Back River Project

Llama and Umwelt Lake Dewatering Plan

VERSION #1.0

Prepared by:
ENVIRONMENT
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1.0 INTRODUCTION

B2Gold Nunavut (B2Gold Nunavut) is submitting this dewatering plan (hereinafter referred to as the "Plan") for the dewatering of Llama and Umwelt lakes at least 60 days prior to the initiation of dewatering to the Nunavut Water Board (NWB) for approval per the requirements of Part E, Item 14 of Water Licence 2AM-BRP1831 (the Licence). This Plan will become an appendix of B2Gold Nunavut's (B2G) approved Water Management Plan.

As outlined in B2Gold Nunavut's approved applications to the Nunavut Impact Review Board (NIRB; Project Certificate No. 007), Nunavut Water Board (Water Licence 2AM-BRP1831), and Fisheries and Oceans Canada (DFO; Fisheries Authorization Number NU-12-007), Llama Lake will be dewatered to facilitate the Project's open-pit construction and mining operations and Umwelt Lake will be dewatered to facilitate construction of the Project Saline Water Pond. During dewatering, water from both Llama and Umwelt lakes will be discharged to Goose Lake, the natural downstream waterbody, or to the Primary Pond to be utilized as start-up water for the Back River Project Process Plant. Dewatering discharge criteria for discharge to the environment are specified in the Water Licence and water treatment may be required ensure these criteria are not exceeded.

B2Gold Nunavut's initial applications to the NIRB, NWB and DFO indicated that, after dewatering, approximately 50% of Llama Lake, site contact water (effluent) would be directed to the partially dewatered lake, converting it to Llama Reservoir and making the remaining water to be discharge 'effluent'. However, B2Gold Nunavut no longer plans to direct any effluent to either lake prior to, or during, dewatering (WSP 2022). B2Gold Nunavut will not be depositing any deleterious substances into either Llama or Umwelt lakes.

A fish-out program was conducted in 2023 at both of Llama and Umwelt lakes and associated tributaries and tributary ponds in anticipation of 2024 dewatering. The Fish-Out Plan was developed in alignment with DFO's *General Fish-Out Protocol for Lakes and Impoundments in the Northwest Territories and Nunavut* (Tyson et al. 2011), incorporated feedback from local communities, Hunters and Trappers Organizations, and the Kitikmeot Inuit Association (KIA), and was undertaken with DFO authorization (Fisheries Authorization Number NU-12-007).

B2Gold Nunavut's various already-approved applications considered and described the Project dewatering needs, timing of the open water season, fish out activities, the potential for erosion, and surface water quality and hydrology effects. In consideration of these potential environmental effects, this Plan has been developed to outline in greater detail how the dewatering will be undertaken to minimize and manage potentially adverse environmental effects.

In addition to complying with the requirements of Water Licence 2AM-BRP1831, dewatering plan requirements issued by the Wek'èezhìi Land and Water Board (WLWB) under Water Licence W2020L2-0004 for the dewatering of Lynx Lake and Point Lake at the Ekati project and the recently approved Point Lake Dewatering Plan (Arctic Canadian Diamond Company Ltd. 2022; approved by the WLWB on June 27, 2022) were also considered. This Plan reflects best practices used by others during successful dewatering activities as well as consideration of site-specific conditions, pumping rates, and relevant project-specific requirements, such as those outlined in the Licence.

2.0 DEWATERING VOLUMES

Water Licence 2AM-BRP1831 limits the volume of dewatering to 1,400,000 m^3 annually. This volume is estimated to be sufficient to allow the dewatering of compliant water from both Llama Lake (with a natural capacity of 1.13 (million cubic meters (Mm^3)) and Umwelt Lake (0.24 Mm^3) as well as associated tributaries and tributary ponds, while allowing for natural variability and seasonal recharge. An overview of each lake including their respective bathymetry is provided in Figures 1 and 2.

For both lakes, Stage 1 (dewatering of compliant raw water) of pumping will be comprised of discharging Llama and Umwelt water to Goose Lake without treatment. At some point (anticipated to be when approximately 50%

of the water has been discharged from each lake), drawdown effects may increase Total Suspended Solids (TSS) to a point that may exceed Licence discharge criteria.

When raw water no longer meets TSS discharge criteria, Stage 2 of dewatering (dewatering of compliant treated water) may be initiated and would entail treatment of the water for TSS prior to discharge to Goose Lake. Alternately, Stage 3 of dewatering may be initiated, with the storage of non-compliant water in either Llama or Umwelt Lakes or in the Primary Water Pond or another water management structure.

If water treatment is undertaken (Stage 2), it is anticipated that TSS in the Llama and Umwelt will continue to increase over time to a point where treatment is no longer practical or sufficiently effective. At that time, Stage 3 of pumping would be initiated.

Depending on process water start up requirements and timing, water from Llama and Umwelt lakes may be directly or indirectly (via the Primary Pond) be used by the Process Plant.

3.0 SCHEDULE

Based on the pump rates (see Section 4 below) and anticipated volumes to be discharged (see Section 1 above), dewatering of Llama Lake is anticipated to take between 5-10 weeks and Umwelt Lake is anticipated to take 6-10 weeks. Discharge period and length may be influenced by factors such as freshet start, fish monitoring access, transient variations in water quality, equipment maintenance, weather, or pump use priority at site.

Discharge infrastructure will be constructed in advance of the initiation of dewatering. Centrifugal pumps will be placed on the lake edge, within containment, with suction hoses suspended in the water column to minimize entrainment of lakebed sediments. This infrastructure will be retrieved at the completion of pumping, either in late September/early October (if ice conditions safely permit) or during the following open water season .

4.0 PUMPING METHODS AND PIPELINE, INTAKE, AND OUTFLOW STRUCTURE DESIGN

Centrifugal pumps with self-contained mobile diesel-powered generators with internal fuel tanks will be located within secondary containment on the lake shores with intake hoses suspended in the water column. Refueling of the pumps will be conducted by fuel truck and a visual inspection of the fuel transfer area and generators will be conducted during each refuelling event.

Water uptake pipes will be equipped with screens to prevent the entrainment of debris. If required based on fish presence and DFO guidance, water intakes may be further screened to prevent possible entrainment or impingement of fish. Volumes of all water discharged will be monitored with the use of flowmeters sized to the pipeline and will be calibrated per manufacturer specifications.

The dewatering infrastructure, pumps, and pipe alignments for each stage of pumping are depicted in Figure 3. Once dewatering is complete, dewatering discharge pipelines and pumps will be removed if safe to do so otherwise will be retrieved in the following open water season.

During Stage 1 and 2 of discharge, compliant water (whether raw or treated, respectively) from Llama and Umwelt lakes and tributary ponds will be discharged to Goose Lake. This water will not require treatment to meet discharge criteria. Water from Llama Lake and the tributary ponds will likely be discharged to Goose Lake via Umwelt Lake, which is the natural downstream waterbody from Llama Lake and upstream waterbody from Goose Lake. To minimize erosion and sediment suspension in the receiving environment, water will be discharged to areas of rocky substrate along natural lake outflows. If necessary, additional rock or other Best Management

Practices (BMPs) may be utilized to further reduce suspended solids and erosion, including, but not limited to, geotextile fabrics and filter materials. These materials may be placed along discharge points to further diffuse flow.

The lakes will be dewatered to allow the development of an open pit (at Llama) and the Saline Water Pond (at Umwelt). During Stage 3 of pumping, non-compliant water will be either stored in Llama or Umwelt lakes, pumped to the Primary Water Pond to be used as Process Plant source water, or pumped to another suitable water management facility for storage.

Once Llama Lake dewatering is complete, lake bottom sediments within the Llama Open Pit boundaries will be excavated and placed in the Umwelt Waste Rock Storage Area (WRSA) footprint.

5.0 MAXIMUM PUMP RATES

To minimize natural re-filling of the lakes and ensure the mine schedule is not jeopardized, pumping rates must be sufficient to dewater both Llama and Umwelt lakes within a single open water season while minimizing potential impacts. B2Gold Nunavut intends to discharge at a rate no greater than 10% of Goose Lake's average peak freshet discharge rate of 231,000 m3/day to ensure pumping impacts on flow are within system tolerances and natural variability.

Based on these requirements, the maximum targeted pump rate will be 963 m3/hr (10% of 231,000 m3/day) with actual expected pump rates to fall within 750-963 m3/hr . Pumps and piping to be utilized have been selected to ensure attainment of these pump rates.

5. Erosion Prevention Measures and Inspection Procedures

Erosion and sediment suspension are primary impacts of potential concern related to dewatering activities. For this reason, dewatering discharge will be directed to the natural outflows of Llama and Umwelt areas already naturally scoured of soft sediments by natural lake discharge and which can provide natural energy diffusion. Specifically, rocky areas within these natural channels will be selected to further diffuse flow and minimize erosion and sediment suspension. Additionally, maximum pump rates have been tied to natural discharge rates to ensure they are within system tolerances (see Section 4).

To confirm effective mitigation, daily visual inspections of the area surrounding the discharge point will be conducted as well as at the entry point of the water into Goose Lake. Should monitoring indicate concerning or unexpected erosion, additional mitigation may be implemented. These measures may include adjustment of discharge location, placement of armour rock, rip rap, geotextile or other BMPs to further reduce and/or disperse flow, installation of sediment control measures along the flow path to Goose Lake reduce suspended solids, or reductions in flow rates (to the extent practical within the timing constraints previously identified).

6. Hydrological and Water Quality Impacts and Mitigation Measures

Hydrological impacts related to this dewatering were characterized and assessed during the Environmental Impact Assessment (EIA) and water licencing processes for the Back River Project. Full details can be found in B2Gold Nunavut's applications to the NIRB, NWB, and DFO.

The environmental assessment considered the cumulative annual volume of water to be dewatered (1.4 Mm3), the large natural volume of Goose Lake (36.4 Mm3) to which this water would be discharged, the fact that dewatering will occur over an extended period of the open water season, and that the discharge rate will be tied to the natural outflow rates historically observed at Goose Outflow. The impact assessment concluded that the impacts to both lake and stream surface water hydrology would be low in magnitude if change was less than 10% of baseline flow (for streams) or volume (for lakes), as is the case for the dewatering discharge volumes proposed herein.

Potential water quality impacts were similarly initially characterized and assessed in the application to the NIRB and NWB. These impacts were subsequently further characterized in revisions to the Back River Project Water and Load Balance Report (WLBR), the most recent version of which was submitted to the NWB in August of 2022 (WSP 2022). The WLBR predicts that water quality will remain within discharge requirements, with the exception of TSS, which is anticipated to increase to a point of requiring treatment approximately halfway through the dewatering. At that point, water treatment could be initiated (Stage 2) to remove TSS and allow continued compliant discharge. The WLBR also predicts that the effects of the discharge of this water to Goose Lake will be a decrease (i.e. a dilution) of Goose Lake water quality concentrations of metals, major ions, and total suspended solids (WSP 2022).

Non-compliant water will not be released to the environment. Instead, this water will be stored in Primary Pond (for use by the Process Plant), left in Umwelt Lake, or placed in another water management structure. The Primary Pond has a capacity of 0.435 m3 and is designed to accommodate the high suspended solids.

6.0 WATER QUALITY MONITORING

6.1 SCHEDULE AND LOCATIONS

Water quality monitoring will be conducted to ensure water quality is within predicted concentrations, treatment capacity (should treatment be undertaken), and water licence discharge criteria.

During dewatering, water samples will be collected as prescribed in the Water Licence. This includes sampling of raw water from Llama Lake (station BRP-02) and Umwelt Lake (BRP-06) as well as the dewatering discharge at the point of release (Goose Lake Discharge; BRP-01). Llama Lake (station BRP-02) and Umwelt Lake (BRP-06) will be sampled weekly for TSS to confirm continued compliance with discharge criteria. For the Goose Lake Discharge (BRP-01), required sampling parameters and frequencies from the Licence have been consolidated in Table 6.1-1 below. Per Part I, Item 18 of the Licence, these sampling results are reported monthly to the NWB in the monthly report.

Water sampling ports will be installed in the dewatering lines to facilitate water sampling. Water will also be collected near the point of entry into Goose Lake and may be sampled from the shore of Llama and Umwelt Lakes.

B2Gold Nunavut will undertake additional sampling beyond the above requirements to ensure water quality is suitable for discharge. This sampling will include daily operational sampling of discharge water for TSS and/or turbidity once a TSS measurement of at least half the discharge criteria is received, as well as the collection of samples from Llama and Umwelt Lakes once prior to the initiation of discharge to confirm water quality relative to discharge requirements.

Finally, water quality of Goose Lake will also be monitored as part of the Back River Project Aquatic Effects Monitoring Program (AEMP). The results of this program are analyzed and reported annually to the NWB. Sediment quality and biological effects of the Project are also monitored under the AEMP on a three-year cycle. B2Gold Nunavut has committed to initiating this biological sampling within a year of dewatering to verify dewatering impact predictions.

Table 6.1-1 Dewatering Discharge Water Quality Sampling Parameters and Frequencies (BRP-01)

Paramter(s)	Frequency
pH, specific conductivity, and temperature.	Weekly during dewatering
Flow datalogger, calculated volume	
TSS, total cyanide, total arsenic, total copper, total lead, total nickel, total zinc, and radium-226	
Conventional: turbidity, hardness, alkalinity, calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate, total dissolved solids (measured and calculated), TSS, total cyanide, free cyanide, and weak acid dissociable (WAD) cyanide. Nutrients: ammonia, un-ionized ammonia, nitrate, nitrite, total phosphorus (TP), and dissolved organic carbon. Total and dissolved metals: aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, phosphate, selenium, silver, strontium, thallium, uranium, and zinc Other: when required, lab pH and Conductivity	Four times during dewatering, at the same time as the weekly samples
Acute toxicity (Rainbow Trout and *Daphnia magna*)	Once per month during dewatering, at the same time as the sampling for general chemistry
Sublethal toxicity (Fathead Minnow or Rainbow Trout[a], Ceriodaphnia dubia, Lemna minor, Pseudokirchneriella subcapita)	Once per month during dewatering, at the same time as the sampling for general chemistry

a) B2 Gold anticipates selecting Rainbow Trout as the test species of fish.

6.2 WATER QUALITY ACTION LEVELS

Dewatering water quality discharge criteria for discharge to Goose Lake are outlined in Part D, Item 26 of the Licence. They require that dewatering discharge (whether treated or untreated) not exceed:

Parameter	Maximum Average Concentration	Maximum Authorized Concentration in a Grab Sample
TSS (mg/L)	15	30
Turbidity (NTU)	15	30
Aluminium (mg/L)	1.5	3.0
pH	Between 6.0 and 9.5	Between 6.0 and 9.5

Based on the WLBR results (WSP 2022), TSS will be used as the indicator for when (or if) water treatment will be and/or when dewatering to Goose Lake would cease. Daily operational water sampling of TSS will be initiated once a TSS reaches 50% of the discharge criteria (i.e. 50% of 15 mg/L average concentration and/or 30 mg/L grab sample concentration). A second response threshold will be set at 90% of the TSS discharge criteria. If

this threshold is exceeded, pumping will be stopped to investigate and address the cause prior to resumption of dewatering to Goose Lake.

It is anticipated that TSS will increase as water level lowers. Daily operational TSS and/or turbidity sampling data collected from the discharge point (BRP-01) as well as Licence-required sampling TSS results will be used to monitor TSS trends. To reduce data turn around-times associated with having samples analyzed off-site, operational TSS samples may be analyzed on site. These TSS samples will be collected in parallel with field measurements of turbidity to allow the development of a site-specific TSS-turbidity relationship if desired, at which time operational sampling may be continued solely with the use of turbidity data, allowing an even more rapid response to changing conditions.

Transient spikes in TSS may also occur due to processes such as sloughing of the lake basin with drawdown, heavy rainfall (and associated terrestrial runoff), or high winds. Should such spikes be observed, pumping would be discontinued until an inspection of the source lake basin has been conducted to identify possible causes and allow resettling of sediments. Once two consecutive daily operational TSS samples below the discharge criteria are obtained, discharge may be resumed.

7.0 FLOW MONITORING

Flow rates and volumes discharged to Goose Lake will be measured with the use of flow meters installed in the discharge pipes and will be recorded daily during pumping. Flow data will be reported monthly per the requirements of the Water Licence.

8.0 OTHER CONSIDERATIONS

To avoid potentially adverse effects on fish related to the reduced natural discharge in the outflows of Llama and Umwelt lakes resulting from the dewatering of the lakes and associated potential for increased fish and egg stranding, all potential fish use (migration, spawning, rearing, and egg incubation) has been prevented by the installation of permanent fish barriers at the migratory pathway from Goose Lake into Umwelt Lake Outlet. Barriers were constructed at the Llama Lake Outflow, and well as the Umwelt Lake Outflow at the limit of the southern flowing downstream end where the stream connects to eastern flows toward Goose Lake (see Figure 3).

9.0 REFERENCES

WSP 2022. Back River Project Water and Load Balance Report. August 2022.

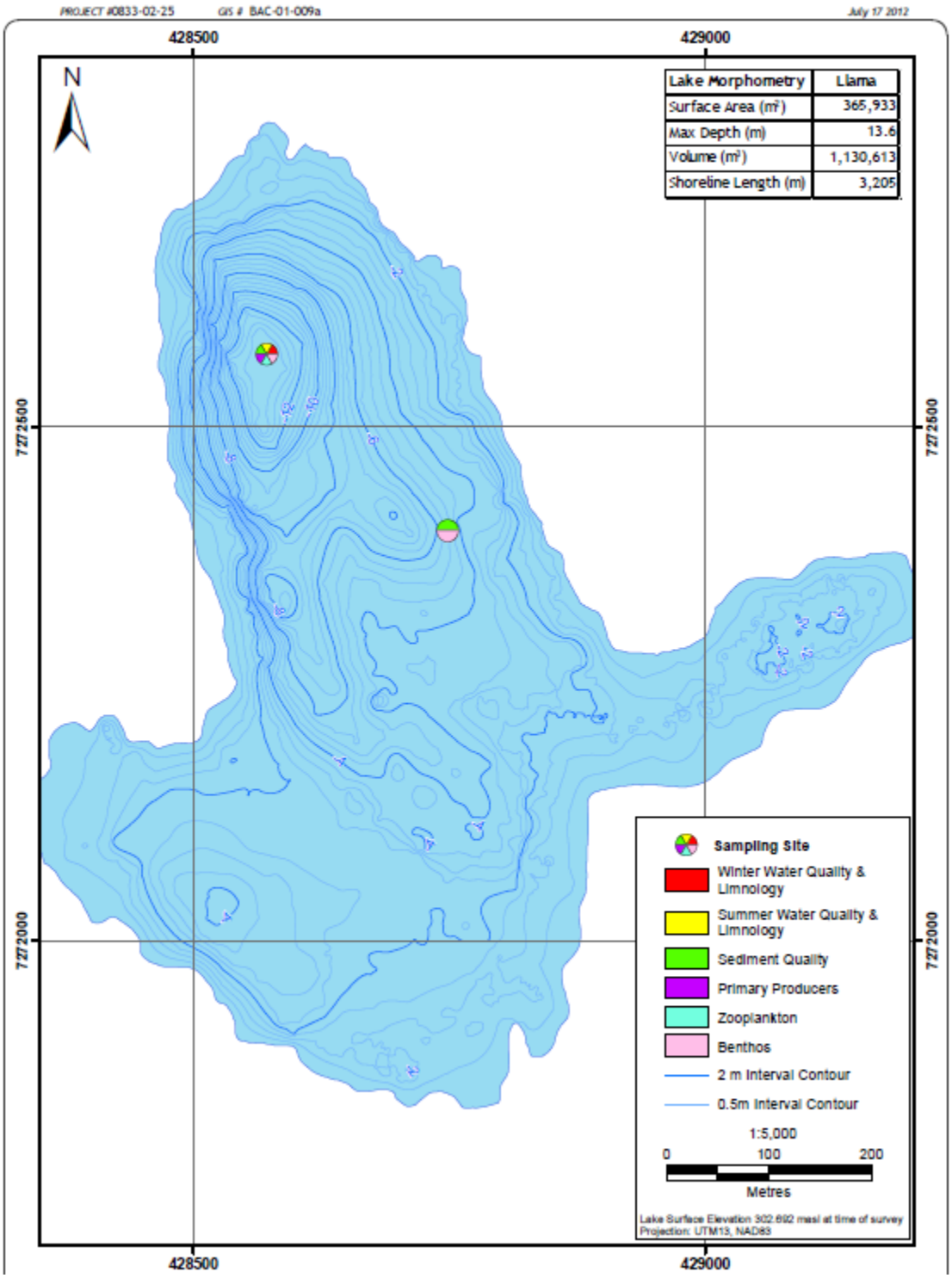

Figure 1. Llama Lake Bathymetry

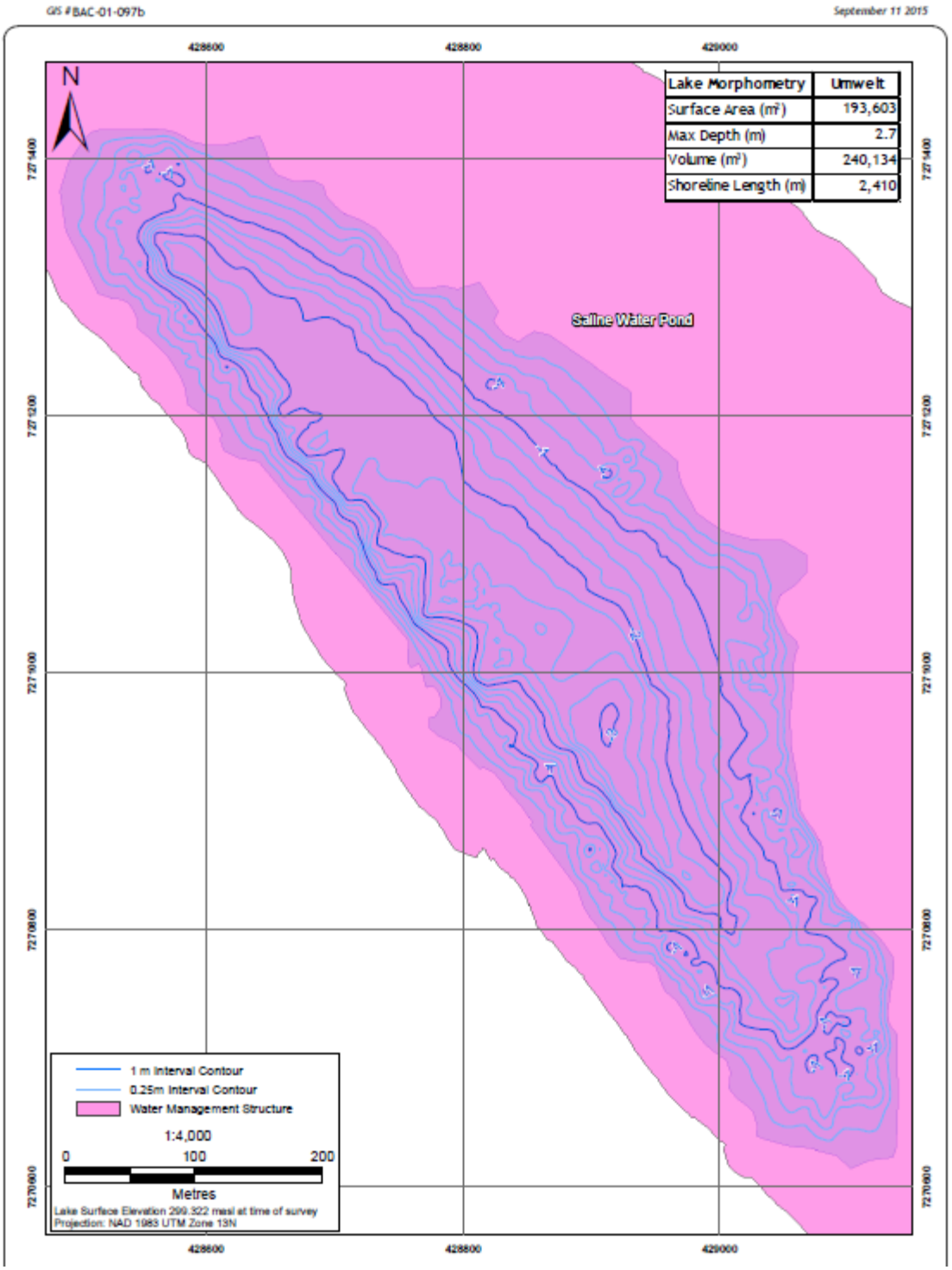

Figure 2. Umwelt Lake Bathymetry

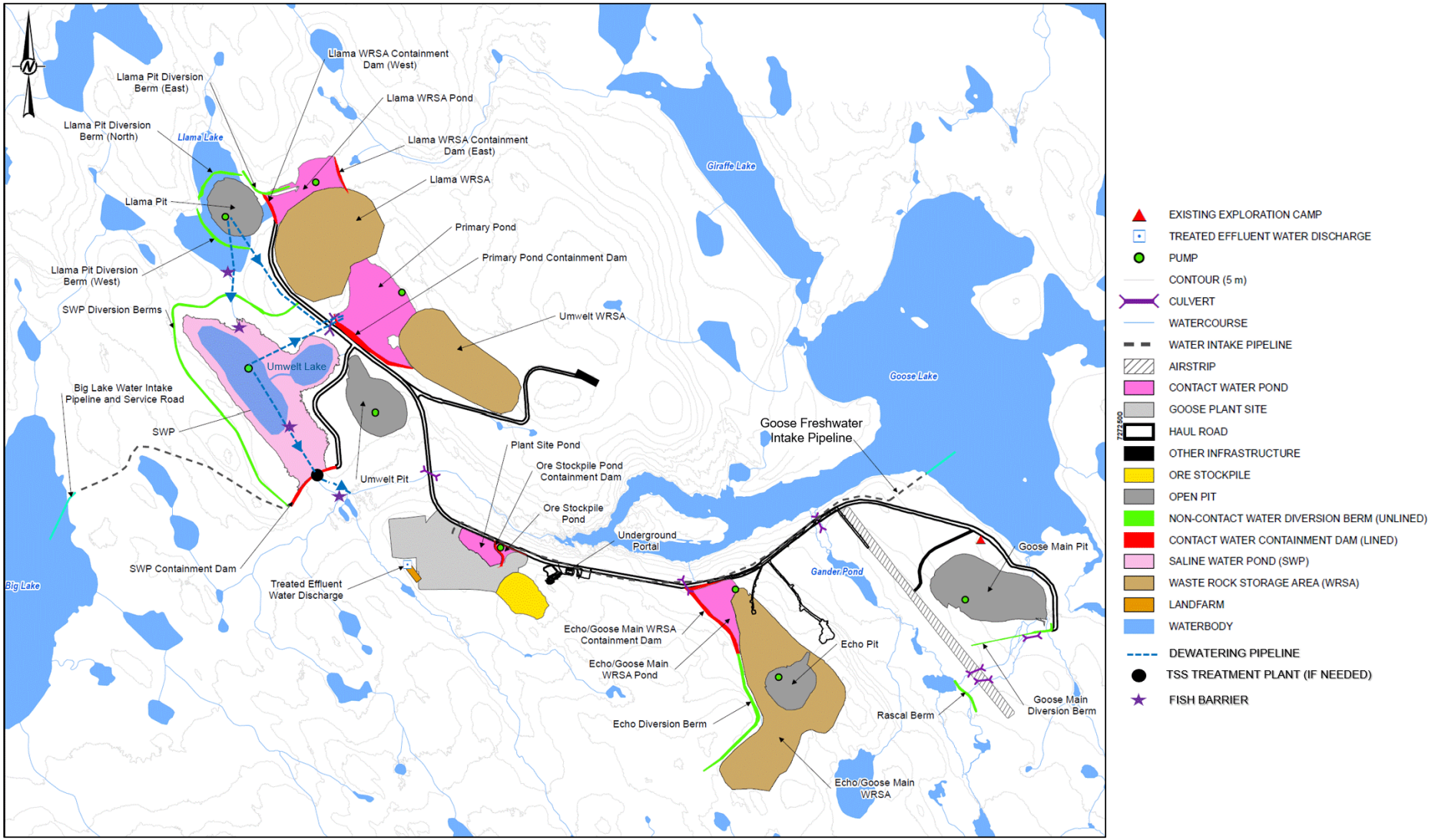

Figure 3. Dewatering Overview