10).

The Plan outlines construction, operation, and management of access and terrestrial transportation for the Project including construction, operations, and closure of an all-weather airstrip, connecting WIRs, and associated borrow pit/quarries.

Winter ice roads, and all-weather haul and service roads are needed during operation of the Project. All Project roads will be private for the exclusive use of Sabina's operations. The road network required for the Project is presented in base Figures 1 to 3 (Appendix A of the MAD) and in Figure 4.1-1.

The measures identified in this plan are intended to protect the targeted valued ecosystem components and valued socio-economic components including, water quality, fish habitat, terrestrial wildlife, health and safety of employees, and cultural resources and heritage.

This plan provides construction and operating maintenance methods and best management practices that will be used for the Project. The purpose of this plan is to ensure sound management of water and waste deposited to minimize the impacts to the local environment during construction, operations, and closure of the transportation corridors.

Implementing best management practices and working responsibly will ensure the protection of the environment and personnel safety. The goal of any management plan is to reduce and prevent impacts to the environment while ensuring personnel safety and appropriate fiscal considerations during mineral exploration activities.

2.1 RELATED PLANS AND STUDIES

Documents within the Application for the Type A Water Licence, which support this plan include the following:

- Spill Contingency Plan (Supporting Document [SD]-17);
- Hazardous Materials Management Plan (SD-13);
- Environmental Management and Protection Plan (SD-20);
- Water Management Plan (SD-05);
- Borrow Pits and Quarry Management Plan (SD-03);
- Interim Closure and Reclamation Plan (SD-26);
- Aquatic Effects Management Plan (SD-21);
- Risk Management and Emergency Response Plan (SD-15);
- Air Quality Monitoring and Management Plan (Final Environmental Impact Statement [FEIS] Volume 10, Chapter 17); and
- Wildlife Mitigation and Monitoring Plan (Version 7; submitted with FEIS Addendum February 2017).

In addition, the following documents have also been used to inform the design and management decisions presented in the Road Management Plan:

- Alternatives Assessment (MAD Section 5.1.3);
- Site-Wide Geotechnical Properties Report (MAD Appendix F-2);
- Water and Load Balance Report (MAD Appendix E-2);
- Geochemical Characterization Report (MAD Appendix E-3);
- Geophysical Survey of Waterbodies (FEIS Volume 6, Appendix V6-3E); and
- Climate and Meteorology (FEIS Volume 4, Chapter 3).

3. Applicable Legislation and Guidelines

The RMP has been prepared to comply with existing regulations and follow the available guidelines provided by the federal government and the government of Nunavut. The applicable regulations are provided in Appendix A.

Water use and waste disposal in Nunavut is regulated by the NWB through the water licensing process.

In addition, the following guidance documents have also been used to inform the design and management decisions presented in the Plan:

- Northern Land Use Guidelines Access: Roads and Trails (INAC 2010);
- Aerodrome Standards and Recommended Practices (Transport Canada 2005);
- Geometric Guidelines (Roads and Transportation 1986);
- Protocol for Winter Water Withdrawal from Ice-Covered Waterbodies in the Northwest Territories and Nunavut (DFO 2010);
- Environmental Guidelines for the Construction, Maintenance and Closure of Winter Roads in the Northwest Territories (GNWT DoT 1993); and
- Guidelines for Safe Ice Construction (GNWT DoT 2015).

3.1 LAND TENURE

The majority of all-weather roads and the WIR will be located on Inuit Owned Lands administered by the Kitikmeot Inuit Association (KIA). The surface ownership of the land encompassing the roads rights-of-way was transferred to the KIA when the Nunavut Land Claims Agreement came into effect. Land and environmental management in this area are governed by the provisions of the Nunavut Land Claims Agreement.

Smaller portions of the all-weather road (i.e., access to the Tailings Storage Facility) and small portions of the WIR will be on crown land, administered by the Department of Indigenous and Northern Affairs Canada (INAC).

Refer to base Figures 1 to 3 (Appendix A of the MAD) for clarification of land tenure status.

3.2 PERMITTING REGIME

Table 3.2-1 outlines the current licenses and permits held by Sabina in relation to the Exploration Phase of the Project.

A list of anticipated approvals and authorizations required for construction of all-weather haul and service roads, as well as the WIR are shown in Table 3.2-2.

Table 3.2-1. Current Authorizations and Permits (as of July 2017)

Permit	Expiry (year-mo-day)	Agency	Description
KTL204C012	2017-12-12	KIA	Boulder: Staking/prospecting, exploration (ground/air geophysics), geophysical survey, gridding and drilling.
KTL204C020	2017-12-12	KIA	Boot: Exploration (air/ground geophysics), staking, prospecting, fly/survival camp and drilling.
KTL304C017	2017-12-12	KIA	Goose: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road, all-weather airstrip and connecting road.
KTL304C018	2017-12-12	KIA	George: Staking/prospecting, exploration (ground/air geophysics), drilling, bulk sampling, bulk fuel storage, camp, winter road, all-weather airstrip.
KTL312C004	2017-12-12	KIA	Wishbone/Malley: Exploration (air/ground geophysics), staking, prospecting, fly/survival camp and drilling
KTL304F049	2017-12-12	KIA	Winter road connecting Bathurst Inlet - Goose and George.
KTP11Q001	2017-12-12	KIA	Goose rock quarry.
KTP12Q001	2017-12-12	KIA	Goose Airstrip borrow area.
KTP12Q002	2017-12-12	KIA	George borrow quarry.
N2011F0029	2018-12-13	INAC	Winter Road connecting George-Goose.
N2017F0016	2022-07-20	INAC	Winter Road connecting Bathurst Inlet - Back River Project.
N2012C0003	2019-02-06	INAC	Wishbone-Malley Mineral Exploration activities on Crown Land
N2016C0011	2021-10-26	INAC	Back River Exploration activities.
2BE-GOO1520	2020-02-18	NWB	Goose water licence.
2BE-GEO1520	2020-05-29	NWB	George water licence.
2BE-MLL1217	2022-06-29	NWB	Wishbone-Malley water licence.

Table 3.2-2. Approvals and Authorizations for All Roads

Authorization	Authority	Basis
Article 12, Part 5 Environmental Assessment	NIRB	allows Project to proceed to authorizations to build and operate roads
Type A Water Licence	NWB	allows for construction of the proposed mine and related roads
Navigation Protection Act evaluation	Transport Canada	Sabina will request a navigability determination and minor works variance from Transport Canada
Inuit Impact and Benefits Agreement	KIA	impacts are compensated and benefits provided to Inuit
Water Compensation Agreement	KIA	compensation for Inuit Water Rights under Nunavut Agreement Section 20
Quarry Permit	KIA	various quarry and borrow pit sites on Inuit Owned Land along the right-of-way for building roads and infrastructure pads.
Explosive Magazine Permit Renewal	Workers' Safety and Compensation Commission	permits an explosive magazine on-site and at other approved locations
Class 2 Permit for Heritage Sites (obtained by qualified professional archaeologist)	Department of Culture, Language, Elders and Youth	unavoidable impacts of roads on heritage sites must be mitigated

4. Planning and Implementation

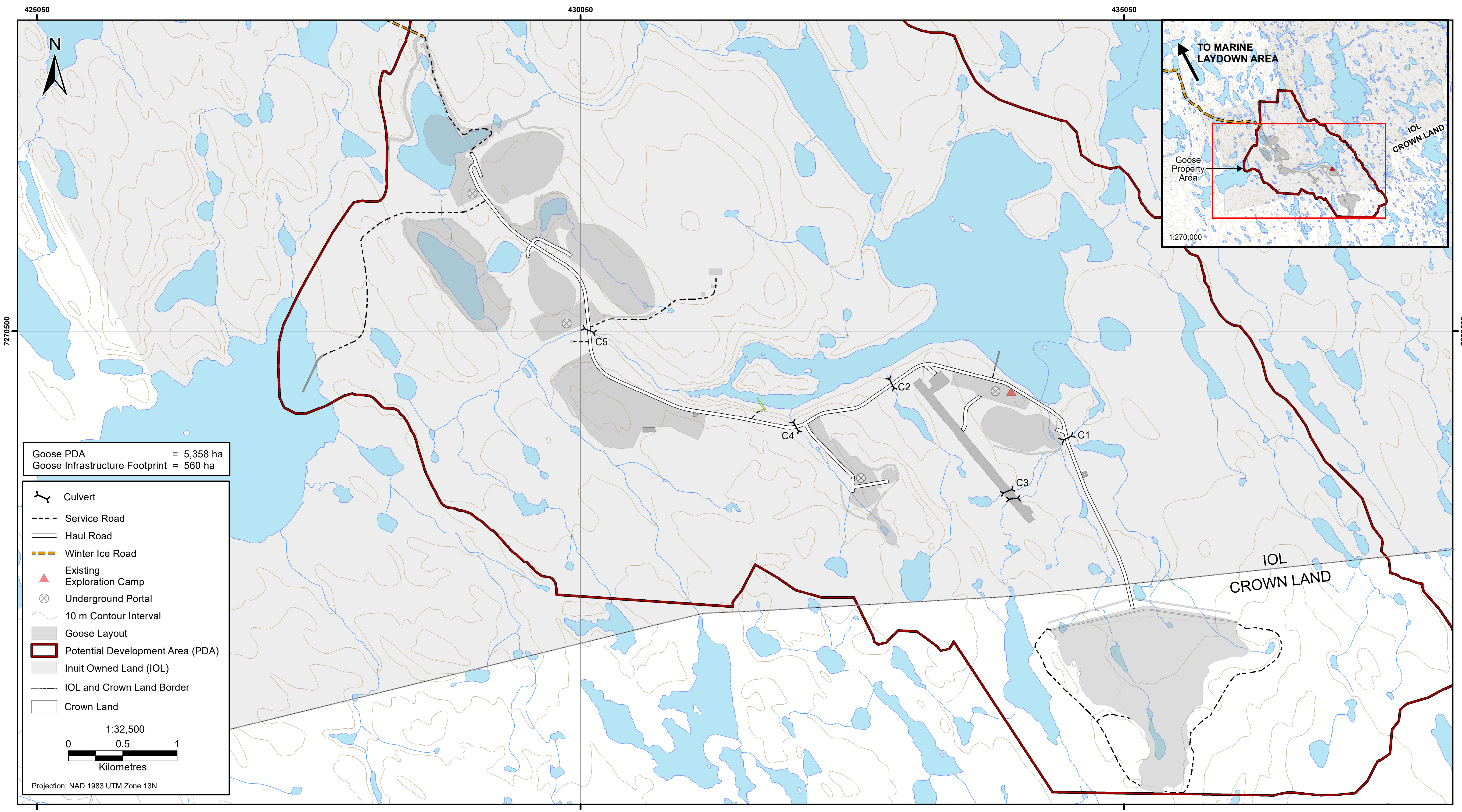
4.1 ALL-WEATHER ROADS

The MLA and Goose Property will require all-weather roads to operate year-round. All-weather roads consist of haul roads and service roads. Goose Property will have 4 km of service roads and 9 km of haul roads (Figure 4.1-1). The MLA will have less than 2 km of service roads and no haul roads. These roads will be constructed in a permafrost environment. In non-permafrost areas, it is common for road designs to incorporate both cuts and fills to establish the final grade along the alignment. However, in permafrost areas, disturbing sensitive overburden soils and surface vegetation can result in thaw degradation and the creation of unstable ground. Consequently, the design for the Project calls for limited cuts in overburden soils and focuses mainly on embankment construction. The embankment material will come from rock quarry sources near to the existing road alignment.

The roads will cross a number of ephemeral streams. While the streams will be dry most of the year, there may be considerable flow during freshet. All culverts and bridges will be designed to handle a 1-in-100-year event. Surface gravel will be used on all service roads. Where there is combined haul and service traffic on a road, surfacing gravel will be used.

Due to site constraints, a portion of the haul roads at Goose Property will share the road with service vehicles. Strict traffic controls will be implemented to ensure safe operating conditions.

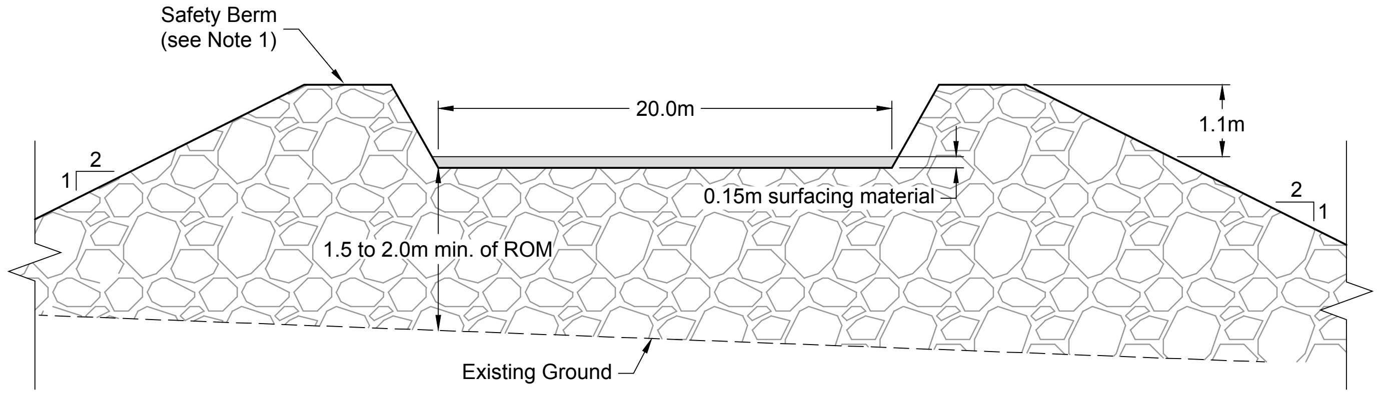
Further studies, reports, and plans relevant to the design of all-weather road infrastructure are presented in Section 2.1. Preliminary typical cross-sections of all-weather roads and watercourse crossings are shown in Figure 4.1-2. Detailed design drawings will be provided at least sixty (60) days prior to construction.



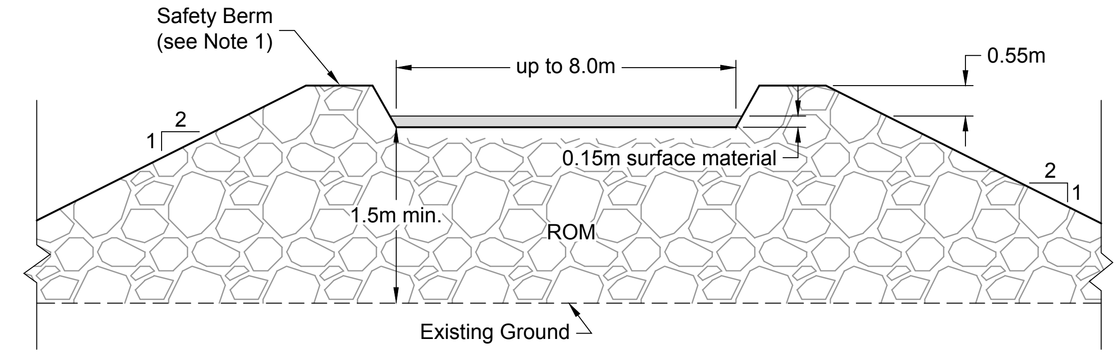
Sabina GOLD & SILVER CORP.

Goose Property Area
Road Infrastructure
Type A Water Licence

Figure 4.1-1



Typical Cross Section of Haul Road



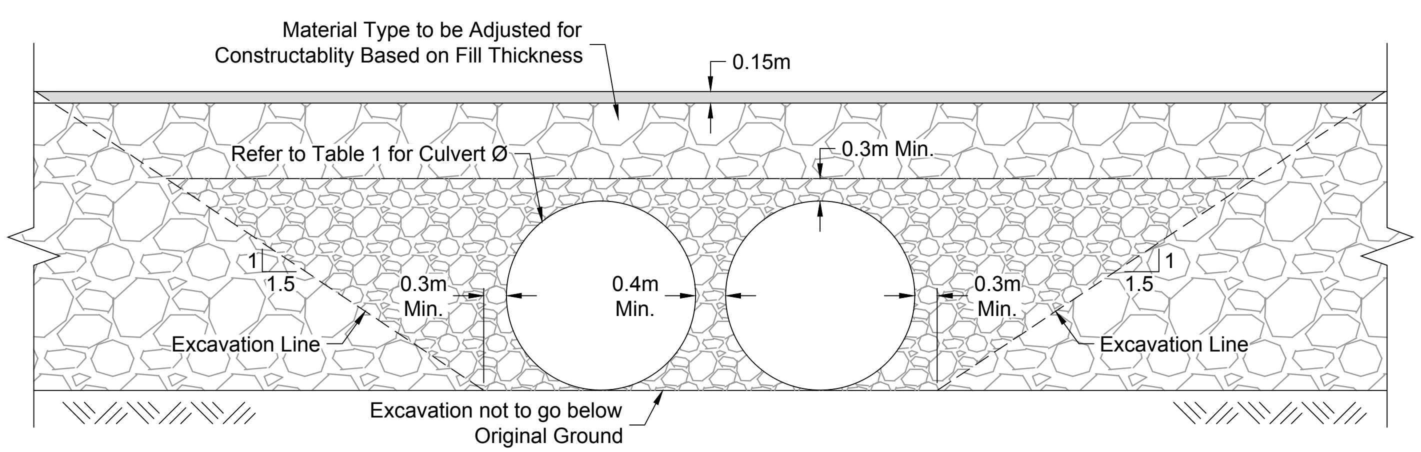
Typical Cross Section of Service Road

LEGEND

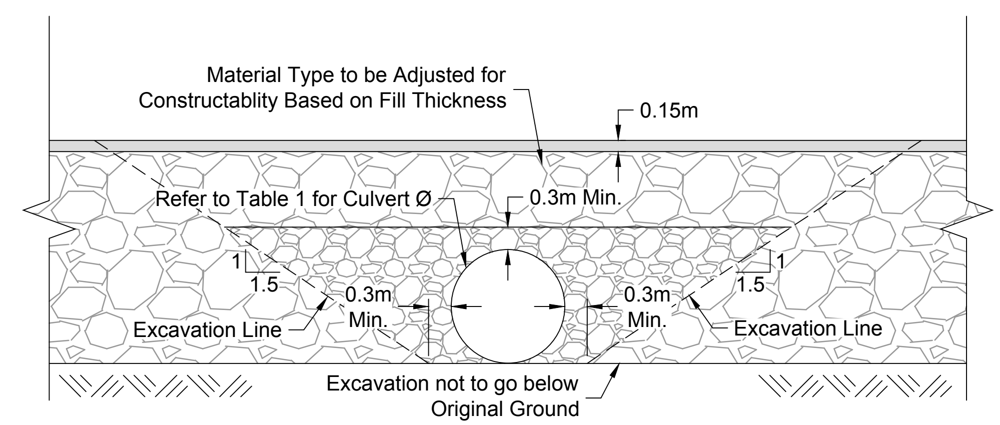
- Existing Ground Surface
- ROM (or ROQ)
- Engineered Fill
- Surfacing Material

NOTES

1. Where more than 3.0m drop-off exists at edge of road, a safety berm will be built at a height at least as high as the mid-axle height of the largest equipment piece that uses that road (NWT/NU Mines Act).
2. Not to scale.



Typical Cross Section of Double Culvert Crossing



Typical Cross Section of Single Culvert Crossing

TABLE 1: CULVERT SIZING AND LOCATION

Culvert Location	CSP Culvert Diameter Ø (m)	Number Required
Goose Culvert (C1)	2.5	2
Gander Pond Culvert (C2)	2.5	2
Goose Airstrip Culvert (C3)	2.5	2
Echo Culvert (C4)	1.2	1
Goose Creek Culvert (C5)	2.5	1

REFERENCE DRAWINGS

DRAWING NO.	DRAWING TITLE
-	-

REVISIONS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
B	ISSUED FOR PERMIT	CP	EMR	17/08/30
A	ISSUED FOR PERMIT	CP	EMR	16/05/31
-	-			

PROFESSIONAL ENGINEERS STAMP

Original Drawings Stamped and Signed by Engineer

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srk consulting

DESIGN: CP	DRAWN: MZS	REVIEWED: EMR
CHECKED: EMR	APPROVED: EMR	DATE: 2017/08/30

FILE NAME: 1CS020.011_RMP_FIGURE_4.1-2.dwg

Sabina GOLD & SILVER CORP

BACK RIVER PROJECT

SRK JOB NO.: 1CS020.01, Task 500

ROAD MANAGEMENT PLAN

All-Weather Road and Watercourse Crossing Typical Cross Sections

REVISION NO. B | SHEET 1 OF 1 | FIGURE NO. 4.1-2

\\VAN-SVR0\Projects\01_SITES\Back River\1CS020.011_Type_A_Water_Licence\040_AutoCAD\2017_Drawings\1CS020.011_RMP_FIGURE_4.1-2.dwg

4.1.1 Design Criteria for Haul Roads

The design criteria have been determined considering the *Mine Health and Safety Act* (Northwest Territories and Nunavut), and the appropriate Transportation Association of Canada Geometric Guidelines. The following design criteria were used for the haul roads:

- Design vehicle: Cat 775G or similar;
- Minimum width of travelling surface: 20 m;
- Design speed: 60 km/h;
- Side slopes: 2H:1V;
- Maximum grade: 10%;
- Safety berms for fills greater than 3 m in height: 1.1 m; and
- Drainage: major culverts and bridges to be designed to a 1-in-100-year return period.

4.1.2 Design Criteria for Service Roads

Service roads are used for smaller vehicles (i.e., light trucks) to access ancillary infrastructure, such as water supply sources, Goose Airstrip, and explosives storage facility. The following design criteria were used for the service roads:

- Design vehicle: light/medium truck;
- Minimum width of travelling surface: 4.5 m for single-lane or 8 m for double-lane;
- Design speed: 50 km/h;
- Side slopes: 2H:1V;
- Maximum grade: 10%;
- Safety berms for fills greater than 3 m in height: 0.55 m; and
- Drainage: major culverts and bridges to be designed to a 1-in-100-year return period.

4.1.3 Construction of All-weather Roads

The site roads at the Goose Property will be constructed as all-weather roads. All-weather roads will be constructed with run-of-mine or run-of-quarry rock placed directly onto the tundra to preserve the permafrost. A layer of graded surfacing material will be placed to provide a protective trafficking layer. Construction materials are assumed to be from locally developed geochemically suitable overburden and rock quarries. Construction of service roads will occur at the MLA in Y-4 and Y-3. Construction of service and haul roads at Goose Property will occur during Y-3 through Y-1. Pre-development work may also include the development of roads at the MLA or Goose Property.

4.1.3.1 Geotechnical Recommendations

The understanding of ground conditions for design and engineering of Goose Plant Site infrastructure, including all-weather roads, has been informed by four geotechnical investigations from 2010 to 2015 including test pits, drill holes, thermistor installations, and a variety of laboratory and in-situ testing. Geotechnical design is also supported by ERM Rescan's 2014 Cumulative Permafrost Baseline Data Report which includes observations on active layer freeze-thaw cycle and active layer depth from 2007 to 2014. Refer to the Site-Wide Geotechnical Properties Report (MAD Appendix F-2) for more detail.

Road preparation recommendations produced by SRK (refer to MAD Appendix F-2) as a result of geotechnical investigations and thermal modelling for the Goose Plant Site for unheated infrastructure such as roads, pipelines, and airstrips where some differential settlement is acceptable, include:

- 1.0 m compacted run-of-quarry rock-fill pad (or geochemically suitable waste rock) on top of undisturbed grade for service roads;
  - maximum rock size limited to 0.9 m.
- 1.5 to 2.0 m thickness for haul roads to minimize deformation
  - maximum rock size limited to 0.9 m.
- Rock shatter required where roads cross over rock highs that impact road grade.
- 150 mm of 2” minus topping directly on top of rock-fill pad for trafficability (no need for intermediate 6” minus layer).

4.1.4 Water Crossings

There are five culvert crossing locations planned for the Project, all of which are situated on the Goose Property (Figure 4.1-1). Roads will be incorporated into water retention and water diversion structures as described in the Water Management Plan (SD-05); however, no water courses will be diverted for the sake of building roads.

Two types of culverts are considered for the site roads and airstrip:

- Non-fish-bearing crossings; and
- fish-bearing crossings.

The non-fish-bearing crossings will consist of corrugated steel pipe and are currently designed with a diameter of either 1.2 m or 2.5 m, depending on the required flow. The fish-bearing crossings will be sized to keep maximum water velocities below 1.5 m/s such that they do not present a velocity barrier to migrating Arctic Grayling. In addition, the culverts will be embedded to a depth of 0.4 m and filled with streambed material to promote fish passage and habitat suitability. Culverts will be designed to minimize Permanent Alteration to, or Destruction of, fish habitat, and conform with Fisheries and Oceans Canada (DFO) Measures to Avoid Causing Harm to Fish and Fish Habitat.

4.1.5 Water Use for All-weather Roads

Up to 400 cubic metres (m^3) per day has been allocated in the Water Management Plan (SD-05) for dust suppression for all-weather roads, the airstrip, and pads at the Goose Property. It is expected dust from all-weather roads will not pose a significant problem during the colder winter and early spring months when snow and ice cover roadways.

At the MLA, water for dust suppression for the local service roads and laydown pads is included in a 24 m^3 per day allowance for Miscellaneous Industrial uses. At the MLA, water will be sourced from Bathurst Inlet desalination.

4.1.6 Measures to Prevent Permafrost Degradation

Roads have been designed, and will be constructed, to reduce the potential for permafrost degradation. Thermal modelling confirms that a run-of-quarry (or geochemically suitable waste rock) haul road thickness of 1.5 to 2-m thick will minimize deformation. Where thinner fill is used, and for roads constructed during summer, some thaw consolidation is expected. Once the active layer is re-established, which would likely be achieved within one or two seasons, no further settlement is expected. Where possible, roads will be constructed in winter months, when soils are frozen, to prevent permafrost degradation and limit differential settlement. More detail can be found in the MAD, Appendix F-2.

Other mitigation and environmental design features to reduce the potential for permafrost degradation include:

- Avoiding ice-rich, poorly-drained, frost-susceptible soil conditions where possible favouring higher, more competent, well-drained ground;
- Placing road fill directly over overburden soil limiting cuts that can lead to thaw degradation;
- Removing accumulated snow before placing fill;
- Increasing road fill thickness in areas with thaw susceptible soils where necessary; and
- Construct roads in winter months when possible over frozen ground conditions.

4.1.7 Measures to Protect Fish and Fish Habitat

Sabina is committed to ensuring that serious harm to fish is avoided where possible in compliance with the *Fisheries Act* when undertaking construction or operating near water. The presence of fish in potentially affected habitats was confirmed through the multi-year baseline fish sampling programs performed for the Environmental Assessment of the Project. For example, baseline sampling suggests that most waterbodies and watercourses have the potential to support small-bodied fish species, such as Ninespine Stickleback, for at least part of the open water season; whereas only deeper waterbodies have the potential to support large-bodied species such as Lake Trout during the winter (assuming water depths exceed the maximum ice thickness). Watershed position is also a consideration in the classification of fish-bearing status and distribution of species. Streams and ponds, including ephemeral streams and ponds, that connect two fish-bearing waterbodies with confirmed fish presence have a high likelihood of supporting fish for at least part of the open water season (e.g., spring freshet). Refer to Tables 6.3-1 and 6.3-2 of the Conceptual Fish Offsetting Plan for a list of all waterbodies and watercourses with total or partial habitat losses that were either confirmed to support fish or identified as being highly likely to support fish.

The fish-bearing crossings will be sized to keep maximum water velocities below 1.5 m/s such that they do not present a velocity barrier to migrating Arctic Grayling.

Sabina is committed to deploy all applicable recommended measures where possible, including those related to Project planning, erosion and sediment control, shoreline re-vegetation and stabilization, fish protection, and the operation of machinery, as per DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html). The below information re-iterates what is provided within the assessment of watercourse crossings and water intake/discharge pipes in the FEIS (FEIS Volumes 6 and 10), and in the Type A Water Licence Application MAD and Water Management Plan (SD-05).

<u>Watercourse Crossings</u>

For the fish bearing crossing at Gander Outflow, effects related to the installation of the culvert were assessed in the FEIS (FEIS Volume 10, Chapter 21, Section 6.3.3,). Within the implementation of DFO's recommended measures, the fish-bearing crossing will continue to serve as a migration corridor, between Goose and Rascal lakes. For example, the culvert will be sized to keep maximum water velocities below

1.5 m/s such that it does not present a velocity barrier to migrating Arctic Grayling. In addition, the culvert will be embedded to a depth of 0.4 m and filled with streambed material to promote fish passage and habitat suitability. Timing of in-water construction activities will conform, when possible, to Nunavut timing windows for the protection of fish and their habitat. Additional details on the Gander Outflow crossing can be located in the Site Water Monitoring and Management Plan (FEIS Volume 10, Chapter 7). Detailed design drawings will be provided to the NWB at least 60 days prior to construction, and DFO for review during the permitting stage of the Project.

It is important to re-iterate that the construction and maintenance of all stream crossings, roads, and berms will follow DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat. These include the following mitigation measures to guide these processes and to ensure that fish and aquatic habitat is not adversely affected by development (FEIS Volume 6, Chapter 7, Section 7.5.3):

- Design and plan in-water activities and works such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided.
- Where possible, approaches will be designed to be perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.
- Instream activities will be undertaken in isolation of open or flowing water, or when frozen, to maintain the natural flow of water downstream and avoid introducing sediment into the watercourse.
- Effective erosion and sediment control measures will be installed before starting work to prevent sediment from entering the waterbody.
- Site isolation measures (e.g., silt boom or silt curtain) will be used to contain suspended sediment where in-water work is required.
- Regular inspection and maintenance of erosion and sediment control measures and structures will be conducted during the course of construction.
- Repairs to erosion and sediment control measures and structures will be promptly completed if damage occurs.
- Removal of non-biodegradable erosion and sediment control materials will be completed once site is stabilized.
- Clearing of riparian vegetation will be kept to a minimum to avoid disturbance to the riparian vegetation and prevent soil compaction.
- If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, appropriately-sized, clean rock will be installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
- All construction equipment and supplies will be removed from the construction site upon Project completion.
- Machinery will be in a clean condition and maintained free of fluid leaks, invasive species, and noxious weeds.
- Whenever possible, machinery will be operated on land above the high-water mark or on ice in a manner that minimizes disturbance to the banks and bed of the waterbody.
- Whenever possible, machine fording of a watercourse will be limited to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, a temporary crossing structure will be constructed.

- Service machinery will be washed, refuelled, and fuel and other materials for the machinery stored, in such a way to prevent any deleterious substances from entering the water.
- Screens will be used on all water intake hoses and pumps to prevent fish entrapment.

Disposal of excavated material will be in a location above the high water mark to ensure that this material does not enter the watercourse. Efforts shall be made to minimize the duration of any in-stream works and minimize disturbance at stream crossings. This practice will prevent the release of sediment or sediment-laden water into water frequented by fish. Exposed landscape surfaces will be protected, where possible, by the installation of covering material like riprap, aggregate, or rolled erosion control products. All in-stream works for waterbodies frequented by fish shall be completed in accordance with the relevant DFO Guidelines.

Sediment loading in runoff will be minimized by the application of measures to intercept Total Suspended Solids before it reaches the freshwater environment. Sediment control measures could include:

- Buffer zones to trap sediment and to reduce flow velocities;
- Installation of synthetic permeable barriers, fibre rolls, and/or silt fences as required;
- Installation of check dams, gabions, and sediment basins to reduce flow velocities and encourage sediment deposition; or
- Locating stockpiles well away from watercourses.

4.2 WINTER ICE ROADS

Overland access to the Project is possible between January and April each year. During the Mobilization and Construction phases, equipment, materials, and supplies delivered mainly overland via the WIR to Goose Property will be staged at the MLA. Annually, in early December, preparation of the WIR linking the MLA to Goose Property will be undertaken. Once the WIR is ready for traffic, the equipment, materials, fuel, and supplies staged at the MLA will be transported by trucks over the WIR to Goose Property. It is expected that the transfers will occur annually between January and April.

The WIR between the MLA and Goose Property will be approximately 160 km long, travelling over 58% water and 42% land. The George Exploration Camp could connect to this WIR by a winter spur road approximately 13 km in length. This spur may further extend to provide a connection to the proposed Bathurst Inlet Port and Road all-weather road.

4.2.1 Public Use of Winter Ice Road Corridors

All Project roads, including the WIR, are private and not intended for public use.

4.2.2 Expected Traffic on Winter Ice Roads

Winter ice roads will be used for the life of the Project. It is expected that vehicle traffic will be between January and April annually. The expected number of vehicles on the WIR is presented in Table 4.2-1. Freight hauling is expected to average 25 tonnes per load including double and triple-axle flat-deck trailers. Fuel hauling will utilize standard B-train tankers with an estimated 75,000 litres per load capacity.

Table 4.2-1. Estimated Annual Vehicle[1] Traffic on Winter Ice Roads

	Construction Cargo/Freight/Fuel	Operations Cargo/Freight/Fuel
MLA to Goose	Up to 16 trucks making a return trip every 1 to 1.5 days (up to 1,100 transits)	Up to 27 trucks making a return trip every 1 to 1.5 days (up to 2,300 transits)

1 includes trips by vehicles moving cargo, freight, and fuel over the WIR season; this does not include any personnel movement, or equipment movement on the WIR.

Environmental conditions determine the route selected for WIR corridors including:

- Ice of a sufficient thickness to support equipment so that pumping and using water to build up ice will be limited.
- Snow/ice thickness on land will be sufficient to prevent damage to soil and vegetation.
- Weather conditions permit safe transport of equipment and materials.

The "Guidelines for Safe Ice Construction" published by the Northwest Territories Department of Transportation (2015) will guide the planning and construction of the WIRs. Further details on studies, reports, and plans relevant to the design of WIRs are presented in Section 2.1.

The WIR will be constructed yearly in December and January. The road will be open to traffic from late January to April of each year. The roads will be designed to be capable of carrying legal highway loads.

The effective use and duration of a WIR depends on a number of variables, the most important of which are the climatic conditions (air temperatures and snowfall), surface conditions, and the amount and type of traffic that will be using it.

The WIR will be constructed over land and over ice. Overland crossings rely on a frozen subgrade to support the vehicle loads and a prepared surface layer to provide a level driving surface. Surface layers usually consist of compacted snow and/or ice where available. Ice-capped snow roads will be constructed for highway legal loads (e.g., B-trains). A discontinuous pad of granular fill may be required over short areas of rough terrain or where there is insufficient snow cover to create a smooth surface. If this is insufficient to provide an acceptable surface and gradient, additional grading effort may be required to create a road that meets the design criteria. Although Sabina currently does not anticipate any such locations, it is possible that operational requirements may require some fill. Should small quantities of material be required, only quarries or borrows with geochemically suitable material will be developed, and Sabina will work with the land owner (KIA or INAC) to obtain the necessary approvals.

Roads that will be built over floating ice covers on lakes and rivers for B-trains will be built to a minimum 30 m cleared width. This width is necessary to provide a 5 m buffer along the edges to separate the vehicle traffic from the thinner ice found under snow banks. This minimum width also provides additional lane width for when roads are blown with drifted snow. Snow banks need to be managed carefully as they are an additional load on the ice, and the thinner ice underneath is prone to cracking and flooding. The final cleared width to account for floating ice covers will be determined during the next stages of the Project.

In high wind locations, it is often desirable to initially open the road to widths greater than the 30 m, which will provide space for the operational width to narrow due to snow drifting throughout the season to a minimum width of 30 m. The final cleared width to account for high wind locations will be determined during the next stages of the Project.

4.2.3 Design Criteria for Winter Ice Roads

The following design criteria were used for the WIRs:

- Road widths:
  - On Ice - minimum 30 m.
  - On land – minimum 10 m, with maximum 5% grade.
- Operating speeds (maximum 60 km/h):
  - Loaded Trucks (>50% of maximum load limit):
    - 35 km/h on ice.
    - 40 km/h on land.
    - 10 km/h on and off portages (i.e., shoreline-lake transition points).
  - Empty Trucks (<50% of maximum load limit):
    - 60 km/h on ice.
    - 40 km/h on land.
- Load limits:
  - Table 4.2-2 provides minimum ice thickness and total allowable weight for various vehicle configurations.

Table 4.2-2. Load Limit at 100% of Highway Legal Gross Vehicle Weight

Vehicle Configuration	Minimum Ice Thickness (cm)	Total Allowable Weight (kg)
2-Axle Hotshot	66	14,600
3-Axle Hotshot	73	22,500
6-Axle Tractor Trailer	89	46,500
8 Axle Super B Train	99	63,500

4.2.4 Winter Ice Road Alignment

In response to TK and a request by the KIA, the winter ice road north of Tahikafflok Lake (Bathurst Lake) was realigned to address potential impacts to riparian zones identified during two local focus group workshops (Cambridge Bay Hunter Focus Group 2012; Kugluktuk Hunter Focus Group 2012). Sabina realigned a 5.5 km section of the winter road alignment away from the area identified. Approximately 200 m of the 160 km winter road will need to be assessed for vegetation prior to construction (see below commitment). Air photos and remote sensed images were used to perform a table top assessment of the area. Vegetation and archeological assessments have already been completed for the entire alignment with the exception of the 200 m mentioned above. Sabina will seek appropriate authorization from the KIA and/or Indigenous and Northern Affairs Canada prior to use.

4.2.5 Winter Ice Road Construction and Use

The WIR is anticipated to be constructed in early December 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 days utilizing two work fronts from Goose Property and the MLA.

Maintenance will be required over the operating season from late January to April annually, with crews accommodated at both the MLA and Goose Property.

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. Winter ice roads are not planned to be constructed during temporary or permanent Closure; however, the WIR may be utilized during the Closure Phase to facilitate back-hauling of materials from Goose Property to the MLA for permanent disposal off-site.

Winter ice road construction will adhere to the following guidelines based on DFO Operational Statements:

- Use existing trails or WIRs wherever possible as access routes to limit unnecessary clearing of additional vegetation and prevent soil compaction.
- Construct approaches and crossings perpendicular to the watercourse wherever possible.
- Construct ice bridge and snow fill approaches using clean, compacted snow and ice to a sufficient depth to protect the banks of the lake, river, or stream.
- Install sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and decommissioning activities and make all necessary repairs if any damage occurs.
- Operate machinery on land or on ice and in a manner that minimizes disturbance to the banks of the lake, river or stream.
- Ensure that the intakes are sized and adequately screened to prevent debris blockage and fish entrapment.
- Crossings do not impede water flow at any time of the year.
- When the crossing season is over and where it is safe to do so, create a v-notch in the centre of the ice bridge to allow it to melt from the centre and also to prevent blocking fish passage, channel erosion and flooding. Compacted snow should be removed from snow fills prior to the spring freshet.
- Stabilize any waste materials removed from the work site to prevent them from entering the lake, river, or stream. This could include covering spoil piles with biodegradable mats or tarps.
- The site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.

4.2.6 Water Use for Winter Ice Road Construction and Maintenance

The expected water use for the construction and maintenance of the WIRs is estimated to be up to 675 m^3/km/year. The volume used will depend on environmental conditions and operational needs. Water will be drawn from various sources along the alignment of the WIR. Sabina will adhere to the DFO Operational Statements on Mineral Exploration, Ice Bridges, and Snow Fills, as well as DFO Under-Ice Water Withdrawal Protocol for the withdrawal of water. The supply locations and consumption rates will be provided at least 60 days prior to construction.

Water withdrawal will adhere to the following guidelines from DFO's Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (DFO 2010):

- In one ice-covered season, total water withdrawal from a single waterbody will not exceed 10% of the available water volume calculated using the appropriate maximum expected ice thickness.
- In cases where there are multiple users withdrawing water from a single waterbody, the total combined withdrawal volume will not exceed 10% of the available water volume.
- Only waterbodies with maximum depths that are ≥1.5 m than their corresponding maximum expected ice thickness should be considered for water withdrawal.

In addition, Sabina committed to implement all applicable DFO best management practices to avoid and mitigate serious harm to fish as a result of the construction, operation, and decommissioning of WIRs, and from under ice water withdrawals. This includes adequately screening the water intakes pipes to prevent impingement and entrainment of fish (FA-DFO-T-4).

The construction of ice bridges and snow fill approaches at the land-water interface will utilize only clean, compacted snow and ice to a sufficient depth to protect the shoreline. Speed limits will be enforced to prevent ice scour along shorelines. Sabina has committed to adhering to the following DFO guidelines based upon the Nunavut *Operational Statement for Ice Bridges and Snow Fills* (DFO 2007):

- Use existing trails or WIRs wherever possible as access routes to limit unnecessary clearing of additional vegetation and prevent soil compaction;
- Construct approaches and crossings perpendicular to the watercourse wherever possible;
- Construct ice bridge and snow fill approaches using clean, compacted snow and ice to a sufficient depth to protect the banks of the lake, river or stream;
- The use of material other than ice or snow to construct a temporary crossing over any ice covered stream is prohibited under section 11 of the Northwest Territories Fishery Regulations, unless authorized by a Fishery Officer;
- Install sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and decommissioning activities and make all necessary repairs if any damage occurs;
- Operate machinery on land or on ice and in a manner that minimizes disturbance to the banks of the lake, river, or stream.
  - Machinery is to arrive on-site in a clean condition and is to be maintained free of fluid leaks;
  - Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water or spreading onto the ice surface;
  - Keep an emergency spill kit on-site in case of fluid leaks or spills from machinery; and
  - Restore banks to original condition if any disturbance occurs;
- Ensure that the intakes are sized and adequately screened to prevent debris blockage and fish mortality. Mesh size will not be larger than 2.54 mm;
- Crossings do not impede water flow at any time of the year;
- When the crossing season is over, and where it is safe to do so, create a v-notch in the centre of the ice bridge to allow it to melt from the centre and also to prevent blocking fish passage, channel erosion and flooding. Compacted snow should be removed from snow fills prior to the spring freshet;

- Stabilize any waste materials removed from the work site to prevent them from entering the lake, river, or stream. This could include covering spoil piles with biodegradable mats or tarps; and
- The site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.

Sabina remains committed to ensuring that all withdrawal of water for the construction of WIRs is completed in a manner that avoids or minimizes the potential for serious harm to fisheries. An innovative plan has been developed to identify those waterbodies that would reduce the potential effects on fish and fish habitat due to water withdrawal from lakes along the WIR. This plan includes collecting the following information to support the decision making process:

- Identify the location of and generate bathymetric maps of all potential water withdrawal source lakes along the WIR Alignment using methods based on satellite imagery;
- DFO's protocol for winter water withdrawal will be applied, where no more than 10% of the under ice volume for lakes deeper than 3.5 m will be extracted;
- Provide locations of proposed water withdrawal sites, calculate the depth, volume, maximum withdrawal limits and maximum reduction in depth for each lake;
- Identify any potential for changes in overwintering capacity for fish; and
- Identify any potential for changes to spawning shoal habitat for fall spawning fish species.

A memorandum describing Sabina's strategy in further detail can be found in Appendix E-4 of the MAD.

4.2.6.1 Bathymetry of Water Bodies Along the Winter Ice Road

A geophysical field program, consisting of ground penetrating radar profiling by snowmobile, was carried out Tetra Tech in 2013 (FEIS, Appendix V6-3E). The field program included a ground penetrating radar-based ice thickness and bathymetric survey along the proposed WIR routes between the Goose Property and George Property and the MLA in Bathurst Inlet, and a ground penetrating radar survey of Bathurst Inlet in an attempt to identify areas of grounded sea ice in the vicinity of the proposed WIR alignment.

The alignment of the WIR route has been further enhanced since the 2013 geophysical program and may alter further in detailed engineering. Detailed bathymetry of waterbodies along the final alignment of the WIR will be provided at least 60 days prior to construction of the WIR.

Sabina has committed to providing the bathymetry, depth, and location of the proposed water withdrawal sites, volumes to be extracted, anticipated water level decreases, and fish habitat features within each water body proposed to be used for winter water withdrawal in support of the construction of the winter ice roads.

4.3 GOOSE AIRSTRIP

The proposed all-weather Goose Airstrip and connecting all-weather road will be privately-owned infrastructure built entirely on Inuit Owned Land (see MAD Appendix A, base Figure 3). This infrastructure will be constructed, operated, inspected, and maintained by Sabina. It will be built at the onset of construction activities by extending and upgrading the current exploration/development gravel airstrip. This airstrip will serve as the main air access to the Property throughout the life of the Project. The Goose Airstrip will be classified as a "registered aerodrome" and the design will be in accordance with Transport

Canada's Aerodrome Standards and Recommended Practices (Transport Canada 2005). The construction of the airstrip will follow generally accepted good engineering practices for building airstrips in permafrost areas of the Northwest Territories and Nunavut.

At the onset of construction activities, the all-weather airstrip and apron capable of servicing passenger and large cargo aircraft will be constructed at the Goose Property by extending and upgrading the current exploration/development gravel airstrip. This airstrip will serve as the main air access to the Property throughout the life of the Project. The airstrip will be up to 1,524 m long and 45 m wide. Due to the continuous permafrost and possible thaw degradation on the Goose Property, the airstrip extension, if completed, will be constructed with embankment fills of approximately 2 m thick. The fill material will be geochemically suitable quarried rock or waste rock. This will be topped by an approximately 0.3-m thick compacted granular base trafficable layer. The airstrip will be equipped with lights, communications equipment, and instrumentation in accordance with appropriate Federal regulations.

Environmental considerations are incorporated into design and routing. Wind direction and speeds, in addition to existing terrain and ground conditions, determined the optimal airstrip orientation. Road alignment, connecting the airstrip to the Goose Camp Accommodations and to the quarries, considered the existing terrain and topography to determine the optimal route for equipment movement. The design aimed to minimize the Project footprint. Additional fieldwork determined that the airstrip and road alignments did not include any archaeological sites or vegetation/wildlife species under the *Species at Risk Act*.

Establishing fish and fish habitat included water quality and quantity, fish population, and fish habitat studies. These data have been incorporated to determine the optimal alignment for the airstrip, the connecting road, and the associated water crossings. The Goose Airstrip will incorporate two water crossings similar to all-weather road water crossings described in Section 4.1.4 and Figure 4.1-2.

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of the Plan and approves all relevant policies and documents, auditing, action planning, and the verification process.

The Mine Manager, along with his/her direct reports, is responsible for the implementation of this plan including safety, traffic management, and maintenance.

The Environmental Superintendent, along with his/her direct reports, is responsible for monitoring the effective implementation of this plan.

6. Traffic Management and Road Safety

Sabina's traffic management and road safety regulations will be inspired from the Tibbitt to Contwoyto Winter Road Joint Venture, Winter Road Regulations, and Rules of the Roads. This comprehensive document on WIR regulation will be developed once the Project is approved. This document will address:

- General Regulations for Use of the WIRs:
  - general regulations;
  - enforcement;
  - signage; and
  - dispatching.
- Rules of the Road:
  - speed restrictions;
  - truck and convoy spacing;
  - right of way;
  - portage traffic;
  - dangerous driving and unsafe practices;
  - interference with security;
  - drug, alcohol, and firearms;
  - littering and refuse disposal;
  - safety restrictions and equipment;
  - hours of works/log book;
  - designated refuge and rest areas;
  - dispatching;
  - communications;
  - spills and dangerous/emergency situations;
  - stopping on lakes/water crossings;
  - wildlife; and
  - wildlife reporting.

Key concepts of the traffic and road safety plan are discussed below.

6.1 ROAD SAFETY AND COMMUNICATION

Sabina security personnel, along with Sabina's road supervisor, will monitor activity on all roads through radio contact with both staff and drivers on the roads, and through periodic patrols of the roads. All Sabina vehicles that routinely travel on the roads will be equipped with a radio set to the requisite road frequency. Similarly, contractor's vehicles that routinely travel on the roads will be equipped with a radio set to the requisite road frequency. Consequently, Sabina's traffic on the roads will always have radio contact.

This system will be used to report any unusual conditions along the roads such as:

- Location of other Sabina vehicles.
- Presence of wildlife on the roadway.

- Presence of non-Sabina vehicles, such as all-terrain vehicles, snowmobiles, or other.
- Presence and location of any non-Sabina vehicles broken down on the roads.
- Unsafe practices noticed.
- Special road conditions.
- Special weather conditions, etc.

The safety rules that will apply to all users of the roads, including Sabina's employees and contractor employees of the roads are as follows:

- Maximum speed limits will be enforced. Signs will be posted.
- Use of seat belts by all drivers and passengers is mandatory.
- Driving under the influence of alcohol or intoxicating drugs is prohibited.
- Wildlife has right-of-way on the roads, and no harassment of wildlife is allowed.
- No public traffic is allowed within mining areas; these are industrial work sites and, thus, non-Project related vehicles will be stopped and escorted to the camp. Signs will be posted.

Sabina may temporarily place emergency shelters approximately every 60 km along the WIR. These shelters will have the necessary safety supplies to allow stranded travelers to wait out an event, such as a prolonged blizzard.

All roads associated with the Project, including all WIRs and all-weather roads, are private roads.

6.2 ROAD SIGNAGE

Sabina will post appropriate road signs along the roads. Typically, signs will advise drivers of the posted speed limit, approaching bridges, approaching curves, and/or areas of lower visibility (e.g., blind hills or obstructed curves).

Speed limit signs will be posted at intervals of approximately every 20 km along all roads, and posted at smaller intervals where necessary. Reflective flags will be installed along one side of the road to help drivers identify the road shoulder during a blizzard, white out conditions, or dense fog. Typically, these flags will be black in colour to help them stand out in white-out conditions, and will be nominally placed at intervals of 500 m apart. Kilometre markers will be posted along the all-weather roads at 1-km increments and at appropriate intervals along the WIR.

6.3 POLICING

Responsibility for all road operation and maintenance activities will rest solely with Sabina. Sabina will concentrate on raising awareness and commitment to road safety, and improving communication, cooperation, and collaboration among all stakeholders on the safe use of the roads. Sabina employees and its contractors who will use the roads will be required to take road safety training before being allowed to drive on the roads.

Sabina will use its road supervisor and site security to monitor activity on the roads. This will be achieved through radio contact, through periodic patrols of the roads, and in conversations with drivers on the roads. Sabina will monitor speed limit infractions by direct observation of active road users. Sabina will also rely on radio contact with its employees and contractor vehicles on the roads to monitor unsafe conditions or activity.

6.3.1 Emergency Response

As a private road, the responsibility for response to any emergency or accident lies solely with Sabina. It will be Sabina personnel that respond and address any emergencies that occur on the road and airstrip. Sabina will have staff on-site trained in emergency response including firefighting, first aid, vehicle recovery, and spill response. Sabina does not anticipate that emergency response will result in any demand on local public service providers in Cambridge Bay (fire, police, ambulance, medical, maintenance).

In most circumstances, the emergency response will be met by Sabina personnel. Sabina's emphasis will be on prevention with ongoing awareness, training, and ongoing safety measures while at the same time keeping resources close at hand to respond to emergencies at the Project in a timely manner. Sabina will implement the Risk Management and Emergency Response Plan for roads if needed.

6.4 ACCIDENTS AND MALFUNCTIONS

Sabina's emphasis will be on prevention, while at the same time keeping resources close at hand to respond to emergencies on the roads in a timely manner.

Three possible causes of road emergencies are the road itself, vehicles, and people. It is the interplay of these three elements that lead to either safe use of the roads or potential emergency response. Sabina is fully responsible for the design, construction, and maintenance of the roads on the Project site. This will include regular inspection and maintenance of transportation infrastructure, including service roads, haul roads, road crossings, water crossings, signage, and any refuge stations located along the WIRs.

Sabina will ensure its vehicles are in good working order before road use is allowed. As well, Sabina will train its employees on road safety and emergency response (first aid, firefighting, spill response, etc.). By educating and protecting its workers, Sabina will lead by example in road safety.

Some accidents and malfunctions may have an indirect effect on local fauna. For example, fish spawning success appears to be strongly affected by stream blockages. Thus, improper decommissioning of ice bridges and snow fills may cause stream channels to become blocked to fish during the spring migration, which could in turn lead to fish failing to spawn. Sabina will ensure that streams along the road alignments are appropriately monitored, and that any issues will be addressed as soon as feasible.

A Sabina trained emergency response and spill response team will be available on-site with appropriate equipment to respond to all spills and road accidents. The Emergency Response Team will be trained in emergency response (firefighting, first aid, mine rescue, spill response, vehicle accidents, etc.). In addition, emergency response equipment is to be carried in all Sabina vehicles. This equipment will include survival gear, emergency first aid equipment, and initial spill response equipment. Spill response will be implemented by environmental staff who will advise, document, and report on initial response and clean-up actions. The Spill Contingency Plan will be activated in response to a spill.

6.4.1 Spill Prevention

Training and awareness are two major elements of spill prevention. All site staff and contractors will review the contents of the Spill Contingency Plan during their on-site orientation and will be informed of where copies of the Plan are stored. The mandatory site orientation will provide hazard awareness training, identify the locations of spill kits and other response equipment, and discuss appropriate application. A more detailed description of the training to be provided to site staff is provided in Section 5 of the Spill Contingency Plan.

In addition to training, all work sites and hazardous materials storage facilities will be routinely inspected. Good housekeeping practices will be adopted with emphasis on storage facilities and loading zones.

General practices, to be implemented by Sabina, that support spill prevention include the following:

- Assign spill response personnel and clearly publish their contact information;
- Provide easy access to current Safety Data Sheets for all hazardous materials on-site;
- Maintain updated inventory of hazardous materials present at each site (in the Hazardous Materials Management Plan [SD-13]);
- Store materials in appropriate containers to the specified capacity, in areas adequately protected from weather and physical damage;
- Conduct regular inspections of storage facilities;
- Segregate incompatible materials;
- Provide training involving the Spill Contingency Plan (SD-17), spill sits, and other response equipment;
- Stock adequate spill response materials and equipment, and have them readily available for transportation, transfer, and storage of hazardous materials; and
- Create an environment which promotes prompt communications of all spill incidents.

Spill prevention practices specific to roads include:

- Inspection and maintenance of roadways and vehicles (Section 7);
- Adhering to traffic management and road safety practices (Section 6.1); and
- Ensuring proper storage of materials during transportation (Spill Contingency Plan [SD-17]).

6.4.2 Incident Response

Despite the preventative and mitigation measures taken, should any incident arise as a result of human error or unforeseen circumstances, the response procedures outlined in the Spill Contingency Plan will be implemented. The types of accidents and malfunctions that may occur are as follows:

- Vehicle collisions that may result in personal injury and spillage of potential harmful materials such as fuel, lubricating fluids, or antifreeze.
- Contact between vehicles and wildlife that may result in harm to wildlife, personal injury, and spillage of potentially harmful materials.
- Single vehicle accidents that may result in personal injury and spillage of potentially harmful materials.
- Risk of people getting stranded on the roads in bad weather, such as in blizzard, white out or dense fog conditions, or due to mechanical breakdown.
- Risk of accident due to an intoxicated or impaired driver on the roads.
- Spills of harmful materials onto the land or into water through a vehicle rollover or tipping during bad weather.

Sabina will report all reportable-scale incidents to the appropriate authority; this may include the KIA, Mines Inspector, RCMP, NWB, Nunavut Spill Line, Environment and Climate Change Canada, Government of Nunavut Department of Environment, and DFO.

The following actions are to be taken in the event of an accident on the roads involving other vehicles (including all-terrain vehicles), or in the event of an accident involving contact with wildlife, such as caribou, muskox, bear, wolf, etc.:

- Check the condition of people involved in the accident and provide immediate first aid if appropriate.
- Call the Sabina road dispatch by radio and report the location and nature of the accident and indicate the type of assistance required (e.g., medical help, environmental cleanup, fire, and/or mechanical help).
- Secure the accident site so that any vehicles do not continue to present a hazard to others. This may involve moving the vehicles to the nearest pull off in the event of a minor accident, or blocking off the road in both directions in the event of a more serious accident.
- If safe to do so, secure the site to prevent continued spill or leakage of contaminants into the surrounding environment.

Upon receiving the accident call, the road dispatch will initiate the emergency response procedure passing along the information to the emergency response coordinator. The emergency response coordinator will then call out the required emergency response personnel to assist at the accident site.

Once the accident site is secured and all people requiring assistance have been relocated to receive appropriate medical care, the emergency coordinator will turn the accident scene over to the mine's safety personnel so that an appropriate accident investigation can be initiated.

In the event of an incident involving contact with wildlife, the road dispatch will notify the site security personnel and the environmental representatives. Security and the site environmental team will then initiate an appropriate accident investigation. The Environmental Department will ensure that appropriate reporting of such incidents is made on a timely basis to the KIA, relevant Hunters and Trappers Organization(s), and the Government of Nunavut Wildlife Officers.

In the event of a serious accident, the RCMP will be contacted and advised of the incident. The RCMP will then decide on whether they will become involved or take the lead on any subsequent accident investigation.

7. Inspection, Maintenance, and Monitoring of Roads

Sabina has sole responsibility for the ongoing inspection and maintenance of all components of roads and the airstrip, including the road bed, airstrip foundation, culverts, water crossings, and quarry sites. Sabina will have the Site Supervisor, or their designate, responsible for ongoing inspection and maintenance. The following is a summary of the procedures that will be applied.

7.1 ALL-WEATHER ROADS INSPECTION AND MAINTENANCE

Sabina recognizes that a good inspection program will lead to the early identification of areas of the airstrip and road where improvements are necessary. The early resolution of any deficiencies will result in less ongoing maintenance and repair of the infrastructure.

The all-weather roads and its shoulders will be inspected regularly during the summer period for evidence of seasonal freeze and thaw adjacent to the toe of the road embankment. Such movements are expected and may lead to longitudinal cracking and thaw settlement especially for portions of the road founded on thaw-susceptible (ice-rich) soil. When such areas are discovered, the affected area will be repaired using geochemically and geotechnically suitable granular material and/or crushed rock. Sabina will maintain stockpiles of such material for this purpose.

The all-weather roads and airstrip will be inspected for signs of accumulation of ponded water, either on the surface or along the sides. Where noticed, the Site Supervisor will evaluate and monitor the accumulation to determine why water is accumulating in these areas. Based on these evaluations, the Site Supervisor will take remedial action where and when necessary to correct the cause of such ponding, such as grading of the surface to remove areas of ponding or installation of additional culverts if the road is causing excessive water ponding.

The all-weather road surfaces will be maintained with gravel being spread as required and regular grading of the road. Granular surfacing required for yearly maintenance of the all-weather roads will be sourced and stockpiled from local quarries. Refer to the Borrow Pits and Quarry Management Plan (SD-03), as it develops, for each quarry site.

In fall, winter, and spring, maintenance will be adjusted according to the weather conditions. Snow clearing along the roads will be completed to ensure that the roads can be operated safely. The manner in which the snow is cleared will also take into account the road configuration to ensure that snow accumulation will not cause any complications during the freshet.

Inspection frequency will be increased during the following critical time periods:

- Just prior to spring freshet to ensure that the culverts and stream crossings are in a good state to accommodate the rapid spring thaw;
- During the spring freshet to ensure that the culverts and stream crossings are not impeding spring freshet and to initiate action when and where required to prevent wash outs; and
- Just after heavy rainfall events to monitor water accumulation, to ensure that culverts and diversion/collection channels and ponds are passing precipitation as planned and to initiate action when and where required to prevent erosion and wash outs.

7.1.1 Dust Management

The amount of dust generated along the road and airstrip is dependent on the dryness of the surface, the number of vehicles, weight and speed, and maintenance of the driving surface. Dust will not pose a significant problem in the winter and early spring when snow and ice cover road surfaces. The warmer and drier late spring and summer months will lead to more dust generation.

Dust suppression measures, which are typical of the current mine practices (e.g., Meliadine and Meadowbank Mine) and consistent with best management practices, will be considered through design, operation and closure activities to control the dust. Regular grading of the road and airstrip combined with the addition of granular material to the surface will be needed. This will improve road safety and also reduce dust. In areas or times identified by the Site Supervisor as being prone to high dust levels or areas where safe road visibility is impaired or in areas where dust deposition is impacting fish habitat and/or water quality, the Site Supervisor will arrange mitigation measures as appropriate. This could involve actions such as grading of the road surface, placement of new coarser topping, and/or watering of the road surface. Up to 400 m^3 per day has been allocated in the Water Management Plan (SD-05) for dust suppression at the Goose Property. Use of approved chemical dust suppressants may be used and only in accordance with the Environmental Guidance for Dust Suppression on Unpaved Roads (GN 2014).

All Sabina employees and contractors are instructed to report any road and airstrip maintenance problem or hazardous condition to Project Management. Regular scheduled safety meetings will incorporate discussion and reminders related to all-weather airstrip and road use, operation, and maintenance. Additional details on dust management can be found in the Mine Waste Rock Management Plan (SD-08).

7.1.1.1 Air Quality Monitoring

Dust and particulate matter from mobile equipment traffic on roads is a primary air quality concern related to all-weather roads. Wind erosion from roads can also generate particulate emissions.

Upon Project approval, dust fall monitoring will be carried out during the Construction and Operations phases of the Project. As described in the Air Quality Monitoring Plan (FEIS Volume 10, Chapter 17), at the Goose Property, the monitoring will be sited to ensure that all large sources of emissions including ore stockpiles and haul roads are monitored approximately 30 m, 100 m, 1 km, 3 km, and 5 km downwind of the location with the most activity.

Monitoring of total suspended particulate, PM_{10}, and $PM_{2.5}$ concentrations will be carried out according to the National Air Pollution Surveillance (Environment Canada 2011) schedule by drawing a known quantity of air through a pre-weighed filter using a BGI PQ100-FRM Sampler following a standard monitoring cycle where a single 24-hour sample is collected every six days. Specific station locations will be sited approximately 100 m downwind of the location with the most activity.

7.1.2 Watercourse Crossings Inspection and Maintenance

The watercourse crossing inspection and maintenance program has these main components:

- A regular inspection program to identify issues relating to watercourse crossings such a structural integrity and hydraulic function.
- All necessary repairs and adjustments will be conducted in a timely manner.
- An event inspection program to track the impacts of large storm events on watercourse crossings, such as structural integrity and hydraulic function.

- A culvert location inspection program to ensure that culverts have been installed in the right location with respect to the watercourse and that culvert capacity is adequate to ensure that the culvert(s) pass the water under all hydraulic conditions.

Culverts will be sized for each stream crossing to accommodate normal summer flows as well as spring freshet and heavy rainfall flows.

Visual monitoring will be conducted on a regular basis to ensure drainage and erosion controls are effective per the following guidelines:

- Culvert maintenance will be conducted following the DFO's advice, "Measures to Avoid Causing Harm to Fish and Fish Habitat" (DFO 2013).
- Instream work will be conducted during approved timing windows presented in the DFO's advice, "Measures to Avoid Causing Harm to Fish and Fish Habitat" (DFO 2013).
- Winter ice road construction will follow the DFO advice, "Measures to Avoid Harm to Fish and Fish Habitat" (DFO 2013).
- Water withdrawal will follow DFO's Protocol for Winter Water Withdrawal from Ice covered Waterbodies in the Northwest Territories and Nunavut (DFO 2010) and DFO's advice "Measures to Avoid Harm to Fish and Fish Habitat" (DFO 2013).

Starting during the freshet period (mid-May through June), crossing inspections will be performed during the ice-free period prior to fall freeze-up which typically occurs in October of each year. These activities for each watercourse crossing will consist of visual inspection to:

- Identify defects, cracks, or any other risks to structural integrity of the infrastructure. Particular attention will be paid to the inlet and outlet structures of culverts.
- Identify sediment or other debris accumulation impeding the free flow of water through the crossings. Maintenance operations will consist of hand removal of accumulated debris and repairing damage as soon as possible.
- Identify bed erosion or scour around the watercourse crossing of the upstream and downstream channel. Any erosion concerns will be addressed as soon as possible.

Particular attention will also be paid to potential sources of sediment transport at the crossing. Inspection results will be recorded to help track changes in conditions over time. Maintenance operations will consist of undertaking remediation of any detected problems and repairing damage as soon as possible.

7.1.3 Closure

In the event of temporary Closure, service roads will be maintained, including plowing snow from roads and the airstrip, repairing culverts, employing erosion and sediment control measures, etc. Infrastructure, including ditches and spillways, will be routinely inspected to ensure proper operation or to implement contingency measures. Camp facilities will be operated and maintained to support this effort. The level of effort involved in maintaining the site in a state of temporary Closure will depend upon the Project phase.

In the event of permanent Closure, culverts will be removed from all-weather roads and the natural drainage restored. Roads will otherwise remain intact to ensure preservation of permafrost and facilitate long-term site access for monitoring and inspection.

Any airstrips will remain functional with a gravel surface for use during Post-Closure monitoring. Final closure of the airstrip will be similar to the all-weather roads.

7.2 WINTER ICE ROADS INSPECTION AND MAINTENANCE

During WIR operations, the roads will be inspected and maintained in accordance with the "Guidelines for Safe Ice Construction" (GNWT DoT 2015). These regulations state that ice thickness testing inspections should be done once a week on snow roads, twice a week on ice roads, and daily on ice bridges. Test hole spacing and frequency as recommended in the field guide are presented below for each WIR construction phase in Table 7.2-1.

Table 7.2-1. Field Guide for Ice Construction Safety Recommended Ice Testing

	Preconstruction	Construction	Operations and Maintenance
	Initial test run	From start of construction until road is opened to traffic	This may overlap with construction activities at lower load levels
Rivers	If GPR is used, test holes are only required for calibration and for mapping of thin areas 30 meters between test holes along centre line	If GPR is used, test holes are only required for calibration and for mapping of thin areas 30 meters between test holes along alternate edges	If GPR is used, test holes are only required for calibration and for mapping of thin areas 30 meters between test holes along alternate edges Look for thin areas caused by river current
Lakes	If GPR is used, test holes are only required for calibration If within 250 metres of shore: 30 meters between test holes along centre line If more than 250 metres from shore: 250 metres between test holes along centre line	If GPR is used, test holes are only required for calibration If within 250 metres of shore: 30 metres between test holes along alternate edges If more than 250 metres from shore: 250 metres between test holes along alternate edges	If GPR is used, test holes are only required for calibration and for mapping of thin areas 250 metres between test holes along alternate edges
Mackenzie Delta	If GPR is used, test holes are only required for calibration 250 metres between test holes along centre line	If GPR is used, test holes are only required for calibration 250 metres between test holes along alternate edges	If GPR is used, test holes are only required for calibration and for mapping of thin areas

Source: Northwest Territories Department of Transportation. "Guidelines for Safe Ice Construction" 2015.
GPR = ground penetrating radar.

7.3 SNOW CLEARING

The Project is located near the northern boundary of the North American Continent in the vicinity of the Arctic Circle. The climate in the area is characterized by extremes. The Project area experiences relatively low amounts of precipitation, but due to sub-zero temperatures for much of the year, also experiences high snow accumulation. Summer is a season of nearly perpetual sunlight, while winter is dominated by night, twilight and extreme cold. Due to the relative absence of obstructions to impede the wind (e.g., trees, buildings, mountains), wind speeds are generally high. Refer to the Climate and Meteorology chapter of the FEIS (Volume 4, Chapter 3) for further information on Project area climate and meteorology.

A geophysical field program, consisting of ground penetrating radar profiling by snowmobile, was carried out Tetra Tech in 2013 (FEIS Appendix V6-3E). The field program included three main components:

- a ground penetrating radar-based (GPR) bathymetric survey of three lakes near the Goose Exploration Camp to calculate under-ice free water volume, for DFO winter water-withdrawal permitting purposes;
- a GPR-based ice thickness and bathymetric survey along several proposed winter road (i.e., "ice road") routes between Sabina's Goose and George Exploration Camps and Bathurst Inlet; and
- a GPR survey of Bathurst Inlet in an attempt to identify areas of grounded sea ice in the vicinity of the proposed WIR alignment.

This information, along with metrological information collected during baseline data collection from 2004 to 2014, was used to inform the design of the WIR, and inspection and maintenance plans for the all-weather roads.

The Project is expected to experience snow drifts due to strong winds and snow accumulation over the winter season. Roads will be cleared of snow drifts as needed to ensure a safe running surface is maintained. Routine spring snow management will include the removal of any snow that accumulates at culverts so that water at freshet can move freely through the culverts and waterway. In the case of culverts, snow is removed from both ends but not from the inside.

7.4 WATER MANAGEMENT

The Water Management Plan (SD-05) describes in detail water monitoring and management activities and design for the Project during all phases of Project life. A summary of monitoring practices applicable to roads include:

- Visual inspections to confirm that the mitigation measures identified in this document and other relevant management plans (e.g., the Environmental Management and Protection Plan [SD-20], Aquatic Effects Management Plan [SD-21]) are implemented satisfactorily;
- Visual inspections to monitor the effectiveness of sediment and erosion control and runoff collection measures on a regular basis (daily or weekly as appropriate); and
- Recording water consumption used for dust suppression and WIR construction and maintenance to ensure compliance with DFO (2010) winter water withdrawal guidelines.

For additional details on water management, refer to Water Management Plan (SD-05).

8. Wildlife Protection Measures

Wildlife may occasionally be observed near Project roads or the airstrip. This section describes the measures to ensure that wildlife is protected, including:

- Roles and responsibilities,
- Mitigation measures that will apply at all times,
- Management measures should wildlife be observed near all-weather roads, the WIR, and the airstrip, and
- Management of wildlife incidents.

Measures to protect fish and fish habitat are described in Section 4.1.7.

More information on the protection of wildlife is available in the Wildlife Mitigation and Monitoring Program Plan (Version 7, submitted with FEIS Addendum February 2017).

8.1 ROLES AND RESPONSIBILITIES

The protection measures described in this section apply to all Project personnel, contractors, and visitors to site who use Project roads or the airstrip. In cases of operational challenges (e.g., groups of caribou), the Environmental Manager and environmental personnel on-site will manage the situation. The Project personnel will be notified by radio if any wildlife is observed on the road according to current communication procedures.

8.2 MITIGATION DURING ROAD CONSTRUCTION

- The all-weather roads will be constructed to avoid active wildlife residences, such as dens or active bird nests. More information is available in the Wildlife Mitigation and Monitoring Program Plan.
- Road crossing structures will be built on all-weather roads at crossing locations identified by land users. Road crossing structures may include ramps, stretches of the road shoulder made of smaller rocks, or other methods identified through TK, land user information, scientific literature, or based on best practice.
- The WIR will be constructed each year so as to avoid active grizzly bear dens and avoid disturbing esker habitat used for carnivore dens. More information is available in the Wildlife Mitigation and Monitoring Program Plan.
- The WIR will be constructed each winter such that it is not a barrier to movement for caribou; the height of snowbanks will be limited to approximately 1 m and snow plowing will be conducted in such a way as to limit the angle and vertical height of the snowbank edge.

8.3 MITIGATION MEASURES FOR ALL ROADS

The following protocol will be implemented on the road and airstrip for the protection of wildlife:

- Traffic on all roads will be managed and monitored through a central dispatch.
- Observations of caribou and other large mammals will be reported to the environment department.

- Roads will be closed to the public.
- Vehicle speeds on the all-weather and WIR will be limited to 60 km/hr.
- It will be strictly forbidden for any individual to feed wildlife, litter or harvest wildlife while on-site.
- Appropriate mitigation strategies (e.g., signage) will be developed for areas with higher frequency of encounters with wildlife.

8.4 MANAGEMENT FOR THE ALL-WEATHER ROADS

- If a driver observes a caribou, 10 muskox, or other large mammal (e.g., grizzly bear, wolves, or wolverine) within 500 m of any road, the driver will slow to 40 km/hr, alert other drivers, and proceed with caution.
- If a driver on an all-weather road observes that caribou (or muskox, grizzly bear, wolves or wolverine) are on the road or within 50 m of the road and moving towards the road with the intention to cross the road, then the vehicle will stop, the driver will alert the Environment Department, and will proceed when the animals have crossed the road and moved off or may then proceed slowly after a wait of 20 minutes.
- If a driver on the all-weather road observed caribou on the road, they will stop the vehicle until the caribou move off. If other wildlife are standing on the road, then the driver will stop for up to 20 minutes, then proceed slowly to encourage the wildlife to move off the road.

8.5 MANAGEMENT FOR THE WINTER ICE ROAD

The WIR is planned to be operated from January through April of each year.

- If a driver observes a caribou (or other large mammal) within 500 m of any road, the driver will slow to 40 km/hr, alert other drivers, and proceed with caution.
- If a driver observes that caribou (or other large mammal) are within 50 m of the road and moving towards the road with the intention to cross it, then the vehicle will stop, the driver will alert the Environment Department, and will proceed when the animals have crossed the road and moved off; alternatively, after 20 minutes the driver may proceed slowly if animals have not made their road crossing.
- If caribou are resting on the road, then the driver will wait until the animals have moved off on their own.

Should unforeseen circumstances require operation of the WIR after April 15th, then some additional management will be conducted to protect Beverly/Ahiak caribou that may cross the WIR during spring migration:

- The WIR will be temporarily closed by the Environment Manager should collar information, results of caribou surveys or incidental observations indicate that groups of caribou are lingering near the road or moving towards the road with the intention to cross the WIR.
- Should a driver make an incidental observation that large groups of caribou are attempting to cross the road, the driver will stop, report the observation to the Environmental Manager – who will dispatch an environmental monitor and may close the road.
- To reduce the frequency of traffic on the WIR that may deter caribou from crossing, trucks may be grouped into convoys during the spring migration.

- If a driver observes that caribou are within 500 m of the road and moving towards the road with the intention to cross it, then the vehicle will stop, the driver will alert the Environment Department, and will proceed either when the animals have crossed the road and moved off or proceed at slow speed after a wait of 20 minutes.
- If a driver observes caribou at a distance greater than 500 m of the WIR and moving towards the road then they will alert the Environment Department, slow to 40 km/hr, and proceed with caution.

8.6 MANAGEMENT FOR THE AIRSTRIP

- Prior to aircraft landing on the airstrip, a visual inspection will be conducted to identify the presence of any wildlife on the airstrip. Small groups of wildlife will be escorted off the airstrip; the flight crew will be notified by radio that such action is taking place and aircraft will not be approved to land until the airstrip is clear.
- If groups of greater than 25 caribou are observed on the airstrip then no action will be taken. If the wildlife cannot be escorted from the airstrip within a reasonable length of time, the flight crew will be instructed to divert to another location.

8.7 MANAGEMENT OF WILDLIFE INCIDENTS

- All incidents between vehicles and wildlife must be reported to the environmental department whether they are:
  - near miss incidents;
  - collision with injury to the wildlife; or
  - wildlife mortality.
- Each incident will be investigated and measures taken to avoid reoccurrence. Disciplinary measures will be taken against any employee if the investigation concludes that the accident is the result of negligence.
- In the case of the accidental death of an animal, environment personnel will contact the Government of Nunavut Wildlife Officer, KIA Senior Lands Manager, and the Hunters and Trappers Organization office in Kugluktuk and Cambridge Bay to discuss what to do with the carcass. The default action will be to remove the carcass from the road for community use or incinerate it to avoid attracting scavengers, such as wolves, grizzly bear, Arctic fox, and/or wolverine.

More information on wildlife protection measures can be found in the Wildlife Mitigation and Monitoring Program Plan (Version 7; submitted with FEIS Addendum February 2017).

Wildlife monitoring will be incorporated into current wildlife tracking according to the terms and conditions of current land use permits. This includes a log of sightings that detail wildlife observed, estimate of numbers, and nearest kilometre marking along the all-weather or WIR. The data will be aggregated and reported in the annual Wildlife Effects Monitoring Program Report. Additional details can be found in the Wildlife Mitigation and Monitoring Program Plan (Version 7; submitted with FEIS Addendum February 2017).

Refer to Section 4.1.7 for measures to protect fish and fish habitat.

9. Adaptive Management

The Plan will be updated again prior to Construction if instructed to do so by the NWB during the licensing process. The Plan will be reviewed on a regular basis to incorporate any lessons learned, major changes to facility Operations or maintenance, and environmental monitoring results. Any updates to the RMP will be filed with the Annual Report submitted under the Type A Water Licence.

All employees will be informed of relevant updates and the updated RMP will be located in a designated area at each site.

Sabina will retain all raw data records and annual reporting for at least two years in digital format. The updated RMP, raw data, and annual reporting will be made available by Sabina at all times for review by the lands and waters inspectors, the NWB, and Environment and Climate Change Canada.

This plan represents an adaptive approach to understanding the effects of the Project on the landscape and the species that live there. In this context, the Plan is part of a continually evolving process that relies not only on the efficacy of data collection and analytical results, but is also dependent on feedback from the communities, government, Aboriginal groups, and the public. Having an adaptive and flexible program allows for appropriate and necessary changes to the design of monitoring studies, and the mitigation and monitoring plans. Some changes may come about through the observation of unanticipated effects or inadequacies in the sampling methods to detect measurable effects. Other changes may result from ecological knowledge acquired through working with Aboriginal community members and discussions with Elders, both in the field and through workshops.

Sabina is committed to considering and incorporating Traditional Knowledge into the Plan. The incorporation of Traditional Knowledge will occur throughout all stages of the Plan, including identification of mitigation measures, monitoring study design, data collection, and follow-up programs to obtain feedback.

10. Reclamation

Reclamation of the haul and service roads will follow the completion of mining. In some instances, progressive reclamation will lead to roads being reclaimed after they are no longer needed. As described in the Interim Closure and Reclamation Plan, the service roads should be the last mining component to be reclaimed. For additional information related to closure refer to Section 7.1.3.

Decommissioning of the roads will involve restoring natural drainage, which will be accomplished by removing all culverts, bridges, and other potential obstructions to drainage paths. Any slopes where there is potential for erosion will be stabilized. Stabilization measures may require pulling back of side-cast fills on locally steep slopes or buttressing and/or re-contouring of steepened slopes using non-acid generating material. Refer to the Interim Closure and Reclamation Plan for additional details on the closure of roads.

A Vegetation Monitoring Plan (Appendix H to the Interim Closure and Reclamation Plan [SD-26]) was submitted as part of the FEIS Addendum (February 2017). The Vegetation Monitoring Plan will be updated to include all commitments discussed throughout the Review of the Project, including commitments to consult with the Kitikmeot Inuit Association, the Government of Nunavut, and other relevant parties. The plan will be submitted to the Nunavut Impact Review Board and other authorizing agencies at least 90 days prior to construction of the WIR.

11. References

DFO (Fisheries and Oceans Canada). 2010. Protocol for Winter Water Withdrawal from Ice-Covered Waterbodies in the Northwest Territories and Nunavut. June 2010.

DFO. 2013. Advice, Measures to Avoid Causing Harm to Fish and Fish Habitat.

Environment Canada. 2011. *Analysis and Air Quality Section: National Air Pollution Surveillance Program (NAPS).* http://www.ec.gc.ca/rnspa-naps/ (accessed July 2013).

GNWT DoT (Department of Transportation of Northwest Territories). 1993. G Environmental Guidelines for the Construction, Maintenance and Closure of Winter Roads in the Northwest Territories. October 1993.

GNWT DoT. 2015. Guidelines for Safe Ice Construction. February 2015.

GN (Government of Nunavut Department of Environment). 2014. Environmental Guidance for Dust Suppression on Unpaved Roads. Available online: http://env.gov.nu.ca/sites/default/files/guideline_-_dust_suppression_on_unpaved_roads_2014.pdf. April 2014.

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

Roads and Transportation Association Canada. 1986. Manual of Geometric Design Standards for Canadian Roads.

Tibbitt to Contwoyto Winter Road Joint Venture, Winter Road Regulations and Rules of the Road, current version.

Transport Canada. 2015. Aerodromes Standards and Recommended Practices (TP 312) 5th Edition. Revised July 2015.

Appendix A. Applicable Legislation

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Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (1999 c.33)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2003-307) Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301) Federal Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands or Aboriginal Lands Regulations (SOR/97-10) Fuels Information Regulations, No. 1 (SOR/C.R.C., c. 407) Sulphur in Diesel Fuel Regulations (SOR/2002-254) Sulphur in Gasoline Regulations (SOR/99-236)	Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Canada Water Act (1985 c.11)		
Canada Wildlife Act (1985 w9)	Wildlife Area Regulations (C.R.C., c. 1609)	
Species at Risk Act (2002 c.29)		(Eskimo Curlew – endangered)
Migratory Birds Convention Act (1994 c.22)	Migratory Birds Regulations (C.R.C., c. 1035) Migratory Bird Sanctuary Regulations, [C.R.C., c.1036]	Avoidance Guidelines: • Reducing Risk to Migratory Birds • Technical Information • Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada • Birds at Sea • General Nesting Periods of Migratory Birds in Canada

Acts	Regulations	Guidelines
Fisheries Act (1985, c. F-14)	Metal Mining Effluent Regulations (SOR/2002-2222) Applications for Authorization Under Paragraph 35(2)(B) of the Fisheries Act Regulations Aquatic Invasive Species Regulations (SOR/2015-121) Regulations Establishing Conditions for Making Regulations Under Subsection 36(5.2) of the Fisheries Act (SOR/2014-91)	Fisheries Protection Policy Statement Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut Implementing the New Fisheries Protection Provisions under the *Fisheries Act* - Discussion Paper General Fish-out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters Freshwater Intake End-of-Pipe Fish Screen Guideline Standard Operating Procedure – Clear Span Bridges
Explosives Act (1985 c.E-17)	Ammonium Nitrate and Fuel Oil Order (C.R.C., c. 598) Explosives Regulations (C.R.C., c. 599)	
Navigation Protection Act (R.S. 1985 c. N-22, s. 1; 2012, c.31, . 316)	Navigable Waters Bridges Regulations (C.R.C., c. 1231) Navigable Waters Works Regulations (C.R.C., c. 1232)	List of Scheduled Waters (Schedule in the Act)
Transport of Dangerous Goods Act (1992, c. 34)	Transportation of Dangerous Goods Regulations (SOR/2001-286)	
Territorial Lands Act (R.S. *1985, c. T-7)*	Northwest Territories and Nunavut Mining Regulations (C.R.C., c. 1516) Territorial Lands Regulations (CRC, c 1525) Territorial Land Use Regulations (CRC, c 1524) Territorial Quarrying Operations, [C.R.C., c. 1527] Northwest Territories Mining District and Nunavut Mining District Order	Northern Land Use Guidelines: Administrative Process
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002, c.10)	Nunavut Waters Regulations (SOR/2013-69)	
Nunavut Act (1993 c.28)	Nunavut Archaeological and Paleontological Sites Regulations (SOR/2001-220)	
Nunavut Land Claims Agreement Act (1993, c.29)		

Acts	Regulations	Guidelines
Territorial		
Environmental Protection Act (RSNWT (nu) 1988, c E-7)	*Spill Contingency Planning and Reporting Regulations* (NWT Reg (Nu) 068-93) The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport. Asphalt Paving Industry Emission Regulations, R.R.N.W.T. 1990 c. E-23	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates Guideline for the Management of Waste Antifreeze Guideline for the Management of Waste Batteries Guideline for the Management of Waste Paint Guideline for the Management of Waste Solvents Guideline for Industrial Projects on Commissioner's land Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil
Historical Resources Act RSNWT (Nu) 1988, c. H-3)		
Wildlife Act (RSNWT (Nu) 1988, c W-4)	*Wildlife General Regulations* (NWT Reg (Nu) 026-92) *Wildlife Licences And Permits Regulations* (NWT Reg (Nu) 027-92) *Wildlife Management Barren-Ground Caribou Areas Regulations* (NWT Reg (Nu) 099-98) *Wildlife Management Grizzly Bear Areas Regulations* (NWT Reg (Nu) 155-96) *Wildlife Management Zones Regulations* (RRNWT (Nu) 1990 c W-17) *Wildlife Regions Regulations* (NWT Reg (Nu) 108-98) Critical Wildlife Areas Regulations, R.R.N.W.T. 1990 c. W-3 Polar Bear Defence Kill Regulations, N.W.T. Reg. 037-93 Wildlife Management Muskox Areas Regulations, R.R.N.W.T. 1990 c. W-11 Wildlife Management Polar Bear Areas Regulations, R.R.N.W.T. 1990 c. W-13 Wildlife Sanctuaries Regulations, R.R.N.W.T. 1990 c. W-20 Wildlife Preserves Regulations, R.R.N.W.T. 1990 c. W-18	

Acts	Regulations	Guidelines
Territorial Parks Act (RSNWT (Nu) 1988, c T-4)	*Territorial Parks Regulations* (RRNWT (Nu) 1990 c T-13)	
Scientists Act (RSNWT (Nu) 1988 c S-4)	*Scientists Act Administration Regulations* (NWT Reg (Nu) 174-96)	
Commissioner's Land Act (RSNWT 1988, c C-11)	*Commissioner's Airport Lands Regulations* (NWT Reg (Nu) 067-97) *Commissioner's Land Regulations* (RRNWT 1990, c C-13)	
Mine Health And Safety Act (SNWT (Nu) 1994, c 25)	*Mine Health And Safety Regulations* (NWT Reg (Nu) 125-95) Mine Health and Safety Regulations, amendment, Nu. Reg. 016-2003	
Workers' Compensation Act (RSNWT, 1988, c. W-6)	*Workers' Compensation General Regulations* (Nu Reg 017-2010)	
All-Terrain Vehicles Act (RSNWT (Nu) 1988, c A-3)	*All-Terrain Vehicles Regulations* (RRNWT (Nu) 1990 c A-1)	
Apprenticeship, Trade And Occupations Certification Act (RSNWT (Nu) 1988, c A-4)	Apprenticeship, Trade And Occupations Certification Regulations (RRNWT (Nu) 1990 c A-8) Occupation Designation Order, N.W.T. Reg. 026-96 Trade Advisory Committees Order, R.R.N.W.T. 1990 c. A-9 Trade Designation Order, R.R.N.W.T. 1990 c. A-10	
Electrical Protection Act (RSNWT (Nu) 1988, c E-3)	*Electrical Protection Regulations* (RRNWT 1990 c. E-21)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	*Explosives Regulations* (RRNWT (Nu) 1990 c E-27)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990 c F-12) Propane Cylinder Storage Regulations, N.W.T. Reg. 094-91	
Hospital Insurance And Health And Social Services Administration Act (RSNWT 1988, c T-3)	Territorial Hospital Insurance Services Regulations (RRNWT (Nu) 1990 c T-12) Baffin Regional Health and Social Services Board Order, N.W.T. Reg. 059-98 Hospital Standards Regulations, R.R.N.W.T. 1990 c. T-6	
Labour Standards Act (RSNWT (Nu) 1988, c L-1)	*Various*	
Motor Vehicles Act (RSNWT (Nu) 1988, c M-16)	*Large Vehicle Control Regulations* (RRNWT (Nu) 1990 c M-30) *Motor Vehicle Registration And Licence Plate Regulations* (RWT Reg (Nu) 054-94)	

Acts	Regulations	Guidelines
Petroleum Products Tax Act (RSNWT (Nu) 1988, c P-5)	*Petroleum Products Tax Regulations* (RRNWT (Nu) 1990 c P-3)	
Public Health Act (RSNWT (Nu) 1988, c P-12)	*Camp Sanitation Regulations* (RRNWT (Nu) 1990 c P-12) *General Sanitation Regulations* (RRNWT (Nu) 1990 c P-16) *Public Water Supply Regulations, R.R.N.W.T. 1990 c. P-23* *Public Sewerage Systems Regulations, R.R.N.W.T. 1990 c. P-22*	
Public Highways Act (RSNWT (Nu) 1988, c P-13)	*Highway Designation And Classification Regulations* NWT Reg (Nu) 047-92)	
Safety Act (RSNWT 1988, c.S-1)	*General Safety Regulations, Amendment NU Reg 021-2000* (RRNWT (Nu) 1990 c S-1) Asbestos Safety Regulations, N.W.T. Reg. 016-92 General Safety Regulations, R.R.N.W.T. 1990 c. S-1 Safety Forms Regulations, N.W.T. Reg. 102-91 Silica Sandblasting Safety Regulations, N.W.T. Reg. 015-92 Work Site Hazardous Materials Information System Regulations, R.R.N.W.T. 1990 c. S-2	
Transportation Of Dangerous Goods Act (1990. RSNWT (Nu) 1988, c 81 (Supp))	*Transportation Of Dangerous Goods Regulations* (1991, NWT Reg (Nu) 095-91)	Emergency Response Assistance Plans (ERAPs)

Applicable Legislation and Guidelines for the Back River Project