REPORT

Back River Project

Water and Load Balance Report

Submitted to:
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Executive Summary

Sabina Gold & Silver Corp. (Sabina) is developing the Back River Project (Project) gold mine within the west Kitikmeot region of southwestern Nunavut, 95 km southeast of the southern end of Bathurst Inlet. The Project is comprised of two main areas: the Goose Property and the Marine Laydown Area. The Project entails mining of approximately 18.7 million tonnes of ore from both open pit and underground methods at the Goose Property. The total mine life of the Project from Construction to the end of Closure is approximately 25 years.

As part of its commitment under Type A Water Licence (2AM-BRP1831), Sabina has agreed to submit an updated water management plan to the Nunavut Water Board (NWB) for review following the commencement of Operations. This report presents the methods and results of the water and load balance model (Model) developed for the Goose Property to support the 2022 Water Management Plan (WMP; Sabina 2022).

The Model was created to provide water quantity and quality estimates based on the Project timeline, water management plans, and available input data. The Model can be used as a tool to analyze water management options and treatment needs that would be potentially required during the life of the Project. The water management strategy focuses on managing the inventory of the mine water stored on site, and maximizing the separation of saline, contact, and non-contact water. Water quality predictions were evaluated in open pits, tailings facilities, storage ponds and at predefined prediction nodes. Relevant results were compared to Metal and Diamond Mining Effluent Regulations discharge limits (Government of Canada 2002).

The Model results demonstrated that there is sufficient capacity on site to store tailings slurry, contact water, and saline water for the Project life. The volume of water collected was also confirmed to be adequate to support the water demands for the Process Plant when supplemented by the freshwater from Goose Lake and Big Lake while staying within their maximum consumption limits. With the support of treatment during late Operations and Closure, concentrations in discharge from the mine site to Goose Lake are predicted to be below Metal and Diamond Mining Effluent Regulations discharge limits.

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1.0 INTRODUCTION

Sabina Gold & Silver Corp. (Sabina) is developing the Back River Project (Project) gold mine within the west Kitikmeot region of southwestern Nunavut, 95 km southeast of the southern end of Bathurst Inlet. The Project is comprised of two main areas: the Goose Property and the Marine Laydown Area. The Project entails mining of approximately 18.7 million tonnes of ore from four deposit areas (i.e., Echo, Umwelt, Llama, and Goose Main) at the Goose Property using both open pit and underground methods. The total mine life of the Project from Construction to the end of Closure is approximately 25 years.

As part of its commitment under Type A Water Licence (2AM-BRP1831), Sabina has agreed to submit an updated water management plan to the Nunavut Water Board (NWB) for review following the commencement of Operations. This report presents the methods and results of the water and load balance model (Model) developed for the Goose Property to support the 2022 Water Management Plan (WMP; Sabina 2022), which includes the following:

A summary of the Goose Property mine plan, including timelines, infrastructure, and water management plan (Section 2.0);

- A description of the water balance component framework (Section 3.0);
- A description of the load balance component framework (Section 4.0);
- Model implementation (Section 5.0);
- Water balance results (Section 6.0);
- Load balance results (Section 7.0);
- Limitations of the Model (Section 8.0); and
- Conclusions (Section 9.0).

2.0 MODEL FRAMEWORK

GoldSim is a graphical, object-oriented, mathematical modelling program where all input parameters and functions are defined by the user and built as individual objects or elements linked together by mathematical expressions. The object-based nature of the program is designed to facilitate an understanding of the various factors that control an engineered or natural system and predict potential changes in the system.

GoldSim was selected as a modelling platform for the following reasons:

- It facilitates probabilistic simulations, allowing descriptive statistics and probabilities to be assigned to the model outputs.
- The model framework can be easily adjusted to account for changing conditions of the mine site, allowing the model to be used as a planning tool.
- Water balance (i.e., quantity) and load (i.e., quality) components of the Model can be directly linked, allowing both to be updated simultaneously when conducting sensitivity scenarios for alternate water management strategies.

The GoldSim Model was developed to be used as a tool to analyze water management options during the life of the Project at the Goose Property; water management options focused on managing the inventory of the mine water stored on site, and maximizing the separation of saline, contact, and non-contact water. When required, treatment of mine water discharges was also assessed to meet water quality guidelines downstream of the discharge points from the Goose Property.

A detailed description of the water management plan can be found in the 2022 WMP (Sabina 2022). This subsection provides an overview of the major infrastructure at the Goose Property, as well as the timelines for key water management activities and development sequencing.

2.1 Mine Infrastructure

The major infrastructure at the Goose Property is shown in Figure 1 which includes the following:

- Goose Plant Site (i.e., Goose Camp Accommodations and Process Plant);
- Ore Stockpile;
- Open pits and underground mine workings (i.e., Echo, Umwelt, Llama, and Goose Main open pits and undergrounds);
- Tailings management facilities (i.e., Echo Open Pit as Echo Tailings Facility [TF], Umwelt Open Pit as Umwelt TF, and Llama Open Pit as Llama TF);
- Waste Rock Storage Areas (WRSAs) (i.e., Umwelt WRSA, Llama WRSA, and Echo/Goose Main WRSA);
- Goose Property All-weather Airstrip;
- Saline Water Pond (SWP) (i.e., Umwelt Lake, once dewatered);
- Primary contact water storage pond (i.e., Primary Pond);
- Goose Main Reservoir (i.e., Goose Main Open Pit as meromictic lake);

- Event ponds (i.e., Llama WRSA Pond, Echo/Goose Main WRSA Pond, Plant Site Pond, Ore Stockpile Pond);
- Non-contact water diversion structures; and
- Haul and service roads.

2.2 Mine Schedule and Mine Phases

Water management throughout the mine life is described in a series of phases:

- Phase 1: Construction (Year -3 to Year -1)
- Phase 2: Operations (Year 1 to Year 15)
- Phase 3: Closure (Year 16 to Year 22)
- Phase 4: Post-Closure (Year 23+)

The Operations Phase (Phase 2) is further subdivided into three stages, representative of the different active Tailings Facility:

- Phase 2: Operations, Echo Open Pit (Echo TF) (Year 1, Q1 to Year 3, Q2)
- Phase 2: Operations, Umwelt Open Pit (Umwelt TF) (Year 3, Q3 to Year 6, Q3)
- Phase 2: Operations, Llama Open Pit (Llama TF) (Year 6, Q4 to Year 15, Q4)

An overview of the timelines for the various water management elements is provided in APPENDIX A and is illustrated conceptually by flow diagrams in APPENDIX B. A summary of the key water management activities and mine development sequencing for the Project is provided in Table 1.

Table 1: Summary of the Key Water Management Activities at the Goose Property

Phase/Stage	Mine Year	Mine Development Sequence and Key Activities
Phase 1: Construction	-3	▪ Water intake infrastructure is constructed at Goose Lake and Big Lake to meet the freshwater demands for domestic, construction, operation, and associated uses, including mining and milling activities. ▪ The Plant Site Pond and Ore Stockpile Pond are constructed at the Goose Plant Site. ▪ Construction of the Primary Pond, and Echo WRSA Pond begins. ▪ Pre-stripping of Echo Open Pit and Umwelt Open Pit begins.
	-2	▪ Echo Open Pit mining begins (production starts Q1). Waste rock is placed in Echo WRSA; contact water runoff from Echo WRSA is collected in the Echo WRSA Pond and pumped to the Primary Pond, as required. ▪ Contact water in the Ore Stockpile Pond is pumped to the Primary Pond. ▪ Umwelt Open Pit mining begins (starts Q2), and inflows are pumped to the Primary Pond. Waste rock is placed in Umwelt WRSA; contact water runoff from Umwelt WRSA is collected in the Primary Pond. ▪ Contact water from the Plant Site is collected in the Plant Site Pond, then released to the tundra.

Table 1: Summary of the Key Water Management Activities at the Goose Property

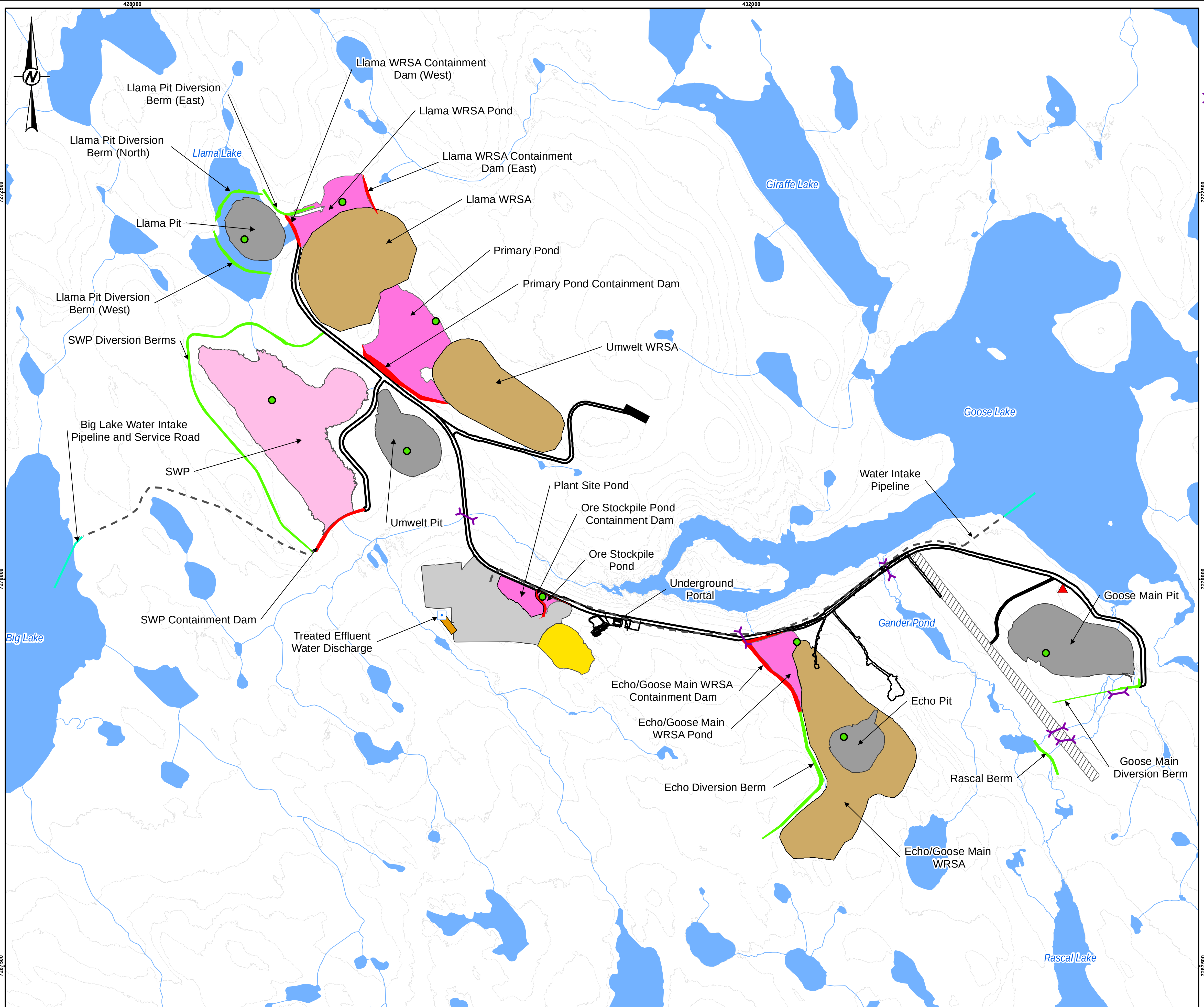
Phase/Stage	Mine Year	Mine Development Sequence and Key Activities
Phase 1: Construction (cont'd)	-1	▪ Llama Lake is dewatered fully during the open water season (i.e., Q3), with approximately 50% of the volume dewatered directly to Umwelt Lake, ultimately flowing to Goose Lake. The remaining 50% volume is expected to have high total suspended solids (TSS) and will be treated prior to discharge into Umwelt Lake. ▪ Umwelt Lake is dewatered fully during the open water season (i.e., Q3), with approximately 50% of the volume dewatered to Goose Lake. The remaining 50% volume is expected to have high TSS and will be treated prior to discharge into Goose Lake. ▪ Pumping of site contact water to the Primary Pond continues, with exception to the Plant Site Pond, which is released to the tundra. ▪ Echo Open Pit mining and deposition of waste rock in Echo WRSA is complete. ▪ Umwelt Underground decline begins (Q1).
Phase 2: Operations, Echo TF Active	1	▪ Milling operations begin and tailings are deposited in Echo TF. ▪ Contact water from the Ore Stockpile Pond and Echo WRSA Pond are pumped to Echo TF. ▪ The Llama WRSA containment dams are built, which create the Llama WRSA Pond. ▪ Mining of Llama Open Pit begins (pre-stripping in Q1 and ore production in Q2). Waste rock is placed in Llama WRSA; contact water runoff from Llama WRSA is collected in the Llama WRSA Pond and pumped to the Primary Pond, as required. ▪ Umwelt Open Pit mining and deposition of waste rock in Umwelt WRSA is complete (Q4). ▪ Underground production starts at Umwelt (Q4) and Llama undergrounds (pre-stripping Q2 and ore production Q4). ▪ Saline groundwater inflows encountered at Llama Open Pit are pumped to the Saline Water Pond, along with saline groundwater inflows from Umwelt and Llama undergrounds. ▪ The Primary Pond collects contact water across the Goose Property, including flows collected in the Llama WRSA Pond, runoff from Umwelt WRSA, and inflows to Umwelt Open Pit. The collected contact water is used as reclaim in the Process Plant. ▪ Runoff from the Plant Site is collected in the Plant Site Pond, which is released to the tundra.
	2	▪ A non-contact water diversion berm, the Goose Main diversion berm, is constructed south of Goose Main Open Pit to divert water away from the facility and into Goose Lake. ▪ Goose Main Open Pit pre-stripping begins. ▪ Mining continues in Llama Open Pit, Umwelt Underground, and Llama Underground. ▪ The contact water collected in the Primary Pond or Echo TF is used as reclaim in the Process Plant. ▪ Saline groundwater inflows encountered continue to be pumped to the SWP.

Table 1: Summary of the Key Water Management Activities at the Goose Property

Phase/Stage	Mine Year	Mine Development Sequence and Key Activities
Phase 2: Operations, Echo TF Active (cont'd)	3 (ends Q2)	▪ Mining continues in Llama Open Pit, Umwelt Underground, and Llama Underground. ▪ Pre-development activities of Goose Main Open Pit continues. ▪ The contact water collected in the Primary Pond or Echo TF is used as reclaim in the Process Plant. ▪ Umwelt Open Pit starts to fill with site contact water within its catchment and stored to be used as reclaim in the Process Plant.
Phase 2: Operations, Umwelt TF Active	3 (starts Q3)	▪ Mining continues in Llama Open Pit, Umwelt Underground, and Llama Underground. Goose Main Open Pit mining begins (Q3). ▪ Tailings deposition transitions from Echo TF to Umwelt TF (Q3). ▪ Contact water from the Echo WRSA Pond and Ore Stockpile Pond are pumped to Umwelt TF. ▪ Saline groundwater encountered is pumped to the SWP, and treated by reverse osmosis, sending brine effluent back to the SWP (or Llama TF) and treated effluent to Umwelt TF until Goose Main Open Pit becomes available to receive saline water for permanent storage. ▪ The contact water collected in the Primary Pond or Umwelt TF is used as reclaim in the Process Plant.
	4	▪ Water management strategies beginning Year 3, Q3 continue.
	5	▪ Llama Open Pit mining and deposition of waste rock in Llama WRSA is complete, and the open pit starts to fill with site contact water (Q2). ▪ Other water management strategies from Year 4 continue.
	6 (ends Q3)	▪ Goose Main Underground decline begins and Llama Underground mining complete (Q1). ▪ Other water management strategies from Year 5 continue.
Phase 2: Operations Llama TF Active	6 (starts Q4)	▪ Mining continues in Goose Main Open Pit, and Umwelt Underground. ▪ Tailings deposition transitions from Umwelt TF to Llama TF. ▪ Saline groundwater is stored in the SWP and treated by reverse osmosis. Brine effluent from the reverse osmosis unit will be deposited back in the SWP or Llama TF until Goose Main Reservoir becomes available to receive saline water. ▪ If additional saline water capacity is required beyond the available volume in the SWP, saline water can be temporarily in the SWP or stored permanently in Umwelt Underground. The contact water collected in the Primary Pond or Umwelt TF is used as reclaim in the Process Plant.
	7	▪ Goose Main Underground mining begins and saline groundwater encountered is pumped to the SWP (Q3). ▪ Water management strategies from Year 6, Q4 continue.
	8-12	▪ Water management strategies from Year 6, Q4 continue.

Table 1: Summary of the Key Water Management Activities at the Goose Property

Phase/Stage	Mine Year	Mine Development Sequence and Key Activities
Phase 2: Operations Llama TF Active (cont'd)	12	▪ When Goose Main Open Pit mining is complete, saline water is no longer added to SWP and is instead routed to Llama TF for temporary storage (Q4).
	13	▪ Water from the SWP, Umwelt TF (when no longer used as reclaim for the Process Plant), and Llama TFs are treated and transferred to Goose Main Open Pit (then called Goose Main Reservoir) to support closure filling and will represent the final repository of permanent saline water storage. ▪ Saline groundwater encountered is pumped to Goose Main Reservoir. ▪ Recirculation treatment of Umwelt and Llama TFs begins. ▪ Echo Underground mining begins (pre-stripping Q2, and ore production starts Q4). ▪ Goose Main Underground mining complete.
	14-15	▪ Umwelt Underground and Echo Underground mining complete. ▪ Recirculation treatment of Umwelt and Llama TFs begins and other water management strategies from Year 13 continue.
Phase 3: Closure	16-22	▪ Umwelt and Llama TFs discharges by gravity to the SWP (then called Umwelt Treatment Pond) for treatment prior to discharge to Goose Lake. ▪ Water in the Umwelt Treatment Pond is treated prior to discharge to Goose Lake until end of Closure (Year 22, Q4). ▪ Goose Main Reservoir and Umwelt TF are actively filled with freshwater from Goose Lake or Big Lake; Llama Open Pit passively fills. Water in Goose Main Reservoir will start being treated prior to discharge to environment in Year 19 and will continue until end of Closure (Year 22, Q4). ▪ All water management structures are decommissioned. ▪ The Goose Airstrip Culvert crossing will be removed, and the Goose Airstrip will be decommissioned.
Phase 4: Post-Closure	23+	▪ Subject to runoff meeting discharge limits. WRSAs and open pits passively runoff/spillover.



LEGEND

- EXISTING EXPLORATION CAMP
- TREATED EFFLUENT WATER DISCHARGE
- PUMP
- CONTOUR (5 m)
- CULVERT
- WATERCOURSE
- WATER INTAKE PIPELINE
- AIRSTRIP
- CONTACT WATER POND
- GOOSE PLANT SITE
- HAUL ROAD
- OTHER INFRASTRUCTURE
- ORE STOCKPILE
- OPEN PIT
- NON-CONTACT WATER DIVERSION BERM (UNLINED)
- CONTACT WATER CONTAINMENT DAM (LINED)
- SALINE WATER POND (SWP)
- WASTE ROCK STORAGE AREA (WRSA)
- LANDFARM
- WATERBODY

0 750 1,500

1:25,000 METRES

REFERENCE(S)

FOOTPRINT DERIVED BY GOLDER FROM FILES OBTAINED FROM SABINA AUG. 2021, OCT. 2021 AND FEB. 2022. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA MODIFIED BY GOLDER. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 13N DATUM: NAD 83

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DESIGNED	SC
PREPARED	SG/NB
REVIEWED	PC
APPROVED	PC

CLIENT
Sabina

CONSULTANT
WSP GOLDER

PROJECT
SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
GOOSE PROPERTY AREA – POTENTIAL DEVELOPMENT AREA AND LAYOUT

PROJECT NO.	FIGURE	REV.
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3.0 WATER BALANCE MODEL DESCRIPTION

3.1 Water Balance Overview

The water balance component of the Model is based on mass balance principles, available hydrology monitoring data, mining and production schedules, and the water management plan, with consideration of geochemistry data. The Model tracks all inputs, outflows, and available storage at the Project site which include:

Water Inputs: saline groundwater inflows from open pits (i.e., Llama Open Pit) and the underground mines (Llama, Goose Main, and Echo), and precipitation in the form of direct precipitation and surface runoff.

Water Storage: contact water ponds, saline water ponds, open pits, underground mine workings, and tailings void spaces.

Water Output: discharge such as pumped contact/saline water to treatment or contact/saline water storage facilities, open pit overflow, evaporation, and seepage.

The cumulative water storage is calculated for each specified time step in a simplistic form using the following equation:

$$Water\ Storage\ (m^3) = Water\ Input\ (m^3) - Water\ Output\ (m^3) \quad (3.1)$$

The water storage calculated for each time step is added to the water storage at the previous time step.

Direct precipitation and surface runoff are calculated as a function of precipitation, where the runoff coefficient accounts for losses such as evapotranspiration, infiltration, and seepage (for waste rock storage areas only). Direct precipitation and surface runoff can be represented as follows:

$$Direct\ Precipitation\ (m^3) = Water\ Surface\ Area\ (m^2)\ x\ Runoff\ Coefficient\ (unitless)\ x\ Precipitation\ (m) \quad (3.2)$$

$$Surface\ runoff\ (m^3) = Land\ Surface\ Area\ (m^2)\ x\ Runoff\ Coefficient\ (unitless)\ x\ Precipitation\ (m) \quad (3.3)$$

3.2 Water Balance Inputs

3.2.1 Hydrology

The Model's hydrological inputs are based on the hydrological analysis for the Project (SRK 2021). Site-specific and regional precipitation data were analyzed to estimate annual precipitation for the Project which included a correction for undercatch based on published data from Environment and Climate Change Canada for the region (details are provided in SRK 2021).

The mean annual precipitation (MAP) for the Project was estimated to be 427 mm/year. As described in Section 3.1, runoff is a function of precipitation, and can be further defined as rainfall runoff and snowmelt runoff. Snowmelt is generated predominantly by the melting of accumulated snowpack and is concentrated during the period of spring freshet. The snowmelt is simulated in the model when the average temperature (T) rises above a base temperature (T_b) and is calculated using the following equation:

$$Snowmelt = Melt\ factor\ x\ (T - T_b) \quad (3.4)$$

A melt factor (M_f) of 3.3 mm/ºC and base temperature (T_b) of 0ºC were applied, based on previous local studies (SRK 2015). Average daily temperatures (T) previously derived for the Project were also applied (SRK 2020).

The mean annual lake evaporation for the Project was estimated to be 324 mm/year. Table 2 summarizes the monthly distribution of precipitation, evaporation, and temperature estimates for the Project. Table 3 summarizes the frequency analysis of annual precipitation used to evaluate water volumes for a range of hydrological conditions (i.e., wet, average, and dry). Climate change projections were also applied as described in Section 3.2.2.

Table 2: Summary of Mean Hydrological Inputs and Monthly Distributions

Month	Precipitation		Evaporation		Average Air Temperature (°C)
	Distribution (%)	Mean (mm)	Distribution (%)	Mean (mm)	
January	4.7	27.9	0	0	-28.7
February	4.1	23.3	0	0	-26.6
March	5.9	30.3	0	0.1	-25.1
April	6.2	28.9	1.8	5.9	15.6
May	6.4	30.0	8.0	25.8	-5.1
June	9.8	40.9	29.8	96.4	5.4
July	12.5	43.2	33.1	107	11.4
August	18.2	63.4	20.3	65.8	9.3
September	11.4	41.8	6.9	22.4	2.3
October	9.7	40.8	0.1	0.4	-7.3
November	6.3	30.8	0	0	-18.4
December	4.8	26.0	0	0	-25.4
Annual	**100**	**427.3**	**100**	**323.8**	**-10.3**

Source: SRK 2021 (precipitation and evaporation, adjusted to fix rounding errors) and SRK 2020 (average air temperature, calculated from daily averages).

Table 3: Summary of Frequency Analysis Results

Hydrological Conditions	Return Period (yr)	Annual Precipitation (mm)
Wet	200	658
	100	628
	50	601
	20	561
	10	527
	5	486
Average	-	427
Dry	5	341
	10	306
	20	278
	50	247
	100	227
	200	209

Source: SRK 2021.

yr = year; mm = millimetre

3.2.2 Climate Change

A climate change analysis was completed for the Project in 2015 (SRK 2015b) which projected the rate of change in precipitation and temperature in the future on an annual basis. While most surface water management infrastructure will have short lifespans and be breached at Closure, open pits filled with tailings and saline water, and waste rock storage areas will remain in perpetuity and long-term climate change effects were considered. The long-term air temperature and precipitation projections used as inputs to the Model are provided in Table 4, based on trends from 1979 to 2005. Temperature and precipitation projections in the Model were linearly interpolated and centred for 2025, 2055, and 2085, with climate projections beyond 2085 assumed to remain constant.

Table 4: Climate Change Projections

Period	Change with Respect to Baseline (1979 to 2005)	
	Mean Annual Air Temperature (ºC)	Total Annual Precipitation (%)
2020s (2011-2040)	2.0	6.0
2050s (2041 – 2070)	3.7	11.0
2080s (2071 – 2100)	5.3	16.0

3.2.3 Catchment Delineation

Mine infrastructure and upstream catchments were delineated for the Project in previous studies and revised based off the most recent mine plan where applicable (KP 2021). In the Model, mine infrastructure reaches their final footprint as soon as the facility becomes active according to the project schedule (Section 2.2).

The delineated catchment areas and associated infrastructure are summarized in Table 5 and shown in Figure 2, including the road areas, where available. A total of 10 prediction nodes (PN) were included in the Model to assess the hydrology and water quality effects of the proposed development. The total area of mine infrastructure (including roads) at the Goose Property encompasses 3.65 km^2, which consists of 3.8% of the total Goose Lake watershed; however, the total extent of the affected area varies depending on the phase of the Project.

Table 5: Goose Property Catchment Areas and Associated Infrastructure Areas

Prediction Node Catchment	Catchment ID	Catchment Description	Area (m^2)		
			Local Catchment[(a)]	Infrastructure	Roads
01	PN01	Downstream of Propeller Lake outlet	6,486,915,430	-	-
02	PN02	At the outlet of Propeller Lake	108,970,650	-	-
03	PN03	Outlet of Goose Lake	10,495,030	-	87,929
04	PN04	West inlet of Goose neck	15,750,500	-	141,364
	LD1	Upstream of Llama diversion	173,728	-	-
	LD2	Upstream of Llama diversion	622,228	-	-
	LCP	Llama WRSA Pond surface	178,328	178,328	-
	LP1	Llama Open Pit ultimate surface	171,484	171,484	-
	LP	Upstream of Llama Open Pit	68,862	-	-[(b)]
	LL	Llama Lake	359,851	-	-

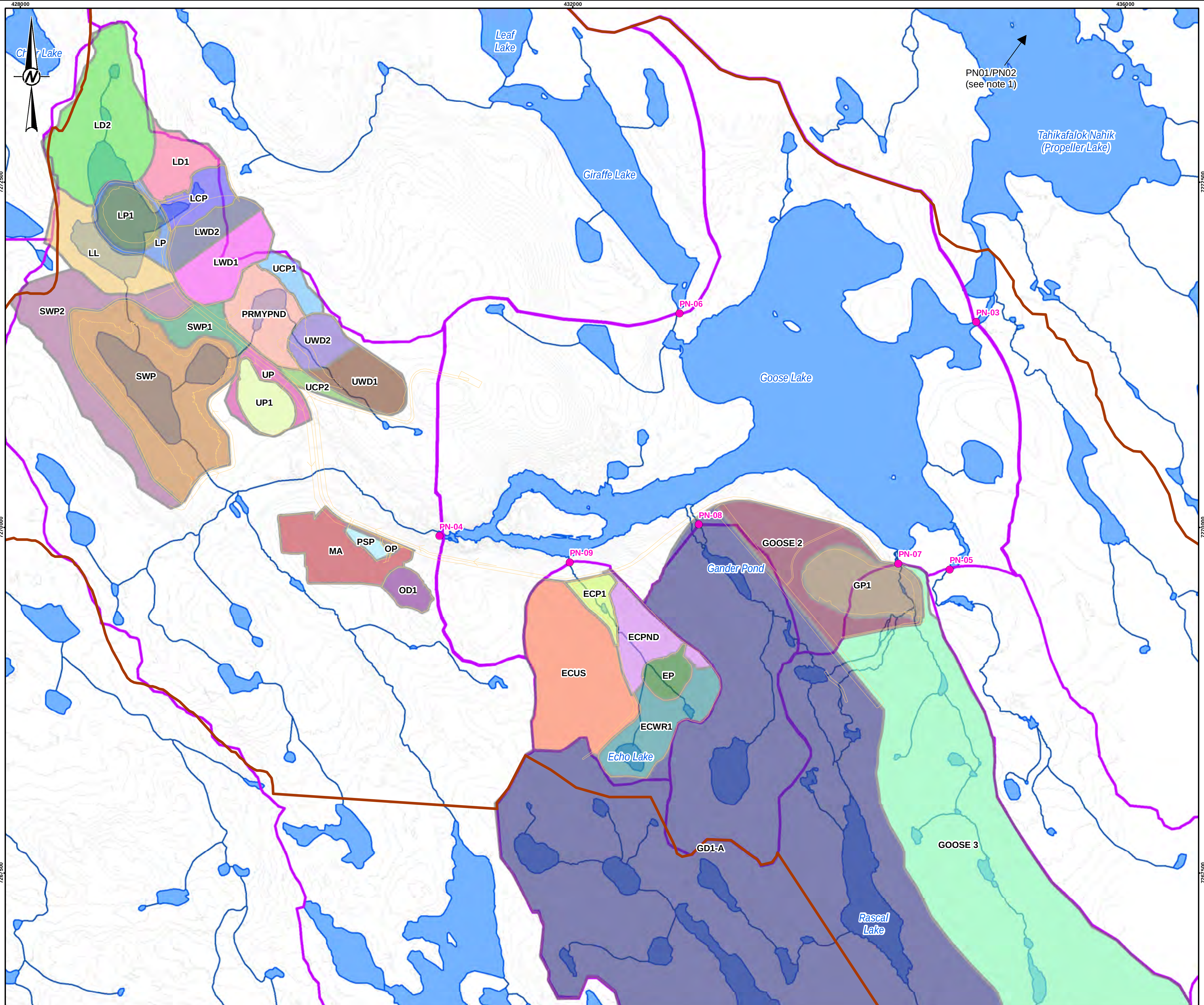
Table 5: Goose Property Catchment Areas and Associated Infrastructure Areas

Prediction Node Catchment	Catchment ID	Catchment Description	Area (m^2)		
			Local Catchment(a)	Infrastructure	Roads
04	LWD1	Llama WRSA	245,946	245,946	-
	LWD2	Llama WRSA	146,729	146,729	-
	SWP	SWP surface	833,186	833,186	-(b)
	SWP1	Upstream of SWP	289,813	-	-(b)
	SWP2	Upstream of SWP	437,722	-	-(b)
	UCP1	Upstream of Primary Pond	115,852	-	-
	PRMYPND	Primary Pond surface	234,931	234,931	-(b)
	UP	Upstream of Umwelt Open Pit	101,680	-	37,990
	UP1	Umwelt Open Pit ultimate surface	148,555	148,555	-
	UCP2	Upstream of Umwelt Open Pit	51,760	-	-
	UWD1	Umwelt WRSA	196,248	196,248	-
	UWD2	Umwelt WRSA	136,650	136,650	-
	MA	Goose Plant Site	140,935	140,935	-
	OP	Ore Stockpile Pond surface	5,860	5,860	-
	OD1	Ore Stockpile	-	88,911	7,710
	PSP	Plant Site Pond Surface	37,490	37,490	-
05	PN05	Discharge from Goose Main Open Pit	2,651,980	-	101,078
06	PN06	Outlet of Giraffe Lake	27,543,410	-	28,532
07	PN07	Upstream of PN05	35,266,910	-	-
	GOOSE2	Upstream of Goose Main Open Pit	445,998	-	-
	GOOSE3	Upstream of Goose Main Open Pit	2,797,933	-	-
	GP1	Goose Main Open Pit ultimate surface	251,323	243,906	7,417
08	PN08	Gander Pond outlet	1,794,650	-	45,067
	GD1-A	Goose Main diversion berm	34,156,852	-	-
09	PN09	Echo outlet	1,517,470	-	13,315
	ECP1	Echo WSRA Pond surface	80,771	80,771	-
	ECUS	Echo Pond diversion	708,494	-	-
	ECPND	Upstream of Echo Pond	239,099	-	-
	EP	Echo Open Pit ultimate surface	71,635	71,635	-
	ECWR1	Echo WSRA surface	378,381	378,381	-
10	PN10	Mam Lake Outlet	10,858,440	-	21,591

(a) Local catchment represents total area of the catchment as delineated in Figure 2; where applicable, the portions of the local catchment occupied by mine infrastructure and roads are provided

(b) Road network unavailable from KP (2021). For water and load balance purposes, this information will have little to no implication on model results.

m^2= square meter



LEGEND

- PREDICTION NODES
- CONTOUR (2 m)
- WATERCOURSE
- SITE INFRASTRUCTURE
- POTENTIAL DEVELOPMENT AREA
- PREDICTED NODE CATCHMENT
- WATERBODY

CATCHMENT

- ECP1 - Echo/Goose Main WRSA Pond
- ECPND - Upstream of Echo WRSA Pond
- ECUS - Echo Diversion Berm
- ECWR1 - Echo/Goose Main WRSA
- EP - Echo Pit
- GD1-A - Upstream of Goose Main Pit (Diverted)
- GOOSE 2 - Upstream of Goose Main Pit (Partially Diverted)
- GOOSE 3 - Upstream of Goose Main Pit (Diverted)
- GP1 - Goose Main Pit Ultimate Surface Area
- LCP - Llama WRSA Pond
- LD1 - East Llama Lake Diverted
- LD2 - West Llama Lake Diverted
- LL - Llama Lake around Llama Pit Diverted
- LP - Llama Pit
- LP1 - Llama Pit Ultimate Surface Area
- LWD1 - South Llama WRSA
- LWD2 - North Llama WRSA
- MA - Goose Main Plant Site
- OD1 - Ore Stockpile
- OP - Ore Stockpile Pond
- PRMYPND - Primary Pond Surface Area
- PSP - Plant Site Pond Surface Area
- SWP - Saline Water Pond
- SWP1 - Upstream of SWP
- SWP2 - Upstream of SWP Diverted
- UCP1 - Upstream of Primary Pond
- UCP2 - Upstream of Primary Pond
- UP - Umwelt Pit
- UP1 - Umwelt Pit Ultimate Surface Area
- UWD1 - South Umwelt WRSA
- UWD2 - North Umwelt WRSA

0 750 1,500

1:28,000 METRES

NOTE(S)

1. PN02 IS LOCATED AT PROPELLER LAKE OUTLET AND PN01 IS DOWNSTREAM OF PROPELLER LAKE OUTLET.

REFERENCE(S)

FOOTPRINT DERIVED BY GOLDER FROM FILES OBTAINED FROM SABINA AUG. 2021, OCT. 2021 AND FEB. 2022. HYDROGRAPHY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA MODIFIED BY GOLDER. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 13N DATUM: NAD 83

YYYY-MM-DD	2022-08-29
DESIGNED	SC
PREPARED	SG/NB
REVIEWED	PC
APPROVED	PC

CLIENT: Sabina

CONSULTANT: WSP GOLDER

PROJECT
SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
GOOSE PROPERTY CATCHMENTS

PROJECT NO.	FIGURE	REV.
21505757	2	0

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

3.2.4 Site Specific Hydrology

Local hydrometric stations are installed at the prediction nodes mentioned in Section 3.2.3. As described in the Hydrology Report (SRK 2015c), some stations experience significantly higher unit flows than others due to catchments spilling over into adjacent catchments during high flows. The equivalent area transferred from one catchment to the adjacent catchment is provided in Table 6, which include:

PN10 to PN04; however, the overflow is contained by Llama diversion berms when in place (see Figure 1).

PN06 to PN04; however, the overflow is contained by Llama diversion berms when in place (see Figure 1).

PN05 to PN08; however, the overflow is contained by Goose Main diversion berm when in place (see Figure 1).

Table 6: Site-Specific Hydrology Inputs

Overflows from	Transferred to	Equivalent Area Transferred
PN10	PN04	2.2 km^2
PN06	PN04	2.2 km^2
PN05	PN08	3.1 km^2

Source: SRK 2015c.

Km^2 = square kilometer

3.2.5 Runoff Coefficients

In the Model, runoff coefficients were set to incorporate evapotranspiration, infiltration, and seepage losses (for waste rock storage areas only) to surface water runoff in the hydrologic system. Specific runoff coefficients were assigned to each area depending on its surface cover. Since the Project is located in a continuous permafrost zone, the thermal state of the waste rock deposited was considered which assumed the waste rock storage areas were in the unfrozen state until the first frost after waste rock placement was initiated, and then frozen thereafter. The runoff coefficients applied to each surface cover are presented in Table 7, which were adopted from previous studies (SRK 2020).

Table 7: Runoff Coefficient by Surface Cover

Surface Cover	Runoff Coefficient (Unitless)
Undisturbed Area	0.36
Waste Rock Storage Area (Unfrozen)	0.30
Waste Rock Storage Area (frozen)	0.60
Open Pit Wall Area	0.80
Underground/Industrial Pads Area	0.30
Road Surface Area	0.30
Ponded Area	1.00

3.2.6 Milling Quantities and Freshwater Demand

The Project consists of open pit and underground mining that will feed a whole-ore leach Process Plant. Ore will be stockpiled at the Goose Plant Site two years prior to commissioning of the Process Plant to generate a stockpile for mill feed. The Process Plant will then be operational for 15 years, processing a total of 18.7 million tonnes of ore. Table 8 summarizes the milling production rates during Operations, which were used in the Model as an input in conjunction with the tailings parameters in Table 9 to calculate tailings solids produced, water lost to tailings voids, reclaim water demand, freshwater demand, and the tailings storage capacity.

Table 8: Milling Production Rate

Mine Year	Production Rate (tonnes/day)
Year -3 to Year-1	-
Year 1, Q1	2,100
Year 1, Q2	2,400
Year 1, Q3	2,738
Year 1, Q4	3,042
Year 2, Q1 to Year 2, Q3	3,042
Year 2, Q4 to Year 13, Q1	4,056
Year 13, Q2	2,441
Year 13, Q3	1,636
Year 13, Q4	1,594
Year 14, Q1	1,788
Year 14, Q2	2,034
Year 14, Q3	1,987
Year 14, Q4	1,773
Year 15, Q1	1,311
Year 15, Q2	1,187
Year 15, Q3	1,397
Year 15, Q4	873

Source: provided by Sabina

Table 9: Tailing Parameters

Parameters	Value
Tailings Specific Gravity	3.1 tonne/m^3
Initial Dry Density	1.2 tonne/m^3
Ore Precent Solid	96.9%
Water Density	1.0 tonne/m^3
Tailings Slurry Solids Concentration	65%
Process Plant Fresh Water Requirement - Fraction of Total Process Water Demand	0.24

Source: provided by Sabina.

Freshwater requirements will be sourced from Goose Lake and Big Lake. Table 10 summarizes the freshwater consumption requirements for domestic and industrial use, excluding process water demand. For modeling purposes, the maximum water consumption from Goose Lake includes 1,500 m^3/day of freshwater year-round and an additional 400 m^3/day during the open water season for a total of 1,900 m^3/day. For Big Lake, water consumption requirements include 750 m^3/day of freshwater year-round for the life of the Project.

Table 10: Domestic and Industrial Freshwater Demands

Demand	Rate
Domestic Water Supply	300 m^3/day during Construction and Operations 15 m^3/day during the Active Closure Stage
Industrial Water Supply (excluding process water demand)	300 m^3/day during Construction and Operations (does not include Process Plant water)

Source: provided by Sabina

3.2.7 Permafrost and Groundwater

The Project is located in a continuous permafrost region of the Canadian Arctic. It is expected that Llama, Umwelt, Goose Main, and Echo underground developments will extend below the permafrost layer (i.e., at least 400 metres below the ground surface) into unfrozen soil and rock referred to as taliks. In addition, open pit mining at Llama Open Pit will occur underneath a large lake, which is also associated with taliks. Other developments (i.e., Umwelt, Echo, and Goose Main open pits) are expected to be fully within permafrost. Although, groundwater may flow through the top 1 to 3 m of overburden during unfrozen months, the volume of flow is likely insignificant in comparison to the surface water runoff. A summary of the estimated annual groundwater inflows for the mining developments that extend into unfrozen rock is presented in APPENDIX C (Table 1). The groundwater inflows for Scenario 1 (Table 1 of APPENDIX C) were used for the model simulation. As detailed in APPENDIX C, inherent uncertainties associated with the estimated groundwater inflows are always present until operational information can verify inflows. The estimate of the groundwater inflows will be refined as additional groundwater information becomes available during earlier stages of mine development. Also, as mentioned in APPENDIX C, strategies to reduce groundwater inflows, such as grouting of the faults, are identified.

4.0 LOAD BALANCE MODEL DESCRIPTION

4.1 Load Balance Overview

The load balance component of the Model was developed to evaluate the potential effects of the Project on water quality of the receiving environment. The Model was also used to inform optimal water management and identify water treatment requirements during all phases of the mine plan (i.e., Construction, Operations, and Closure). The Model was based on conservation of mass and does not consider geochemical reactions or physical processes such as settling and transport.

Mine components were treated as source terms (Table 11). For each source term, the constituent’s concentration was calculated based on humidity cell test (HCT) data, geochemical modelling, and extrapolation of monitoring data from geologically similar sites in the area.

Loading rates were generated based on the predicted corresponding flows in the water balance component of the Model. Loading rates in the load balance component of the Model were defined as:

- Direct loadings based on a defined input source term; or,

- Linked loadings from GoldSim reservoirs (representing open pits, ponds, lakes etc.).

Most often loading rates were direct loadings calculated using source term concentrations.

$$Loading\ Rate = Flow\ \times Source\ Term\ Concentration \tag{4.1}$$

Linked loading rates were used for flows from upstream facilities. They were derived using the calculated concentration in the GoldSim reservoir representing that facility and the associated flow from the upstream facility in the water balance.

$$Calculated\ Concentration_{GoldSim\ reservoir} = \frac{Mass_{Parameter}}{Volume_{GoldSim\ reservoir}} \tag{4.2}$$

$$Loading\ Rate = Flow \times Calculated\ Concentration_{GoldSim\ reservoir} \tag{4.3}$$

Loading rates provide a rate of which mass is being added to the receiving GoldSim reservoir, which is then divided by the volume of water in that reservoir to determine the concentration (Equation 4.2).

The Model also accounted for mass loading from reagent addition rates in the Process Plant and drilling brine in the underground developments.

Table 11: Summary of Source Terms Applied in the Load Balance Component of the Model

Source Term	Units	Applies to	Associated Mine Component	Mining Phase
Background surface water quality	mg/L	Undisturbed catchments, initial water quality in lakes, and non-contact runoff	Undisturbed catchment areas, Llama Lake dewatering, Umwelt Lake dewatering, Goose Lake withdrawals, non-contact runoff	Construction, Operations, Closure, and Post-Closure
Groundwater quality	mg/L	Groundwater inflows into open pits and underground mining	Llama Open Pit, Umwelt Underground, Llama Underground, Echo Underground, Goose Main Underground	Construction, Operations
Ore stockpile runoff	mg/L	Stockpile areas (all Project phases)	Ore Stockpile	Construction, Operations
Waste rock storage area runoff	mg/L	Waste rock surface areas	Umwelt WRSA, Llama WRSA, Echo/Goose Main WRSA	Construction, Operations, Closure, and Post-Closure
Pit wall runoff	mg/L	Pit wall areas below pit overflow elevation	Umwelt Open Pit, Llama Open Pit, Echo Open Pit, Goose Main Open Pit	Operations
			Umwelt Tailings Facility, Llama Tailings Facility, Echo Tailings Facility	Operations
High wall runoff	mg/L	Pit wall areas above pit overflow elevation	Umwelt Reservoir, Llama Reservoir, Goose Main Reservoir	Closure
Industrial pad runoff	mg/L	Process Plant area, roads, and underground pads	Process Plant area, roads, Umwelt Underground, Llama Underground, Echo Underground, Goose Main Underground	Construction, Operations, and Closure

Table 11: Summary of Source Terms Applied in the Load Balance Component of the Model

Source Term	Units	Applies to	Associated Mine Component	Mining Phase
Process water effluent	mg/L	Tailings slurry supernatant	Umwelt Tailings Facility, Llama Tailings Facility, Echo Tailings Facility	Operations
Blasting residue	mg/year	Ore, WRSAs, roads, and underground pads	Ore Stockpile, Umwelt WRSA, Llama WRSA, Echo/Goose Main WRSA, Umwelt Underground, Llama Underground, Echo Underground, Goose Main Underground	Construction, Operations
Brine residue	mg/year	Underground waste rock and ore	Umwelt Underground, Llama Underground, Echo Underground, Goose Main Underground	Operations, Closure

Note: mg/L = milligram per litre, WRSA = waste rock storage area.

4.2 Load Balance Inputs

Site-specific data, such as measured concentrations of background surface water and groundwater quality, were used as model inputs where available. Where data were not available, assumptions were used to simulate the complex interplay of climate, the geochemical characteristics of the rock materials, and the physical characteristics of the mine facilities (e.g., WRSAs and blasting residue). The modelling approach was consistent with industry practices and was appropriate for evaluating the potential effects associated with the Project. Actual contact water quality during Construction, Operations, Closure, and Post-Closure may differ from the predictions presented.

Model inputs and assumptions are presented in the following subsections and reflect the updates made to the Project's WMP (Sabina 2022).

4.2.1 Background Surface Water Quality and Lake Initial Water Quality

Golder compiled and analyzed water quality data collected at the Project Site from 2011 to 2018 (Golder 2019). Stream water samples were collected and analyzed during freshet and the remaining open water season. The median concentrations were used as inputs in the load balance component of the Model (APPENDIX D). Measurements below the detection limit were conservatively assumed to be equal to the detection limit, with the exception of mercury which was treated as half the detection limit.

Initial concentrations were assigned to Llama and Umwelt lakes in the model based on data collected in 2011 by Rescan (Rescan 2012) (APPENDIX E). Initial concentrations for Goose Lake in the model were based on data collected in 2021 as part of the monitoring for the Aquatic Effects Monitoring Program by WSP Golder (Golder 2019) (APPENDIX E).

4.2.2 Groundwater Quality

Groundwater quality was unchanged from the previous version of the load balance component of the Model (SRK 2020), with the exception of flow rates, chloride and TDS concentrations. Westbay well (13-GSE-319) installed by SRK adjacent to the Umwelt deposit at the Goose Property was used as groundwater quality for the load balance. Data from the well were corrected for the concentrated calcium chloride drilling brine used to avoid freezing during drilling (SRK 2015). An average from the Westbay well Zone 3 and Zone 5 monitoring results was applied in the model. WSP Golder updated the flow rates and TDS and chloride concentrations for the developments that extend into unfrozen rock (Section 3.2.7). The average groundwater quality expected during mine operations is included in APPENDIX D.

The salinity of groundwater inflows into the Goose Property is expected to be more saline than sea water. The dominant ions in the groundwater inflows are calcium chloride and sodium chloride. Westbay well monitoring data indicate that salinity concentrations will likely increase with depth.

Total dissolved solids (TDS) concentrations of groundwater inflows are presented in APPENDIX C -Table 2 (Scenario 1 with the highest TDS concentrations). It was assumed that 60% of measured TDS is composed of chloride. Estimated salinities used in the Model are of similar concentrations to those reported for other sites situated in continuous permafrost environments (e.g., Meliadine[1], Hope Bay[2]) (SRK 2015).

4.2.3 Waste Rock Storage Areas, Pit Walls, High Walls, Ore Stockpile, and Industrial Pad Runoff

Waste Rock Storage Areas and Ore Stockpile

Dissolved source concentrations for water in contact with the WRSAs and the Ore Stockpile were developed by SRK (2015), revised by Golder (2020), and further refined by WSP Golder for use in the geochemical modelling used for the load balance component of this model. The approach used to predict the source concentrations used HCT results and included the application of correction factors (i.e., temperature, coarseness, and flow channeling), geochemical modelling, and extrapolation of monitoring data from geologically similar sites in the area. The hydrological inputs for these predictions were based on an average hydrological year and assumed infiltration rate as described in Section 3.2.5. Calculations (Equation 4.4) to derive source term concentrations were built into the load balance component of the Model to allow for source term concentrations to update based on predicted proportions of lithologies in the WRSAs or exposed areas in the pit walls.

$$Source\ Term = \frac{[HCT\ Avg\ Loading\ Rate \times \%Lithology]_{Lithology,Parameter} \times 52\frac{weeks}{year} \times Rock\ Mass}{Pile\ Flow} \times TC \times CC \times FCC \qquad (4.4)$$

Where:

TC = Arrhenius temperature correction factor (0.2),

CC = Coarseness correction factor (0.2),

FCC = Flow channelization correction factor (0.5).

Values for these correction factors are consistent with the geochemical characterization and source term development performed by SRK (2015).

After developing the mass balance-based source term concentration for the WRSAs and Ore Stockpile, the concentrations were adjusted using regional limits (SRK 2015) and geochemical modelling using PHREEQC (ver. 3.6.2; Parkhurst & Appelo, 2013), a publicly available thermodynamic equilibrium modeling software. Maximum concentrations from each mining phase were selected from the time series of the WRSA and Ore Stockpile source terms and used for geochemical modelling using PHREEQC. The goal of this modelling was to

[1] Meliadine Gold Project, Agnico Gold, Nunavut, Advanced Exploration.

[2] Hope Bay, TMAC, Nunavut, Historical Drilling / Advanced Exploration.

balance ion charges, allow for mineral equilibrium reactions, and reflected the application of the regional limits developed by SRK. Source term concentration inputs were adjusted as follows using PHREEQC:

- Alkalinity set to 0.1 mg/L as $CaCO_3$ to allow for geochemical convergence within PHREEQC.
- pH set to 5 based on kinetic testing data.
- Charge balance on chloride (for positive charge imbalance) and sodium (for negative charge imbalance).
- Equilibration with atmospheric pCO_2 value of -3.4.

The outputs from the PHREEQC modelling were then further adjusted for constituents that were below background regional limits. Upper regional limits (SRK 2020) were applied for: aluminum, antimony, arsenic, cadmium, calcium, cobalt, copper, iron, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, and zinc.

The conceptual model for the WRSAs included seasonal freezing of the piles resulting in a permanently frozen core and a minimum 5 m active layer during any period of the year. This active layer thickens with deposition of new material during the unfrozen portion of the year and was reduced to 5 m during the winter months. Once material is no longer being added to a WRSAs, a 5 m non-potentially acid generating (NPAG) cover will be added to the pile. The load model assumed that the NPAG cover will be comprised of NPAG lithologies proportional to the final year of mining from the associated pit.

Pit Walls, High Walls, and Industrial Pads

The HCT results used for the pit walls were based on pre-acidity measurements, while high wall concentrations are based on post-acidity measurements of PAG materials. The reactive mass of the pit walls was determined based on the exposed surface area and an assumed reactive depth of 2 m. The source term calculation for the pit walls was the same as Equation 4.4, but without the coarseness and flow channelization correction factors. The PHREEQC modelling was not done on the pit wall runoff source term.

Runoff from industrial pads, roads, and berms were calculated using Equation 4.4 with inputs being NPAG HCT data and rock masses based on infrastructure areas in the mine plan and an average thickness of 2 m.

APPENDIX D includes a summary of constituents' concentrations for Ore Stockpile and the WRSA runoff applied in the load balance component of the Model.

4.2.4 Process Water Effluent

The process water source term represents a single pass of ore processing through the Goose Process Plant. This source term was refined using samples provided to WSP Golder by Sabina that represent thickener overflow solutions (M. Keefe 2022, pers. comm.). Average concentrations were used for the source term (APPENDIX D).

4.2.5 Sewage Treatment Plant (STP) Treated Effluent

Nitrogen species in treated effluent discharged during Construction, Operations and Closure are presented in APPENDIX D (M. Keefe 2021, pers. comm.).

4.2.6 Blasting Residues

The loads associated with blasting residues (i.e., ammonia, nitrate, and nitrite) applied to blasted rock used as backfill are derived from methods described by Ferguson and Leask (1998). Equation 4.5 was included in the load balance component of the Model with several assumed input parameters (Table 12).

$$NH_4NO_3 - N = Wr \times Pf \times ANc \times Nc \times Rf \quad (4.5)$$

Where:

NH_4NO_3-N (kg of ANFO [ammonium nitrate/fuel oil] / day) = annual release of total ammonium nitrate as nitrogen

Wr (tonne rock / day) = waste rock production rate

Pf (kg ANFO / tonne rock) = powder factor

ANc (constant) = fraction of ammonium nitrate in ANFO

Nc (constant) = fraction of nitrogen content in ammonium nitrate

Rf (%) = residual nitrogen remaining

Table 12: Blast Residue Input Parameters

Parameter	Label	Value
ANFO : NH_4NO_3	ANc	1 : 0.94
NH_4NO_3 : NH_4NO_3 as N	Nc	1 : 0.35
Surface Rock Powder Factor	Pf	0.26 kg ANFO / tonne rock
Underground Powder Factor	Pf	0.74 kg ANFO / tonne rock
Residual ANFO Factor	Rf	5%
Annual Flush Rate	n/a	40%

Note: The residual ANFO factor (1%) specified by Ferguson and Leask (1988) was increased by a factor of five.
ANFO = ammonium nitrate/fuel oil.

The total nitrogen was portioned between ammonia, nitrate, and nitrite according to the speciation of nitrogen in the blast residues: 37% ammonia, 60% nitrate, and 3% nitrite for surface rock; and 43% ammonia, 53.5% nitrate and 3.5% nitrite for underground rock (Morin and Hutt 2009).

Pads made of fill (i.e., underground pads and roads) were based on a 2 m thickness and total surface areas of the infrastructure (Section 3.2.4). The annual nutrient loads were distributed monthly based on the annual hydrograph (Table 3-2) and assume that 40% of the residue would be flushed annually. Nitrogen loadings from blasting residue from all WRSAs, Ore Stockpile area, roads, and underground pads were included in the Model.

4.2.7 Cyanide Degradation Reactions

The SRK derived degradation rates for total cyanide (TCN), cyanate (OCN-), thiocyanate (SCN-), and ammonia (NH_4+). The relevant degradation pathways for these species (Table 13) were included in the Model. WSP Golder conservatively assumed that the final product of the degradation pathway (i.e., ammonia degradation) is nitrate (NO_3) in order to maintain a mass balance for nitrogen species. The previous model iteration only accounted for the decrease in ammonia concentration and did not track the gaining species (attributed to various N forms).

Table 13: Degradation Reactions and Relevant Species

No.	Degradation Reaction	Losing Species	Gaining Species
1	TCN degrades to OCN-	TCN	OCN-
2	OCN- degrades to NH_4+	OCN-	NH_4+
3	SCN- degrades to NH_4+	SCN-	NH_4+
4	NH_4+ is transformed to a variety of other forms of nitrogen (attributed to nitrate)	NH_4+	NO_3

TCN = total cyanide; OCN- = cyanate; SCN- = thiocyanate; NH4+ = ammonia; NO_3 = nitrate.

The SRK calculated degradation rates from mass balance data from the Colomac Mine[3] (SRK 2004). The methods are described in the previous 2020 Water and Load Balance Report (SRK 2020). The degradation rates were preserved in this version of the Model (Table 14).

Table 14: Summary of Degradation Rates

Constituent	Degradation Rate ($mg/m^2/day$)
TCN-N	-218
OCN-N	-300
SCN-N	-674
NH_4+-N	-249

Note: $mg/m^2/day$ = milligrams per meter squared (of surface area) per day.

TCN = total cyanide; OCN- = cyanate; SCN- = thiocyanate; NH4+ = ammonia.

4.2.8 Brine Residues

Calcium chloride will be required for mining the underground portions of Umwelt, Llama, Goose Main, and Echo deposits. Brine loading concentrations used in the Model (Table 15) were based on Hope Bay[4] (SRK 2015), which were derived from shake flask tests and runoff monitoring data from waste rock piles for drilling in permafrost. Brine residues were assumed to be flushed out over time at a rate of 40% per year, and the brine mass from ore was assumed to be 100% flushed upon entering the Process Plant.

Table 15: Brine Addition Details

Material	Location	Calcium Chloride Load (mg/kg)
Underground Waste Rock (on surface)	Permafrost	780
Underground Ore	Permafrost	390

4.2.9 Process Plant Outflow Water Quality

The water quality of the Process Plant outflow was informed by the reclaimed water concentrations from Echo and Umwelt TFs and the Primary Pond, as well as the additional load from ore porewater, release of load from ore dissolution, brine and ANFO flushing, and the Process Plant reagent addition for gold cyanidation and products of cyanide destruction.

[3] Colomac Mine, Closed Mine (1997), Northwest Territories.

[4] Hope Bay, Doris North Project – Water and Load Balance.

The Process Plant reagent addition rates (Table 16) are based on work by JDS Energy and Mining Inc. (JDS 2015). The total nitrogen generated by the cyanide addition was determined by the weak acid dissociable (WAD) cyanide concentration in the carbon adsorption tanks reporting to the cyanide destruction circuit. The nitrogen speciation was derived from the proportion of the cyanide breakdown products in the process water source terms. Sulphate generated in the cyanide destruction was calculated using a $SO_{2(g)}$: $CN\_WAD_{(g)}$ ratio of 5.5. Reagent loads were determined by multiplying the reagent concentrations by the Process Plant inflow rate.

Solubility limits were applied to the following metals to account for precipitation in the Process Plant circuit: aluminum, cadmium, copper, iron, lead, cobalt, magnesium, manganese, mercury, nickel, silver, strontium, thallium, tin, titanium, and zinc (JDS 2015). Sulphate concentrations were determined considering calcium concentrations and calcite precipitation, as well as sodium concentrations and sodium sulphate generation.

Table 16: Summary of Process Plant Reagent Additions Used in the Load Balance Component of the Model

Reagent Dose (kg/tonne)	
Sodium Cyanide (NaCN)	1.4
Sodium Metabisulphite ($Na_2S_2O_5$)	1.5
Species Addition (g/tonne)	
Ammonia (NH_3)	53[(a)]
Nitrate (NO_3)	0.14[(a)]
Nitrite (NO_2)	0.15[(a)]
Cyanate (OCN^-)	21[(a)]
Thiocyanate (SCN^-)	24[(a)]
Total Cyanide	0.62[(a)]
Weak Acid-Dissociable Cyanide	180[(a)]
Sodium	1000
Sulphate (5.5g SO_2 / g of WAD CN)	1500

g-nitrogen/tonne

4.2.10 Cryoconcentration

It was assumed there will be 100% exclusion of constituents from ice formation in water bodies within the Model, resulting in higher concentrations in the underlying water. Water bodies modelled as GoldSim reservoirs in the load balance (i.e., lakes, ponds, and open pit reservoirs including Llama, Umwelt, and Goose Main) therefore experience cryoconcentration. Each water body has an associated volume in the water balance that fluctuates based on the ice thickness, but the mass of each constituent is unaffected by these volume changes, and therefore the concentration increases or decreases with each freeze-thaw cycle. The inclusion of cryoconcentration in the model improves accuracy by capturing seasonal variation of these water bodies.

A maximum ice thickness of 2.0 m was applied to water bodies modelled. Ice was assumed to form in October, reaching a maximum depth in February, and receding to a zero-ice thickness by the start of the open water season in July (Table 17). These assumptions are based on observations recorded during the freshwater baseline study performed by Rescan ERM (2012).

Table 17: Ice Thickness Input

Day of the Year	Average Ice Thickness (m)
1	1.6
31	2
60	2
180	0
274	0
366	1.6

Note: Thicknesses interpolated linearly between points.

5.0 MODEL IMPLEMENTATION

5.1 Modelling Approach

5.1.1 Time Step

The Model relies on a daily timestep from Year -3 to Year 65, which is when the pit lakes and downstream receptors reach steady-state conditions. Although most model input parameters are entered on a monthly time step, the Model calculates daily values by dividing monthly values by the number of days in the particular month.

5.1.2 Stochastic Water Balance Model

The Model results for the water balance component were generated by using a Monte Carlo simulation. A Monte Carlo simulation is a mathematical technique which builds an ensemble of possible results by using a probability distribution. The Model utilizes precipitation probability distribution developed for the Project (see Table 3) to estimate an annual precipitation. The annual precipitation is then multiplied by the monthly distribution, a runoff coefficient (based on the surface type), and the catchment area to estimate the runoff volumes. A total of 100 model runs were completed with a randomly generated annual precipitation for each year. At the end, all results were compiled, and a probability distribution of runoff results were generated for the 5th (i.e., representing lower than average precipitation), 50th (i.e., median precipitation, similar to average precipitation conditions), and 95th (i.e., representing greater than average precipitation) percentiles.

5.1.3 Stochastic Load Balance Model

The Model results for the load balance component were generated using the stochastically modelled annual precipitation of the water balance model. Similar to the water balance component of the Model (Section 5.1.2), a total of 100 runs were completed. Once results (i.e., predicted daily concentrations) of these 100 runs were compiled, the 5th, 50th, and 95th percentiles of the results from the 100 runs were calculated for each daily time step and then monthly mean concentrations were calculated.

The assessment of the load balance results focussed on the 50th percentile of predicted concentrations, which represented average hydrological conditions (i.e., an annual precipitation of 427 mm/yr) and are consistent with conditions used in the derivation of the source terms. The 5th and 95th percentiles of the predicted concentrations are also included in this report to provide a range of predicted concentrations that could potentially occur under different hydrological conditions.

5.2 Modelled Constituents and Discharge Limits

Water quality constituents included in the load balance component of the Model are listed in Table 18. Results of the load balance component of the Model were screened against the Metal and Diamond Mining Effluent Regulations (MDMER) discharge limits (Government of Canada 2002) (Table 19). It is acknowledged that additional requirements for discharge limits may be applicable (e.g., Water Licence discharge limits) to meet in-lake (i.e., Goose Lake) water quality objectives.

Table 18: Constituents Included in the Load Balance Component of the Model

Total Dissolved Solids	Total Ammonia as N[(a)]	Cadmium	Molybdenum	Thorium
Total Suspended Solids	Orthophosphate as P	Calcium	Nickel	Tin
Free Cyanide	Phosphate as P	Chromium	Phosphorus	Titanium
Total Cyanide	Total Organic Carbon	Cobalt	Potassium	Uranium
Weak Acid-Dissociable Cyanide	Aluminum	Copper	Selenium	Vanadium
Cyanate	Antimony	Fluoride	Silicon	Zinc
Thiocyanate	Arsenic	Iron	Silver	-
Sulphate	Barium	Lead	Sodium	
Chloride	Beryllium	Lithium	Strontium	
Nitrate as N	Bismuth	Manganese	Tellurium	
Nitrite as N	Boron	Mercury	Thallium	

Note: N = nitrogen; P = phosphorous.

(a) Total ammonia was used to calculate un-ionized ammonia based on conservative estimates of effluent temperature (15°C) and pH (8.5).

Table 19: MDMER Discharge Limits Applied to Discharge at the Prediction Nodes

Constituent	MDMER Discharge Limit[(a)] (mg/L)
Total Suspended Solids	15
Un-ionized ammonia	0.50[(b)]
Cyanide	0.50
Arsenic	0.10
Copper	0.10
Lead	0.080
Nickel	0.25
Zinc	0.40

(a) Maximum authorized monthly mean concentration.

(b) mg-nitrogen/L

MDMER = Metal and Diamond Mining Effluent Regulations.

5.3 Water Treatment

Model results are the basis for understanding the level of treatment required for the Project to meet MDMER discharge limits at the discharge points to Goose Lake.

During Construction, Llama Lake will be fully dewatered during the open water season (i.e., Q3), with approximately 50% of the volume dewatered directly to Umwelt Lake, ultimately flowing to Goose Lake. The remaining 50% volume is expected to have high total suspended solids (TSS) and will be treated prior to discharge into Umwelt Lake.

Umwelt Lake will also be fully dewatered in Construction during the open water season (i.e., Q3), with approximately 50% of the volume dewatered to Goose Lake. The remaining 50% volume is expected to have high TSS and will be treated prior to discharge into Goose Lake.

Saline water from Llama, Umwelt, Echo, and Goose Main underground workings will be sent to the Saline Water Pond (SWP) for holding prior to being treated by reverse osmosis (RO) at the RO plant. A treatment efficiency of 98% was assumed for the RO process (Sabina 2021), with permeate (i.e., desalinated portion of the treated effluent) being sent to Umwelt TF and brine being cycled back into the SWP or sent to Llama TF. The incoming flow volume will be split 80% to permeate and 20% to brine.

Umwelt and Llama TFs will be dewatered to Goose Main Reservoir in Year 13 to support filling of this pit; as part of the transfer process, the water being pumped will be treated prior to deposition in the Goose Main Reservoir.

Water quality predictions indicate that water treatment will be required to treat water in Umwelt and Llama TFs before discharge to the environment. In Year 14 and 15 as the Umwelt and Llama TFs are filling up, treatment will be circular with treated water being sent back to the TFs. Starting in approximately Year 16, Llama and Umwelt TFs (when they reach capacity) will discharge to the SWP which becomes the Umwelt Treatment Pond to provide flow attenuation for treatment prior to discharge to the environment. The proposed treatment is year-round at a flow rate of 80,500 m^3/day.

Treatment for the Goose Main Reservoir will begin in Year 19 and continue until the start of Post-Closure. Circular treatment in Goose Main Reservoir, with treated water being sent back to the Goose Main Reservoir, can also be considered to improve water quality in this reservoir prior to reaching its capacity, if required.

Modular treatment plants will likely be employed as they can be relocated and combined as necessary to achieve the appropriate water quality at different phases of the Project. The expected required treatment, including a list of primary constituents that will require treatment, is provided in Table 20.

Table 20: Goose Property Treatment Summary

Phase	From	To	Start	End	Flow Rate (m³/d)	Primary Constituents
Construction	Llama Lake	Goose Lake (via Umwelt Lake)	Yr -1 Q3	Yr -1 Q3	20,000	Total suspended solids
Construction	Umwelt Lake	Goose Lake	Yr -1 Q3	Yr -1 Q3	20,000	Total suspended solids
Operations - Closure	Saline Water Pond (SWP)	Umwelt TF (80%); SWP or Llama TF (20%)	Yr 6	Yr 12	2,000-4,000	Salinity
	Llama TF	Goose Main Reservoir	Yr 13 Q1	Yr 13 Q1	10,000	Total dissolved solids, ammonia, nitrate, nitrite, aluminum, arsenic, chloride, chromium, copper, iron, phosphorus, selenium, uranium
	Umwelt TF	Goose Main Reservoir	Yr 13 Q1	Yr 13 Q1		
	Llama TF	Llama TF	Yr 13 Q2	Yr 22 Q4	5,000	Total dissolved solids, ammonia, nitrate, nitrite, aluminum, arsenic, chloride, chromium, copper, iron, phosphorus, selenium, uranium
	Umwelt TF	Umwelt TF	Yr 13 Q2	Yr 22 Q4		
	Umwelt Treatment Pond	Goose Lake (via PN04)	Yr 16 Q4	Yr 22 Q4	80,500	Total dissolved solids, ammonia, nitrate, nitrite, aluminum, arsenic, chloride, chromium, copper, iron, phosphorus, selenium, uranium
	Goose Main Reservoir	Goose Lake (via PN05)	Yr 19 Q2	Yr 22 Q4	20,000	Total dissolved solids, ammonia, nitrate, nitrite, aluminum, arsenic, chloride, chromium, copper, iron, phosphorus, selenium, uranium

6.0 WATER BALANCE RESULTS

Results of the water balance component of the Model are presented at key locations to provide context to other linked modules including water management planning and load balance predictions. Quantities presented in this subsection are based on the inputs provided in Section 3.2 using a Monte Carlo simulation for the 5th, 50th, and 95th percentiles as described in Section 5.1.2. The simulated percentiles represent lower than average (i.e., 5th percentile), average (i.e., 50th percentile, equal to median precipitation), and greater than average (i.e., 95th percentile) hydrological conditions with the average representing the most likely occurrence, and upper and lower assessed bounds represented by 95th percentile and 5th percentile, respectively.

6.1 Saline Water Pond

Umwelt Lake will be fully dewatered in Year -1 to begin the construction of the SWP. In Year 1, the SWP will be operational with a maximum storage capacity of 1.79 M-m³. The purpose of the SWP is to store saline water encountered during the mining of Llama Open Pit, and Llama, Umwelt, Echo, and Goose Main undergrounds (see Section 3.2.7). Other inflows to the SWP include natural runoff and direct precipitation. Starting in the third quarter of Year 3, saline water collected in the SWP will be sent to a RO unit for treatment, with 20% of the volume recirculating back to the SWP as brine reject, and the other 80% of the treated effluent being sent to Umwelt TF. Once Goose Main Open Pit mining is complete (end of Year 12), saline water will be transferred to

Goose Main Open Pit (then called Goose Main Reservoir) for permanent storage. This strategy will allow the SWP to maintain a low water level and excess capacity so the SWP can be used as contingency storage should greater than predicted groundwater inflows be encountered.

At Closure, the top layer sediment within the dewatered SWP will be excavated to remove potential chloride concentrations. Following excavations, the SWP diversion berms will be breached allowing the upstream catchments, including Llama Reservoir, Primary Pond, and Umwelt TF, to discharge to the SWP area. Starting in Year 16, water reporting to the SWP (then called the Umwelt Treatment Pond) will be treated prior to discharge to the environment. It has been assumed that the SWP containment dam will be maintained in place during Closure to provide storage required to attenuate flow to the water treatment plant associated with Umwelt and Llama TF recirculation treatment. Monitoring of water levels in the Umwelt Treatment Pond during the early years of Closure will inform opportunities for breaching the SWP containment dam later in the Closure Phase. Once the SWP containment dam is breached, the storage capacity of the Umwelt Treatment Pond at the end of Closure will ultimately reduce to a volume similar to the original Umwelt Lake when Umwelt Lake will be re-established. For the water balance modeling presented in this report, it was assumed that the Umwelt Treatment Pond will maintain a capacity of 1.79 M-m^3 for the entire Closure Phase.

Table 21 provides the maximum storage volume accumulated in the SWP during Operations for the 5th, 50th, and 95th percentile water balance results. The results show that the SWP has sufficient capacity to store the saline water encountered during Operations until Umwelt TF, Llama TF, and ultimately Goose Main Reservoir are available for storage, with between 0.8 to 1.3 M-m^3 (for the 95th and the 5th percentile results, respectively) contingency storage capacity available.

Figure 3 summarizes the water storage for the 5th, 50th, and 95th percentile water balance results.

Table 21: Saline Water Pond Maximum Storage Volumes

Saline Water Pond Maximum Storage Volume (m^3)		
5th Percentile	50th Percentile	95th Percentile
451,123	683,567	937,148

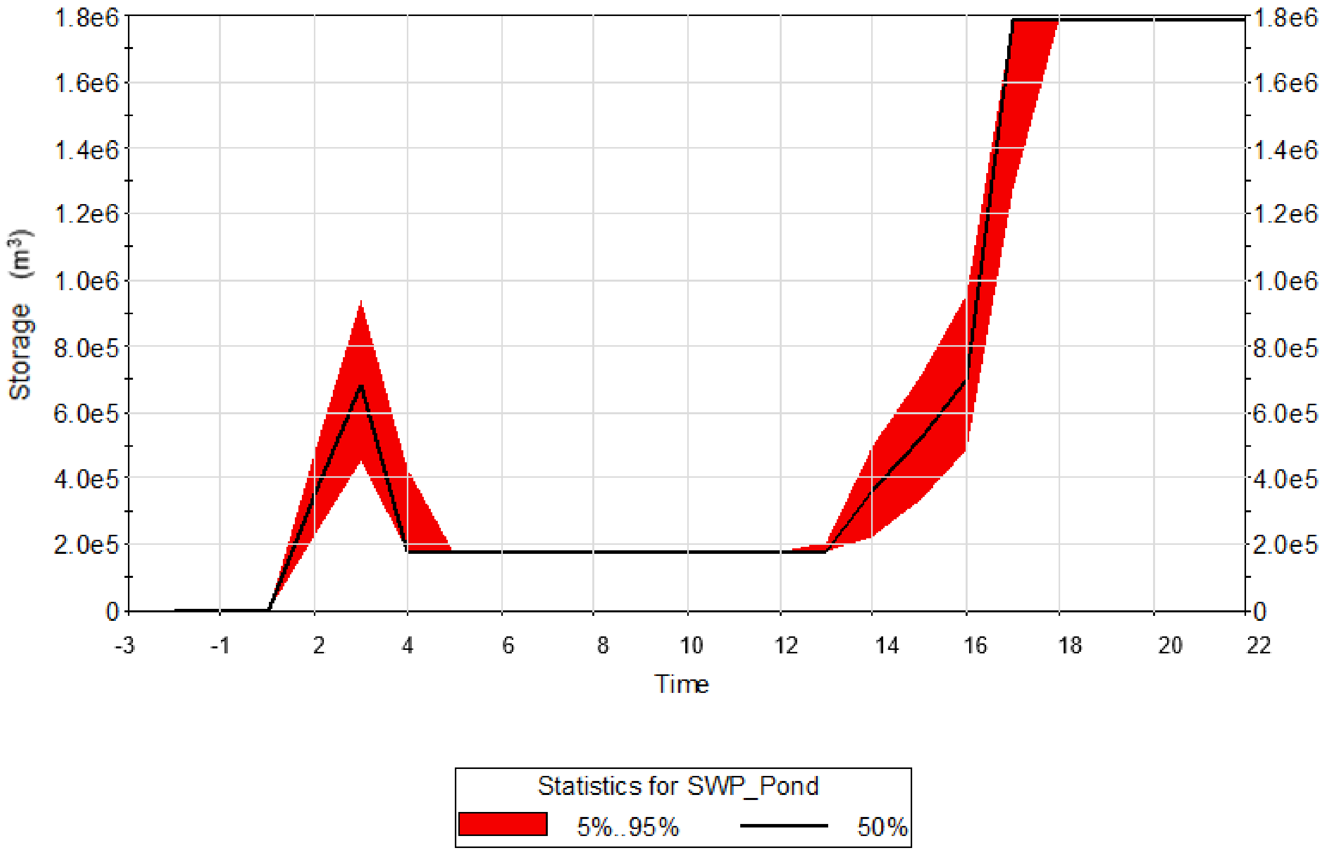


Figure 3: Saline Water Pond Storage Volume

6.2 Echo Open Pit and Echo TF

Stripping of Echo Open Pit will begin in Year -3 to prepare for mining in Year -2. Runoff collected in the open pit will be pumped to the Primary Pond (via the Echo WRSA Pond) for reclaim use in the Process Plant. Once mining is complete in Year -1, the open pit will become the active tailings facility (then known as Echo TF) with a total capacity of 2.54 M-m^3. As tailings slurry is being deposited into Echo TF over the following two and half years, Echo TF will also collect contact water from the Ore Stockpile Pond and the Echo WRSA Pond. This water will be used for reclaim in the Process Plant. Once tailings deposition in Echo TF is completed (expected in the second quarter of Year 3), supernatant water in Echo TF will be pumped to the Primary Pond and then waste rock material (part of Goose Main WRSA) will be placed in Echo TF.

Figure 4 summarizes the storage volume of Echo Open Pit for the 5th, 50th, and 95th percentile water balance results.

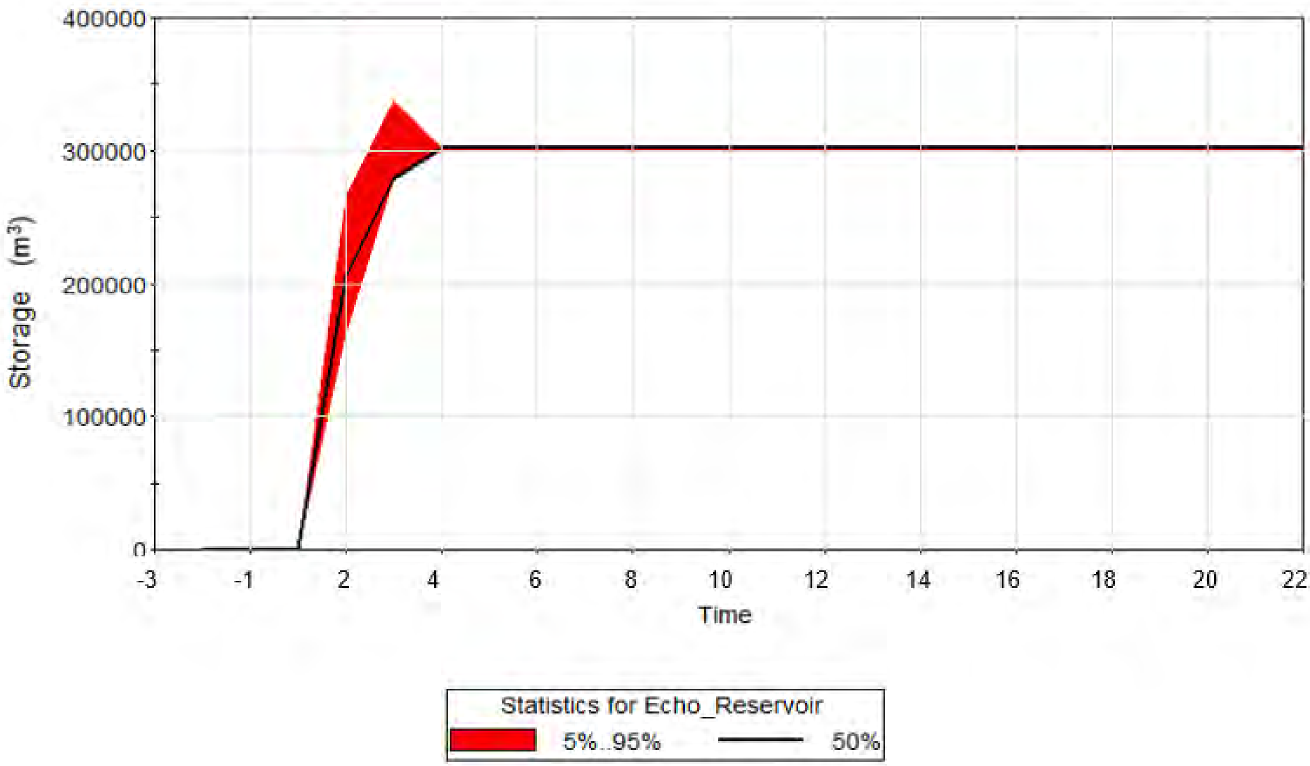


Figure 4: Echo Open Pit Water Storage Volume

6.3 Umwelt Open Pit and Umwelt TF

Stripping of Umwelt Open Pit will begin in the last quarter of Year -3 to prepare for mining in the second quarter of Year -2. Runoff collected in the open pit will be pumped to the Primary Pond for reclaim use in the Process Plant. Once the use of Echo Open Pit for tailings storage (Echo TF) is complete (expected in the second quarter of Year 3), tailings deposition will be transferred to Umwelt Open Pit, then known as Umwelt TF with a total capacity of 5.83 M-m^3. As tailings slurry is being deposited into Umwelt TF until the third quarter of Year 6, Umwelt TF will also collect contact water from the Ore Stockpile Pond, Echo TF, Goose Main WRSA Pond, Goose Main Open Pit and treated saline water (from the SWP) for reclaim use in the Process Plant. Once the use of Umwelt Open Pit for tailings storage (Umwelt TF) is complete (expected in the third quarter of Year 6), tailings deposition will be transferred to Llama TF. However, Umwelt TF will continue to collect contact water for reclaim use. When milling production starts ramping down in Year 13 and mining of Goose Main Open Pit is complete, Umwelt TF will be dewatered to Goose Main Open Pit to support closure filling.

At Closure, Umwelt TF (now known as Umwelt Reservoir) will be filled with catchment runoff and discharge by gravity to Goose Lake via the re-established Umwelt Lake (formerly the SWP). To meet water quality guidelines downstream of PN04 (i.e., ultimate discharge point to Goose Lake), water in Umwelt TF will be treated prior to discharge to the environment during the Closure Phase.

Figure 5 summarizes the storage volume of Umwelt Open Pit for the 5th, 50th, and 95th percentile water balance results. These results show that Umwelt Reservoir will initiate discharging by gravity within the Closure Phase (i.e., Year 16 to Year 22) depending on the hydrological conditions during this period.

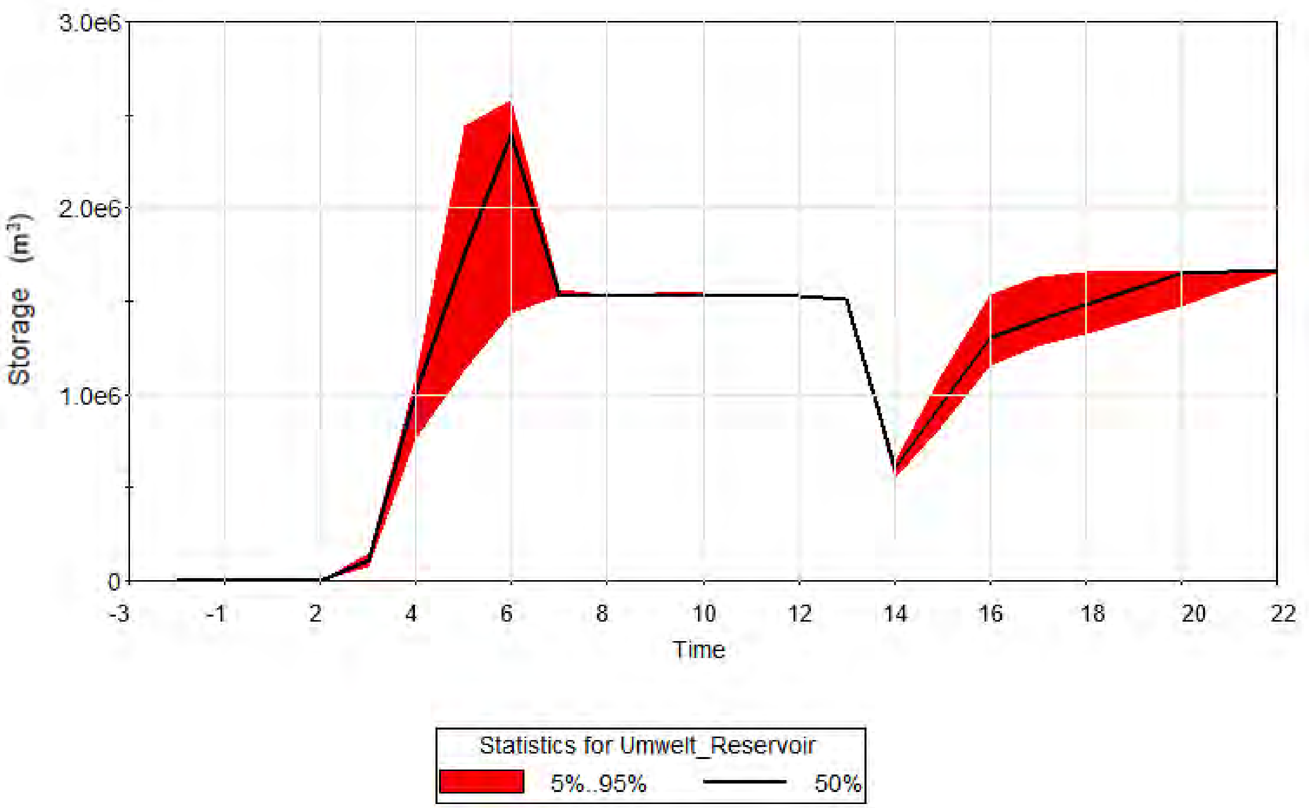


Figure 5: Umwelt Reservoir Water Storage Volume

6.4 Llama Open Pit and Llama TF

Llama Lake, which has a natural capacity of 0.96 M-m^3, will be dewatered to Goose Lake in the open water season of Year -1 in advance of open pit mining below the lakebed. It is assumed that 50% of the lake water will be suitable to discharge directly to Goose Lake (via Umwelt Lake), with the remaining 50% being treated for TSS before discharging to Goose Lake.

Site preparation of Llama Open Pit will begin in the first quarter of Year 1 and mining will begin in the second quarter of Year 1. Inflows to Llama Open Pit during this time include runoff and groundwater inflows. The open pit will be dewatered to the SWP until mining is complete in the second quarter of Year 5 and then allowed to fill to support pit flooding at Closure. From Year 6 (Q4) onward, tailings will be disposed in the mined-out open pit, then known as Llama TF with a total capacity of 11.26 M-m^3. When milling production starts ramping down in Year 13 and mining of Goose Main Open Pit is complete, Llama TF is dewatered to Goose Main Open Pit to support closure filling.

At Closure, the Primary Pond is dewatered to Llama TF to support closure filling. The Llama diversion berms will be breached and runoff from Llama WRSA will be routed to Llama TF (then known as Llama Reservoir). Once full, overflow from Llama Reservoir will be directed to Goose Lake via the re-established Umwelt Lake (formerly the SWP). To meet water quality guidelines downstream of PN04 (i.e., ultimate discharge point to Goose Lake), the water in Llama Reservoir will be recirculated through a WTP during the Closure Phase until the water quality within the Tailings Facility meets discharge criteria.

Figure 6 summarizes the storage volume of Llama Reservoir for the 5th, 50th, and 95th percentile water balance results. These results show that Llama Reservoir will initiate discharging by gravity in Year 16 under the 5th, 50th, and 95th percentile water balance results.

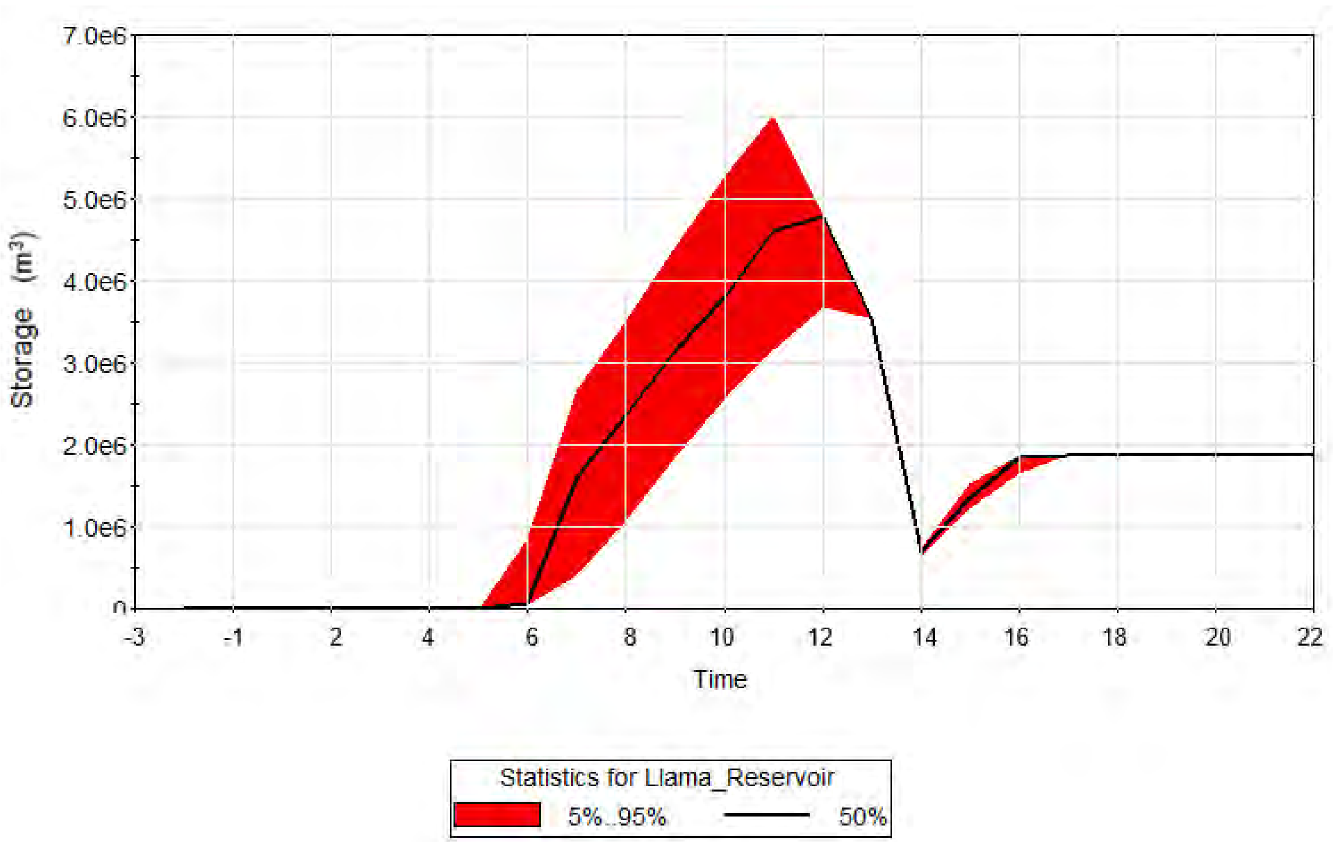


Figure 6: Llama Reservoir Storage Volume

6.5 Goose Main Open Pit and Goose Main TF

Stripping of Goose Main Open Pit will begin in the third quarter of Year 2 to prepare for the following year (i.e., third quarter of Year 3). Runoff collected in the open pit will be pumped to Umwelt TF for reclaim use in the Process Plant. Once mining is complete in Year 12 (Q3), the mined-out open pit, now known as Goose Main Reservoir, will be filled with treated contact water and saline water collected on Project site for permanent storage and to support pit filling at Closure. At Closure, the Goose Main diversion berm and the Rascal berm will be breached to re-establish pre-development flows. The Goose Main Reservoir will be filled with runoff from the upstream catchment and supplemented with freshwater withdrawals from Goose Lake.

Figure 5 summarizes the storage volume of Goose Main Reservoir for the 5th, 50th, and 95th percentile water balance results. These results show that Goose Main Reservoir will initiate discharging by gravity within the Closure Phase (i.e., Year 18 or Year 19) depending on the hydrological conditions during this period.

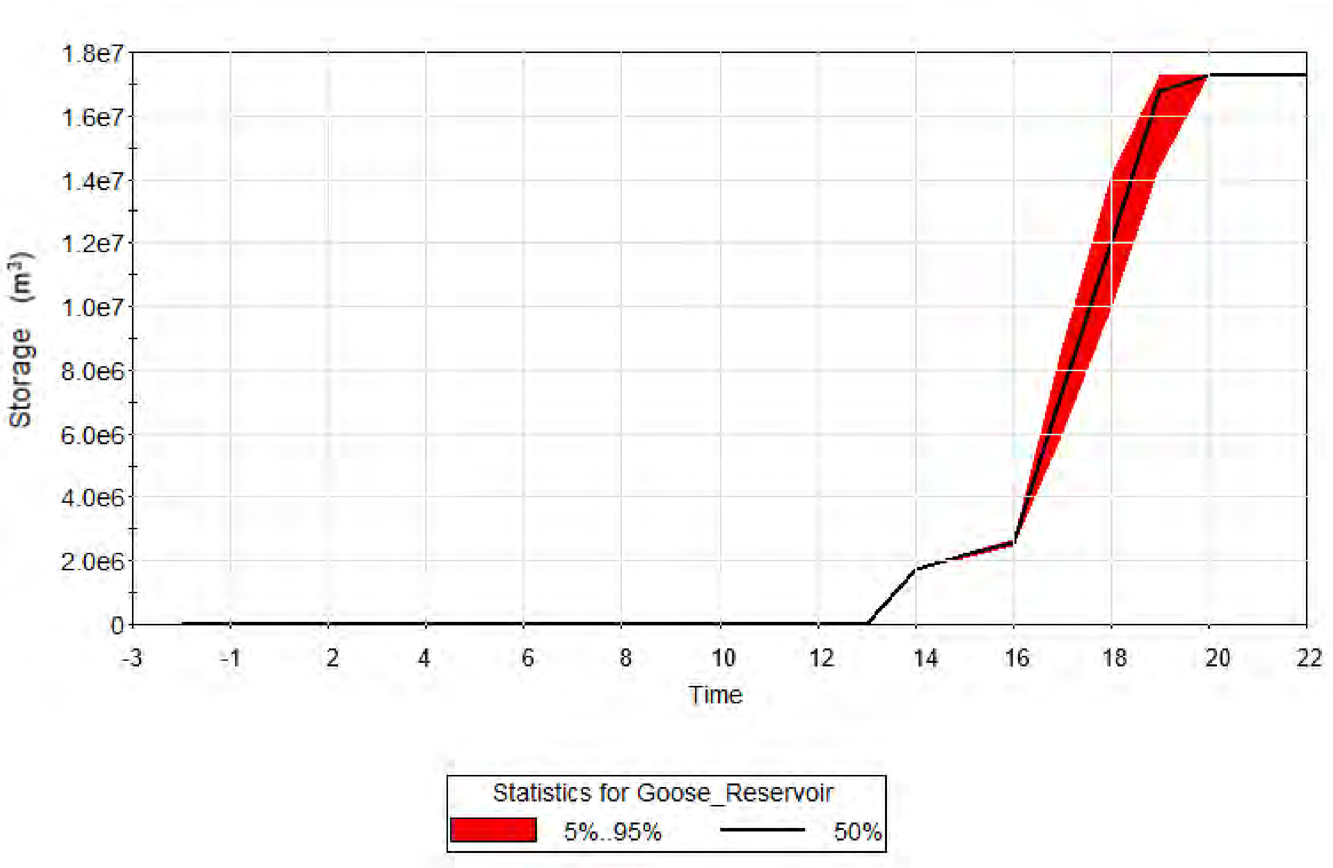


Figure 7: Goose Main Reservoir Storage Volume

6.6 Primary Pond

The Primary Pond will be available by Year -2 to collect contact water from across the site, including flows from the Echo WRSA Pond and Ore Stockpile Pond during Construction, and Umwelt Open Pit, Umwelt WRSA, and Llama WRSA Pond during Operations. The contact water collected is used as reclaim in the Process Plant as well as to support pit filling once milling productions start ramping down in Year 13. Between Year 5 and Year 8, the Primary Pond will reach its capacity of 1.7 M-m^3 and the excess water will be used for reclaim in the Process Plant via Umwelt TF. The Primary Pond can be managed operationally by switching the source of reclaim water from Umwelt TF to the Primary Pond to manage the volume within this facility, as required.

Figure 8 summarizes the water storage of the Primary Pond for the 5th, 50th, and 95th percentile water balance results.

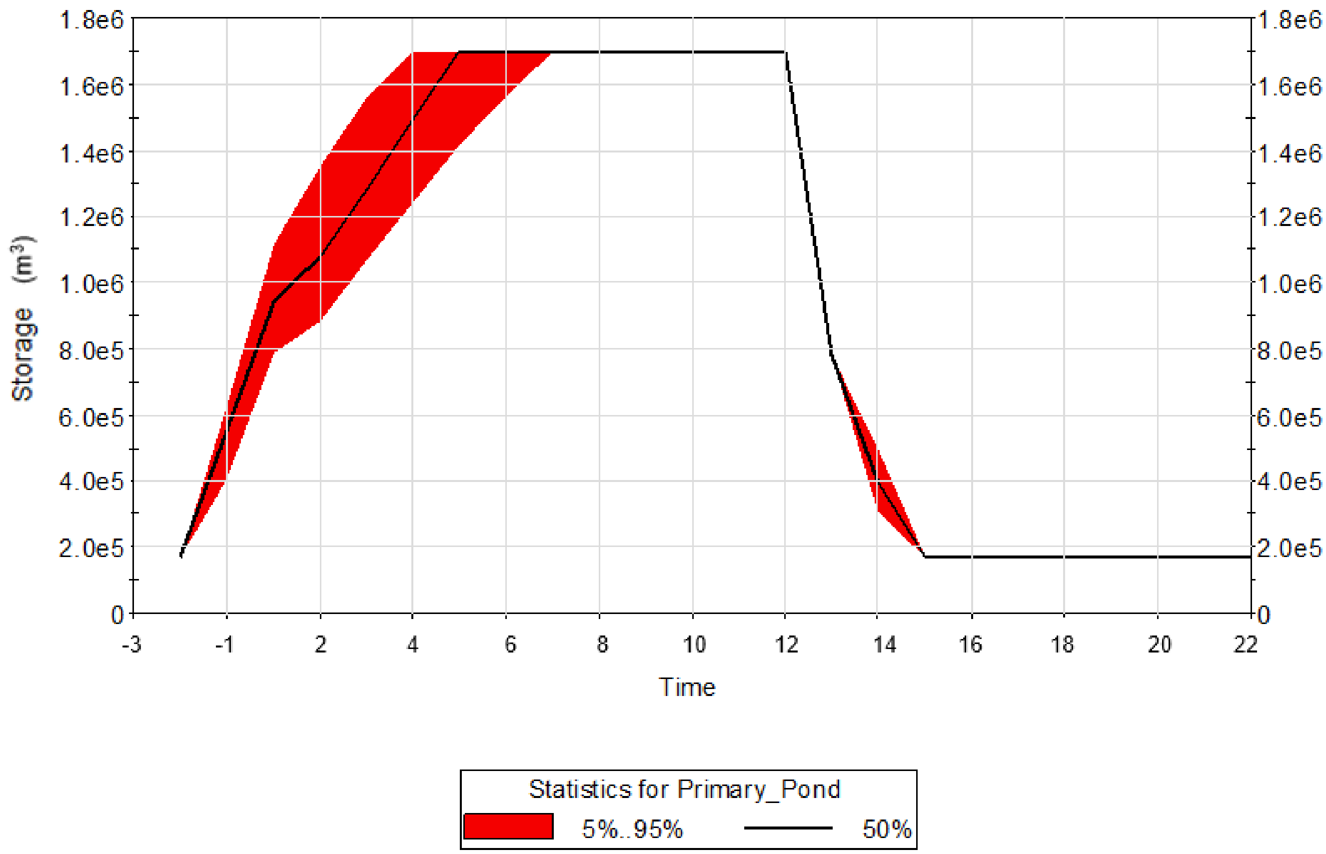


Figure 8: Primary Pond Storage Volume

6.7 Prediction Nodes

The change in annual flows at select prediction nodes were reviewed to assess the effects of the Project to the baseline hydrology. Results from the 5th, 50th, and 95th percentile were reviewed at prediction nodes with Project infrastructure directly upstream (i.e., PN04, PN05, PN08, and PN09; see Figure 2 for locations/catchments).

Predicted daily timeseries of flow rates at the prediction nodes were provided to the hydrodynamic model of the Goose Lake (WSP Golder 2022) to evaluate effects of the Project on the Goose Lake.

A description of the change in hydrology conditions is presented in the following sections.

6.7.1 PN04

The upstream catchment of PN04 consists of Llama Open Pit, Umwelt Open Pit, Llama WRSA Pond, Umwelt WRSA, Primary Pond, SWP, and the Plant Site (including the Ore Stockpile). Figure 9 shows the Project and baseline average annual flows at PN04. During Construction, the Project flows increase until the Llama diversion berm is in place in Year 1. As described in Section 3.2.4, PN06 and PN10 flows spill over into PN04 until the Llama diversion berms are constructed. Due to the placement of diversion berms and the other Project infrastructure, flows during Operations are expected to be lower than baseline. At Closure, the maximum change over baseline occurs due to the outflows from pit lakes upstream beginning in Year 16 which continues into Post-Closure.

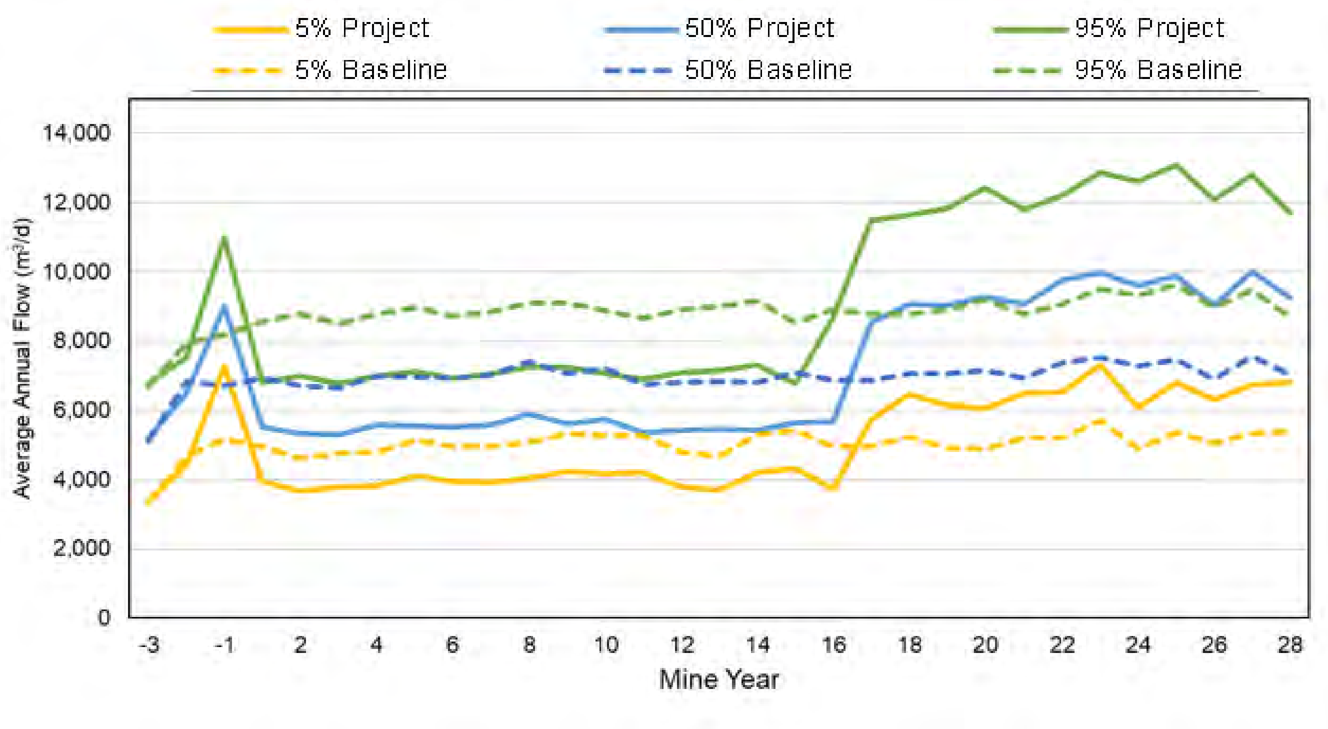


Figure 9: Project and Baseline Average Annual Flow at PN04

6.7.2 PN05

PN05 represents discharge from Goose Main Open Pit, which includes the PN07 catchment once Goose Main Open Pit mining begins. Figure 10 shows the Project and baseline average annual flows at PN05. As described in Section 3.2.4, PN05 also receives spill overflows from PN08 until the Goose Main diversion berm is constructed. As expected, flows are lower than baseline once Goose Main Open Pit mining activities begin. At Closure, the maximum change over baseline occurs due to the Goose Main diversion berm being breached and the upstream catchment is redirected to support filling of the mined-out open pit. Once full, Goose Main Reservoir overflows to PN05 and Project flows similar to that seen during Operations are re-established.

Figure 10: Project and Baseline Average Annual Flow at PN05

6.7.3 PN08

At the outlet of Gander Pond is PN08. Figure 11 shows the Project and baseline average annual flows at PN08. Due to the placement of diversion berms for Goose Main Open Pit mining, flows are higher than baseline. At Closure, the maximum change over baseline occurs due to Goose Main WRSA being diverted to PN08.

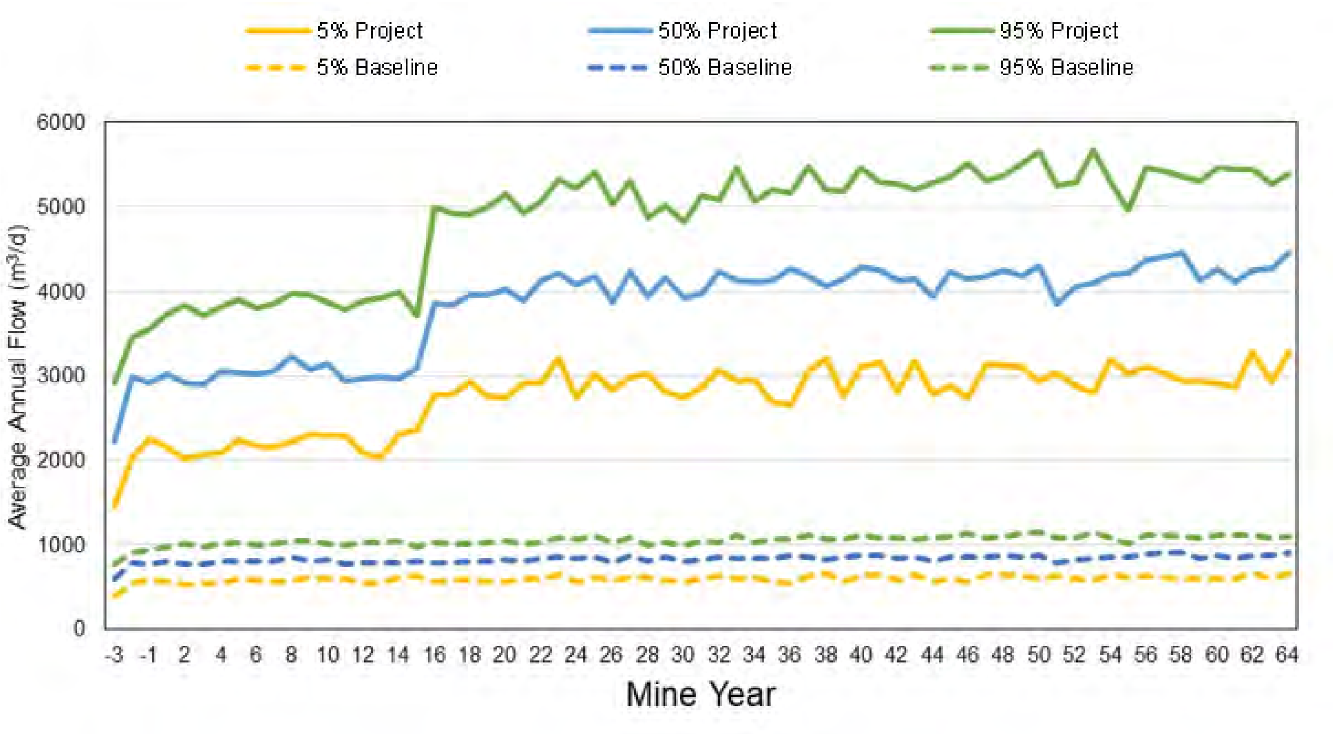


Figure 11: Project and Baseline Average Annual Flow at PN08

6.7.4 PN09

The upstream catchment of PN09 consists of Echo Open Pit and Echo WRSA Pond during Construction, and the Goose Main WRSA Pond during Operations. Figure 12 shows the Project and baseline average annual flows at PN09. Flows are lower than baseline due to Project infrastructure capturing runoff for use in Operations.
After Closure, a similar trend is observed due to the runoff from Goose Main WRSA being diverted to PN08. The maximum change over baseline occurs while Echo Open Pit (TF) is active and diversion berms are changing during the transition from Echo TF/WRSA to Goose Main WRSA.

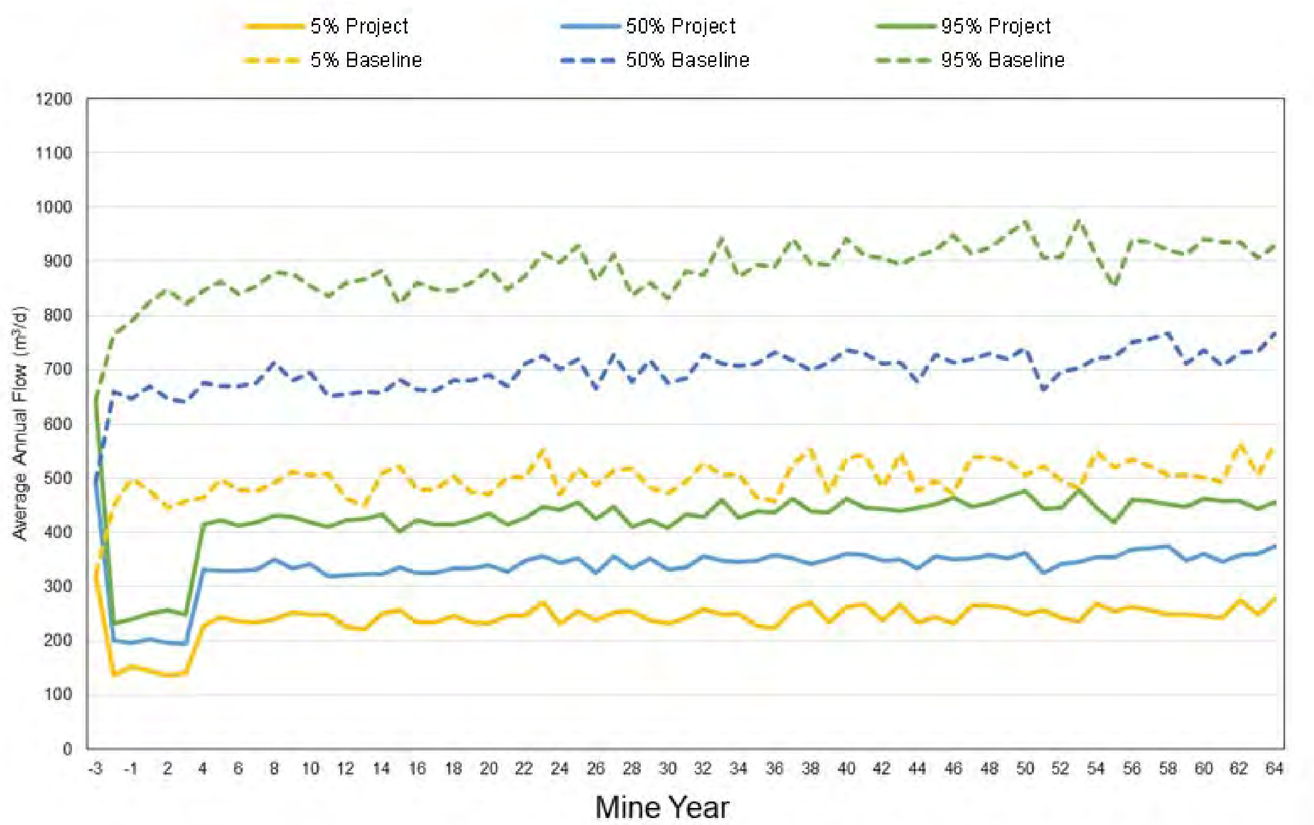


Figure 12: Project and Baseline Average Annual Flow at PN09

7.0 LOAD BALANCE RESULTS

7.1 Prediction Nodes

Results of the load balance component of the Model were evaluated at several prediction nodes (i.e., PN04, PN05, PN06, PN08, and PN09; Figure 2) located downstream of the Goose Property (i.e., at discharge points to Goose Lake). These nodes capture flow and water quality changes from infrastructure associated with the Project and were used to evaluate water treatment requirements to meet MDMER discharge limits (Sections 7.1.1 to 7.1.3) and water quality objectives in Goose Lake (WSP Golder 2022).

Model results are presented as the 5th, 50th, and 95th percentile of predicted monthly average concentrations. The predicted 50th percentile concentrations represent predicted water quality for the average hydrological condition, which is the expected hydrological condition over the long-term; the lower and upper bounds of hydrological conditions are represented by the 5th percentile and 95th percentile, respectively.

Model results are presented for all predictions nodes in:

- Timeseries plots of the predicted monthly average constituent concentrations (i.e., under average climate conditions; Section 5.1.3) (APPENDIX F). These plots are presented for the constituents with MDMER discharge limits and those that were included in the Goose Lake Hydrodynamic Model (WSP Golder 2022);
- Tables of the predicted maximum monthly average constituent concentrations for the average climate condition (i.e., 50th percentile) per mine phase for the constituents with MDMER discharge limits (Sections 7.1 to 7.3), and for all modelled constituents (APPENDIX G); and
- Tables of predicted maximum monthly average constituent concentrations for the lower and upper bound concentrations (i.e., 5th and 95th percentiles) per mine phase (APPENDIX H; Tables H-1 and H-2). These results represent the range of predicted concentrations that could potentially occur under different hydrological conditions (i.e., dry and wet years).

Daily timeseries of predicted constituent concentrations at discharge points to Goose Lake (i.e., PN04, PN05, PN06, PN08, and PN09) were used as an input to the Goose Lake Hydrodynamic Model (WSP Golder 2022) to evaluate the potential effects on Goose Lake water quality due to these discharges.

Prediction nodes PN06 and PN09 are not affected by the Project activities (Section 6.7); thus, the following sections (Section 7.1.1 to 7.1.3) discuss results at the prediction nodes that have their water quality affected by the Project activities (i.e., PN04, PN05, and PN08). Results for all discharge points to Goose Lake are presented in appendices F, G and H.

7.1.1 PN04

PN04 is located at the neck of Goose Lake, downstream of Llama and Umwelt Reservoirs (see Figure 2), and receives the flow from these facilities, routed through the re-established Umwelt Lake when flooding occurs. Table 22 summarizes key events that influence predicted concentrations at PN04.

Table 22: Overview of Activities Affecting PN04 Concentration History Under Average Climate Conditions

Activity	Mine Year(s)	Effect
Construction activities (e.g., roads, berms, pads)	(-3) - 1	Increase in metal concentrations, major ions, and total suspended solids
Dewatering of Llama and Umwelt Lakes routed through PN04 to Goose Lake, treated for TSS	(-1)	Decrease in metal concentrations, major ions, and total suspended solids
Umwelt TF and Llama TF discharge to Umwelt Treatment Pond and initiate discharge to PN04	16 Onwards	Increase in metal concentrations, major ions, and total suspended solids followed by a decreasing trend. Time spent in Umwelt Lake allows more cyanide to degrade, lowering concentrations during post-closure
Treatment of water in Umwelt Treatment Pond until beginning of Post-Closure	19-23	Treatment of overflow reduces concentrations of treated constituents before returning to overall decreasing trend post-closure

Maximum monthly average concentrations are not predicted to exceed MDMER discharge limits at PN04 during any phase of the Project (Table 23).

Table 23: Predicted Maximum Monthly Average Constituent Concentrations for Each Phase of the Project at PN04 Under Average Climate Conditions

Constituent	Units	MDMER Limit[(a)]	Construction	Operation	Closure	Post-Closure
Total Suspended Solids	mg/L	15	3.0	2.9	2.9	2.7
Un-ionized ammonia	mg-N/L	0.50	0.00049	0.00039	0.19	0.028
Cyanide	mg/L	0.50	0.0023	0.0022	0.0035	0.0017
Arsenic	mg/L	0.10	0.0014	0.0016	0.0063	0.015
Copper	mg/L	0.10	0.0014	0.0015	0.0027	0.0022
Lead	mg/L	0.080	0.000052	0.000052	0.0024	0.00088
Nickel	mg/L	0.25	0.0049	0.0052	0.027	0.011
Zinc	mg/L	0.40	0.0033	0.0034	0.011	0.0047

(a) Refer to Table 19 for MDMER discharge limits

7.1.2 PN05

PN05 is located at the south-eastern shore of Goose Lake (see Figure 2) and receives flows from Goose Main Reservoir after it reaches its capacity. Table 24 summarizes key events that influence predicted concentrations at PN05.

Table 24: Overview of Activities Affecting PN05 Concentration History Under Average Climate Conditions

Activity	Mine Year(s)	Effect
Goose Main diversion berm is breached	16-18	Undisturbed flows greatly reduced, less dilution of road runoff flows, change in constituent concentration (increase or decrease) dictated by whether constituent is a higher concentration in pad source term vs. baseline source term
Goose Main Reservoir overflow arrives to PN05	19 Onwards	Increase in metal concentrations, major ions, and total suspended solids followed by a decreasing trend. Time spent in Goose Main Reservoir allows more cyanide to degrade, lowering concentrations during post-closure
Treatment of initial Goose Main Reservoir outflow	19-23	Treatment reduces concentrations of treated constituents before returning to decreasing trend post-closure

Maximum monthly average concentrations are not predicted to exceed MDMER discharge limits at PN05 during any phase of the Project (Table 25).

Table 25: Predicted Maximum Monthly Average Constituent Concentrations for Each Phase of the Project at PN05 Under Average Climate Conditions

Constituent	Units	MDMER Limit[(a)]	Construction	Operation	Closure	Post-Closure
Total Suspended Solids	mg/L	15	3.0	3.0	2.9	3.0
Un-ionized ammonia	mg-N/L	0.50	0.00043	0.00040	0.10	0.000081
Cyanide	mg/L	0.50	0.0023	0.0023	0.0022	0.00047
Arsenic	mg/L	0.10	0.0003	0.00031	0.0023	0.0011
Copper	mg/L	0.10	0.0014	0.0014	0.0016	0.0015
Lead	mg/L	0.080	0.00005	0.00005	0.0015	0.00055
Nickel	mg/L	0.25	0.0035	0.0035	0.0095	0.0059
Zinc	mg/L	0.40	0.003	0.003	0.0086	0.0051

(a) Refer to Table 19 for MDMER discharge limits

7.1.3 PN08

PN08 is located along the eastern part of the neck of Goose Lake (see Figure 2) and receives the runoff from Echo/Goose Main WRSA. Table 26 summarizes key events that influence predicted concentrations at PN08.

Table 26: Overview of Activities Affecting PN08 Concentration History Under Average Climate Conditions

Activity	Mine Year(s)	Effect
Flows diverted from PN09 to PN08, Echo/Goose Main WRSA runoff flows to Goose Lake atPN08.	16 Onwards	Increase in metal concentrations and major ions to a new plateau concentration. Decrease in total dissolved solids, total suspended solids, total organic carbon, cyanide, and ammonia.

Maximum monthly average concentrations are not predicted to exceed MDMER discharge limits at PN08 during any phase of the Project (Table 27).

Table 27: Predicted Maximum Monthly Average Constituent Concentrations for Each Phase of the Project at PN08 Under Average Climate Conditions (i.e., 50th Percentile)

Constituent (mg/L)	Units	MDMER Limit[(a)]	Construction	Operation	Closure	Post-Closure
Total Suspended Solids	mg/L	15	3.0	3.0	2.6	2.6
Un-ionized ammonia, as N	mg-N/L	0.50	0.00040	0.00039	0.00034	0.00034
Cyanide	mg/L	0.50	0.0023	0.0023	0.002	0.002
Arsenic	mg/L	0.10	0.00043	0.00043	0.028	0.028
Copper	mg/L	0.10	0.0014	0.0014	0.0027	0.0027
Lead	mg/L	0.080	0.00005	0.00005	0.00061	0.00029
Nickel	mg/L	0.25	0.0036	0.0036	0.011	0.011
Zinc	mg/L	0.40	0.0031	0.0031	0.0047	0.0047

(a) Refer to Table 19 for MDMER discharge limits

8.0 MODEL ASSUMPTIONS AND UNCERTAINTIES

The Model results are based on the Project timeline, water management plans, and available input data. As with any complex model, there is a degree of uncertainty associated with the modelling methods and inputs. The following sections outline assumptions made in the water balance and load balance components of the Model and their implications.

8.1 Water Balance Model

The following key assumptions were made in the water balance component of the Model:

- The fixed monthly distribution used as an input to the Model does not reflect the true behaviour of a hydrological year as months may vary from year to year (e.g., above average freshet followed by a drier than average summer). This may result in a potential underestimation of the required storage capacities during unusually wet weeks/months and potential underestimation of water supply requirements during unusually dry weeks/months.
    - The effects of annual wet and dry conditions were accounted for in the water balance model through the stochastic simulations and in the sizing of on-site storage facilities capacities and water supply requirements. In addition, the capacity of the on-site storage facilities and the permitted annual freshwater withdrawal volumes include excess capacity that could be used to manage shorter duration (i.e., weeks/months) wet or dry conditions.
- Runoff coefficient estimates for the mine-effected surfaces are based on professional judgement and available documentation (SRK 2020).
    - The runoff coefficient for the undisturbed ground was calibrated to regional data and was used as reference for the selection of the runoff coefficients for other surfaces, reducing the uncertainty related to the runoff coefficients for mine surfaces.

Groundwater inflows are dependent on hydraulic conductivity, and assumptions on permafrost and enhanced permeability structures/faults. Details on assumptions associated with the groundwater model and recommendations for mitigating effects of these assumptions are included in APPENDIX C.

8.2 Load Balance Model

Key assumptions and uncertainties of the load balance component of the Model are:

- Concentrations of constituents along the surface and subsurface flow paths are assumed to remain constant (e.g., no settling, precipitation, or reactions), which may result in an overestimation of constituent concentrations at prediction nodes.
- Diffusion of constituents from tailings consolidation and removal of chemical loading in open pits and tailings facilities are not accounted for in the load balance. This may result in an over- or underestimation of constituent concentrations within open pits and tailings facilities.
- Transport processes affecting TSS are not accounted for in the load balance which may result in an over- or underestimation of total suspended solids concentrations at prediction nodes.
- Water treatment targets that are set in the model are pending final treatment design.

- The load balance model assumes fully mixed conditions. Flows may not fully mix in ponds and reservoirs, which may result in an over- or underestimation of constituent concentrations at prediction nodes.
- The load balance assumes 100% exclusion of constituents from ice during under-ice conditions (i.e., cryoconcentration), which may result in an overestimation of constituent concentrations during under-ice conditions.
- Un-ionized ammonia is calculated based on total ammonia using the methods outlined in the MDMER (Government of Canada 2002). Inputs into the formula conservatively use the 95th percentile of surface water temperature measurements of streams flowing into Snap Lake[5] (15°C; De Beers 2015), and an assumed pH (8.5) based on PHREEQC modelling of source terms and mill processes.
- Ammonia generated in the Process Plant is calculated assuming that the total nitrogen concentration after the leach circuit is the total nitrogen in weak acid-dissociable cyanide concentrations reported on the test work (JDS 2015).

Inherent uncertainties in modelling assumptions may result in differences between model predictions and future monitored conditions; however, the overall effect of the assumptions and limitations above are anticipated to result in predictions that are typically more conservative relative to future conditions (e.g., overestimation of concentrations in discharges).

9.0 CONCLUSIONS

The Model was created to provide water quantity and quality estimates based on the Project timeline, water management plans, and available input data to support commitments under Type A Water Licence 2AM-BRP1831, Amendment No.1. The Model should be used as a planning tool to analyze water management options and treatment needs that would be potentially required during the life of the Project. The water management strategy focuses on managing the inventory of the mine water stored on site, and maximizing the separation of saline, contact, and non-contact water. Water quality predictions were evaluated at the discharge points to Goose Lake (i.e., prediction nodes) and compared to MDMER discharge limits.

During Closure, all open pits (or pit reservoirs) will fill under all hydrological conditions assessed (i.e., 5th, 50th, and 95th percentile water balance results). As part of operational activities, Sabina will adjust water management strategies as required so that relevant discharges to Goose Lake from the Project meet MDMER and relevant Water Licence discharge limits.

The Model should be updated as necessary for design purposes and as more operational data become available, or as directed by the Board in accordance with Type A Water License 2AM-BRP1831 Amendment No.1, Part E, Item 16.

[5] Snap Lake Project, De Beers Group, Northwest Territories, Aquatic Effects Monitoring Program

10.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or comments, please contact the undersigned.

Golder Associates Ltd.

REGISTERED PROFESSIONAL ENGINEER
P. CHIARAMELLO
LICENSEE
NT/NU
30 AUG 2022
FOR SECTION 1, 2, 3, 5, 6 AND 8

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Ryan Shaw,
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Senior Geochemist

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PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature ____________
Date 2022-08-30
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

https://golderassociates.sharepoint.com/sites/136792/project files/6 deliverables/1.0 working/21505757-122-r-rev0-100-water and load balance report/21505757-122-r-rev0-1100-water and load balance report 30aug_2022.docx

11.0 REFERENCES

De Beers (De Beers Group). 2017. 2016 Annual report in support of the Aquatics Effects Monitoring Program Water Licence, Snap Lake Project. Submitted to the Mackenzie Valley Land and Water Board. Yellowknife, NT, Canada.

Ferguson, K.D. and Leask, S.M. 1988. *The export of Nutrients from Surface Coal Mines. Environment Canada, Conservation and Protection, Pacific and Yukon Region.* Regional Program Report 87-12.

Golder (Golder Associates Ltd.). 2019. Sabina Gold & Silver Corp. Back River Project – Aquatic baseline synthesis report. Appendix A to the Aquatic Effects Monitoring Program. Submitted to Sabina Gold & Silver Corp. Ref No. 18114181-047-RPT-Rev0. July 2019.

Government of Canada. 2002. Metal and Diamond Mining Effluent Regulations. SOR/2002-222. Current to 8 August 2022. Last amended on 24 June 2022. https://laws-lois.justice.gc.ca/eng/regulations/sor-2002-222/index.html.

JDS (JDS Energy and Mining Inc). 2015. Technical report for the initial project feasibility study on the Back River Gold Property, Nunavut, Canada. Received October 28, 2015.

Keefe, M. 2021. Environmental Permitting Manager, Sabina Gold & Silver Corp. Updated sewage treatment plant effluent concentrations. Email to Shadi Dayyani, Senior Water Quality Modeller, WSP Golder. 13 January 2021.

Keefe, M. 2022. Environmental Permitting Manager, Sabina Gold & Silver Corp. Representative process water characterization results. Email to Shadi Dayyani, Senior Water Quality Modeller, WSP Golder. 4 February 2022.

KP (Knight Piesold Consulting). 2021. Excel File "Back_River_Water_Balance-2021-02-26.xlsx".

Morin, K. A. and Hutt, N. M. 2009. Mine-Water Leaching of Nitrogen Species from Explosive Residues. GeoHalifax: Halifax, NS.

Parkhurst, D.L., and Appelo, C.A.J., 2013, Description of input and examples for PHREEQC version 3—A computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations: U.S. Geological Survey Techniques and Methods, book 6, chap. A43, 497 p., https://doi.org/10.3133/tm6A43

Rescan ERM. 2012. Back River Project 2011 freshwater baseline report. June 2012.

Sabina. 2017. The Back River Project Main Application Document October 2017. Submitted to the Nunavut Water Board. October 2017.

Sabina. 2021. National Instrument (NI) 43-101 Technical Report, 2021 Updated Feasibility Study for the Goose Project at the Back River Gold District Nunavut, Canada. March 2021.

SRK Consulting (Canada) Inc. 2004. Colomac site enhanced natural removal program 2003 results. Report prepared for Indian and Northern Affairs Canada, NWT Region and Public Works and Government Services Canada, Western Region. March 2004.

SRK Consulting (Canada) Inc. 2015. Back River Project water and load balance report. April 2015.

SRK Consulting (Canada) Inc. 2015b. The Back River Project – Climate Change Projections for Use in Engineering Design. November 2015.

SRK Consulting (Canada) Inc. 2015c. The Back River Project – Hydrology Report. November 2015.

SRK Consulting (Canada) Inc. 2020. Back River Project water and load balance report. Appendix E to the Water Management Plan. June 2020.

SRK Consulting (Canada) Inc. 2021. Back River: Updated Feasibility Study – Hydrology Update. July 16, 2021

WSP Golder. 2022. Hydrodynamic and Water Quality Modelling of Goose Lake. Submitted to Sabina Gold & Silver Corp. August 2022.

STUDY LIMITATIONS

WSP Golder has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

This document, including all text, data, tables, plans, figures, drawings, and other documents contained herein, has been prepared by WSP Golder for the sole benefit of Sabina Gold & Silver Corp. (Sabina). It represents WSP Golder's professional judgement based on the knowledge and information available at the time of completion. WSP Golder is not responsible for any unauthorized use or modification of this document. All third parties relying on this document do so at their own risk.

The factual data, interpretations, suggestions, recommendations, and opinions expressed in this document pertain to the specific project, site conditions, design objective, development and purpose described to WSP Golder by Sabina, and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations and opinions expressed in this document, reference must be made to the entire document.

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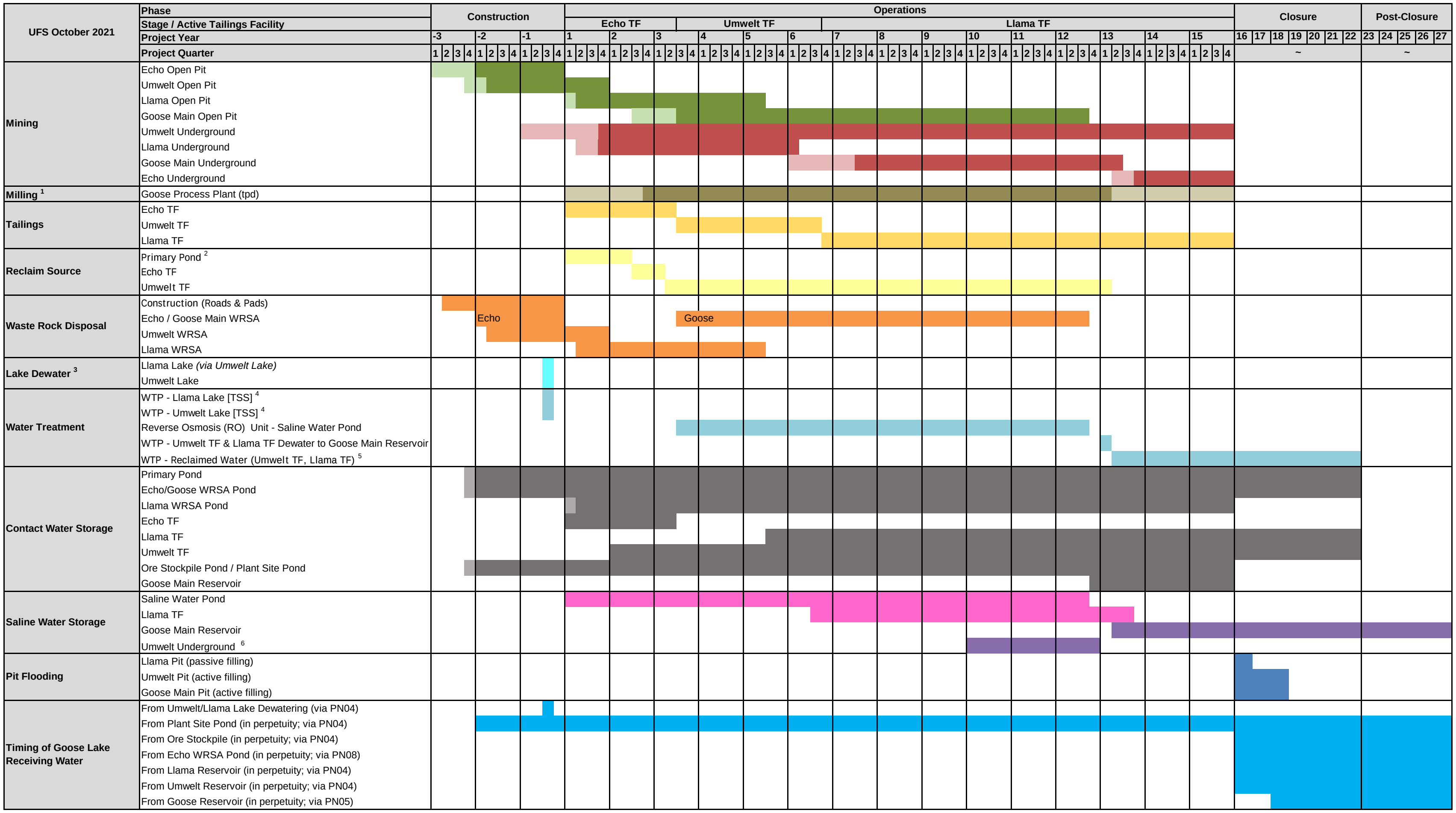
APPENDIX A

Project Timeline

Golder Associates Ltd. (a member of WSP)

Project Timeline – UFS October 2021 (WSP Golder WLB Update; based on average climate conditions)



NOTES:

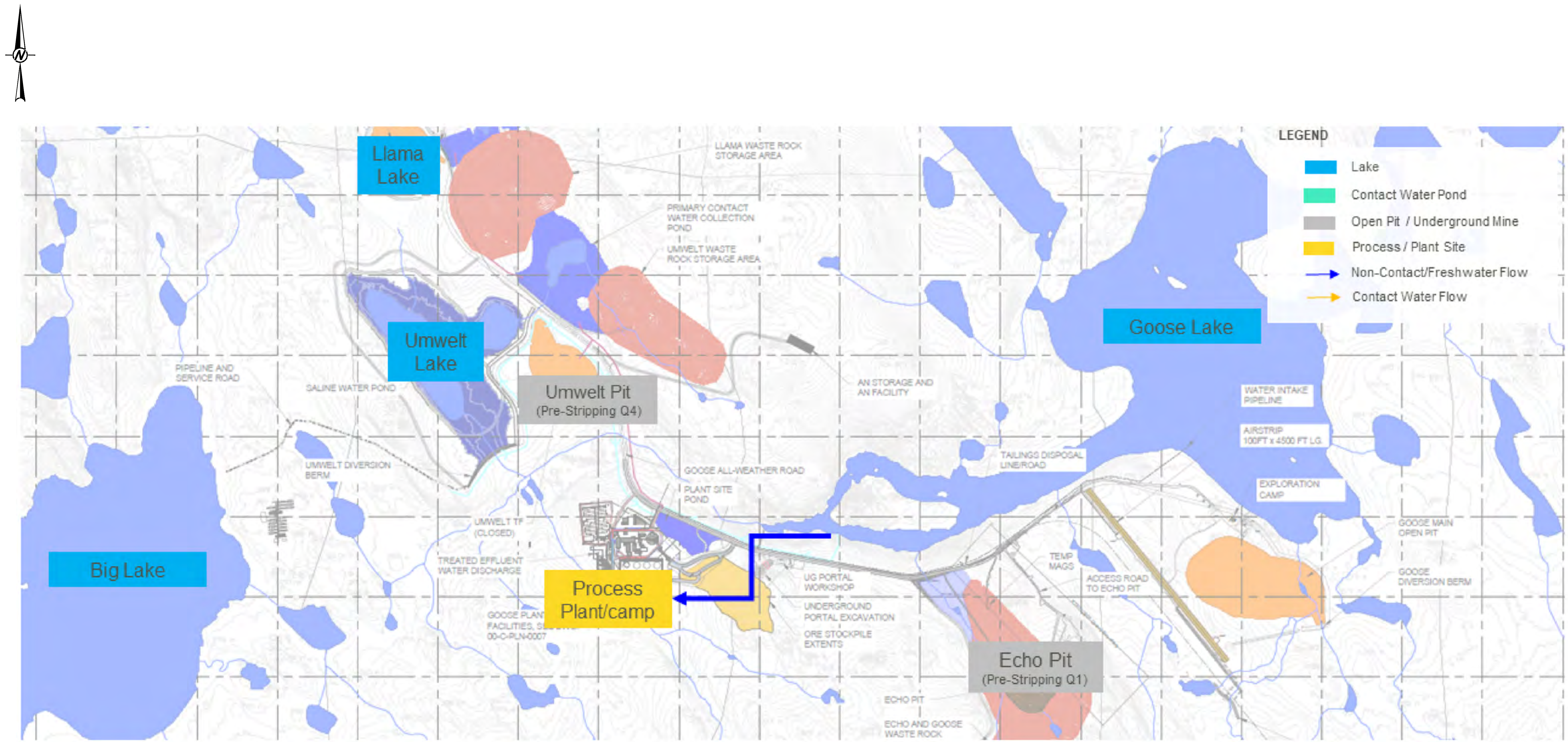
1. Milling will be at 2,000 to 3,000 tpd between Y1, Q1 and Y2, Q3, and 4,000 tpd starting in Y2, Q4, ramping down (variable feed rate) starting in Y13, Q2 till closure.
2. Reclaim from Primary Pond used for start-up until each Tailings Facility supernatant pond is sufficiently established and/or to supplement the reclaimed water requirements.
3. 50% direct discharge to Goose Lake; 50% treated for total suspended solids (TSS) before discharge. Dewatering from lakes (Umwelt and Llama) assumed to be completed in one open water season.
4. Total suspended solids.
5. Water treatment plant treating to reduce metals, phosphorus, nitrogen species, and suspended solids loading in the facilities.
6. The Umwelt Undergrouns is used as repository for saline water in Year 10 to 12. If insufficient volume is available at surface for saline water storage, additional capacity in Umwelt Underground is available..

COLOUR LEGEND

- Open Pit Mining - PreDevelopment
- Open Pit Mining - Production
- Underground Mining - PreDevelopment
- Underground Mining - Production
- Process Plant - Ramp Up & Ramp down
- Process Plant - Full Production
- Tailings Deposition
- Supernatant Water Reclaim for Process Plant
- Waste Rock Placement
- Lake Dewatering
- Water Treatment
- Contact Water (Temporary Storage) - Construction
- Contact Water (Temporary Storage) - Use
- Saline Water (Temporary Storage)
- Saline Water (Permanent Storage)
- Contact and Fresh Water Flooding
- Contact Water Overflow to Goose Lake

APPENDIX B

Flow Diagrams



NOTE(S)
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REFERENCE(S)
DATA OBTAINED FROM SABINA (2022)

CLIENT
Sabina

SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-08-30
DESIGNED	SC
PREPARED	NB
REVIEWED	PC
APPROVED	PC

TITLE
FLOW DIAGRAM
CONTRUCTION: YEAR -3

PROJECT NO.	CONTROL	REV.	FIGURE
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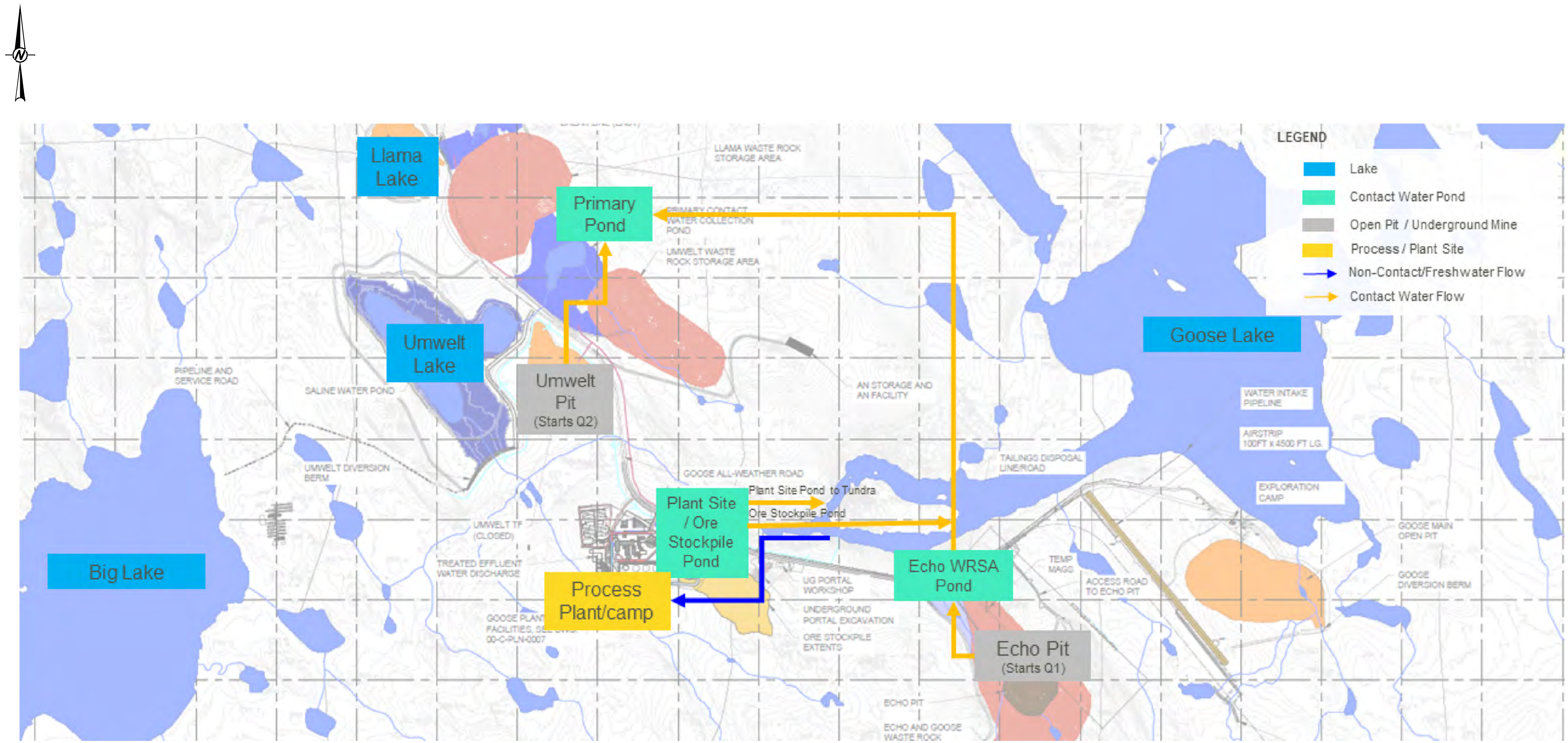

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PREPARED	NB
REVIEWED	PC
APPROVED	PC

TITLE

FLOW DIAGRAM
CONTRUCTION: YEAR -2

PROJECT NO.	CONTROL	REV.	FIGURE
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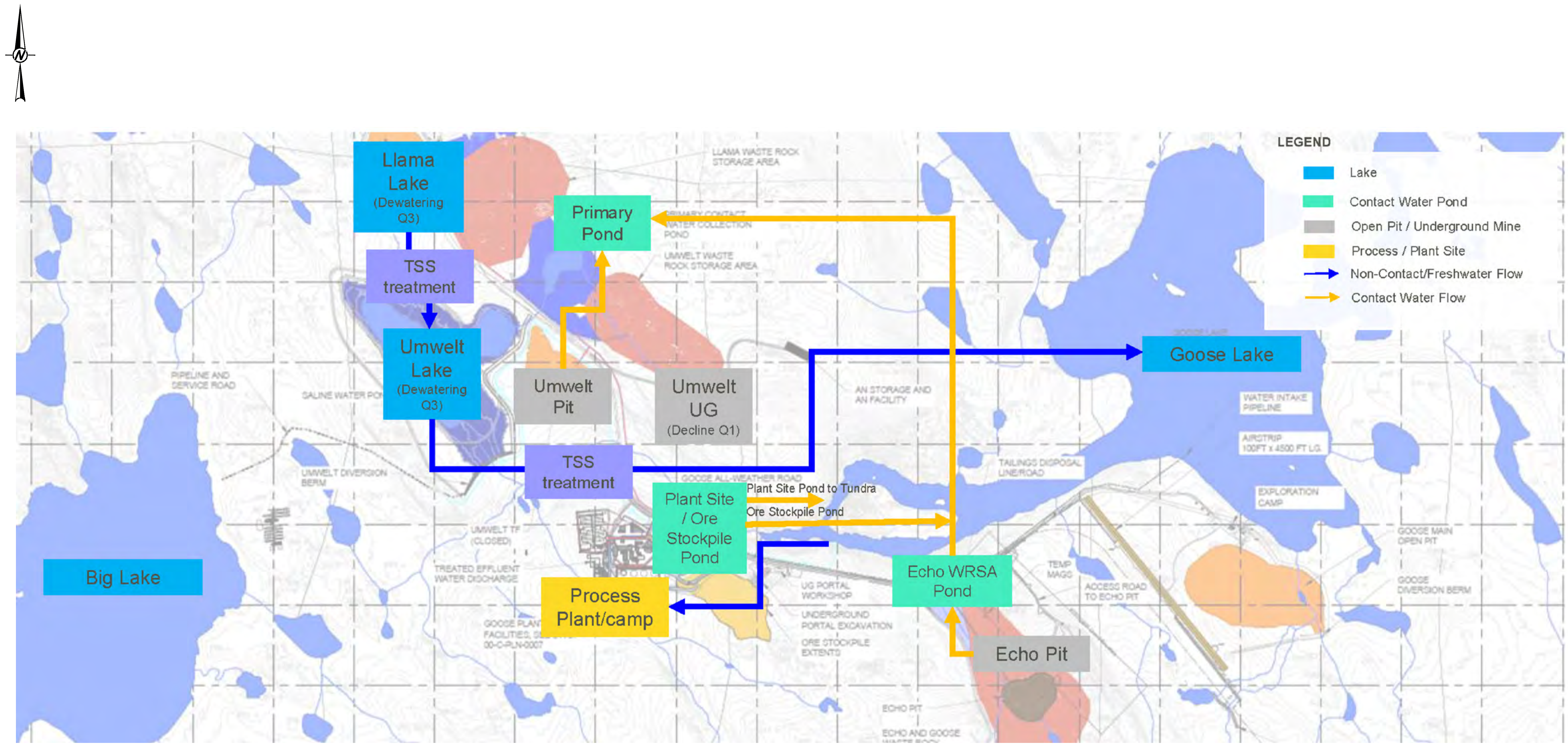

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WSP GOLDER

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PREPARED	NB
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APPROVED	PC

SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
FLOW DIAGRAM
CONTRUCTION: YEAR -1

PROJECT NO.	CONTROL	REV.	FIGURE
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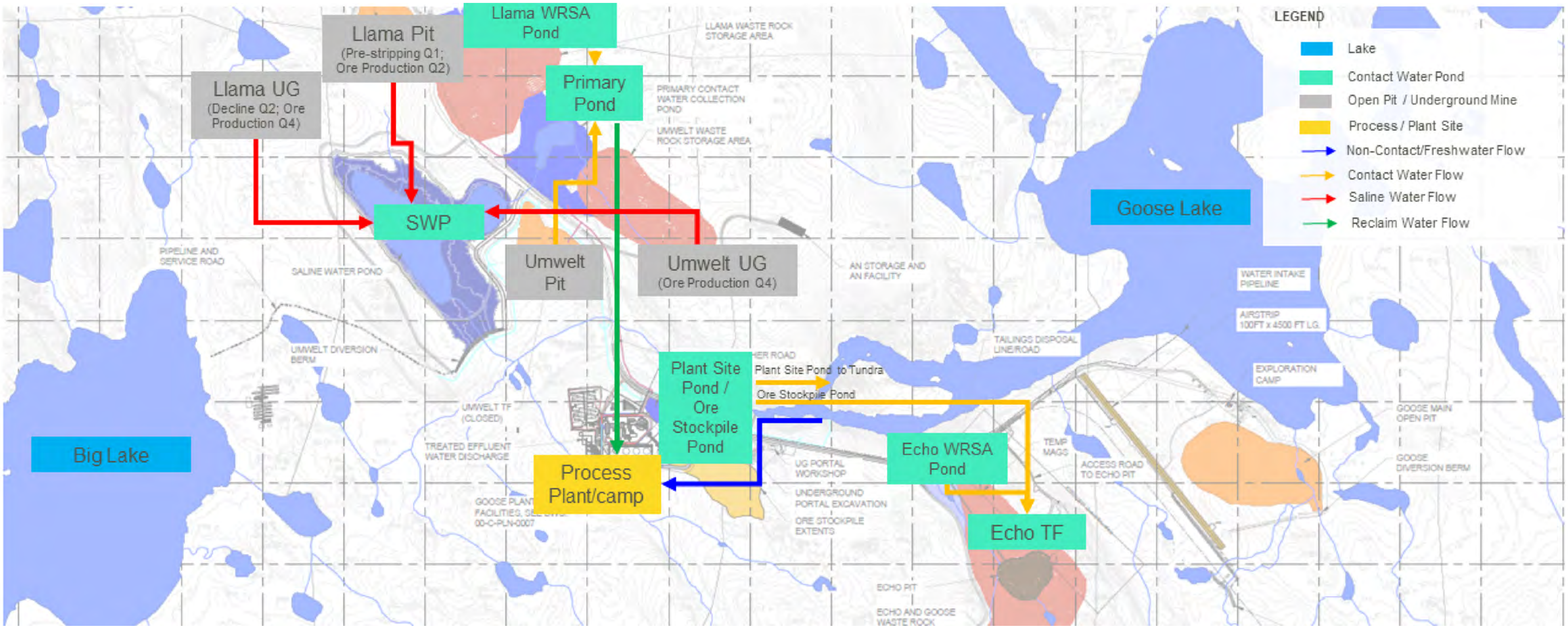

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APPROVED	PC

PROJECT

SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE

FLOW DIAGRAM
OPERATIONS: YEAR 1

PROJECT NO.	CONTROL	REV.	FIGURE
21505757	-	0	B-4

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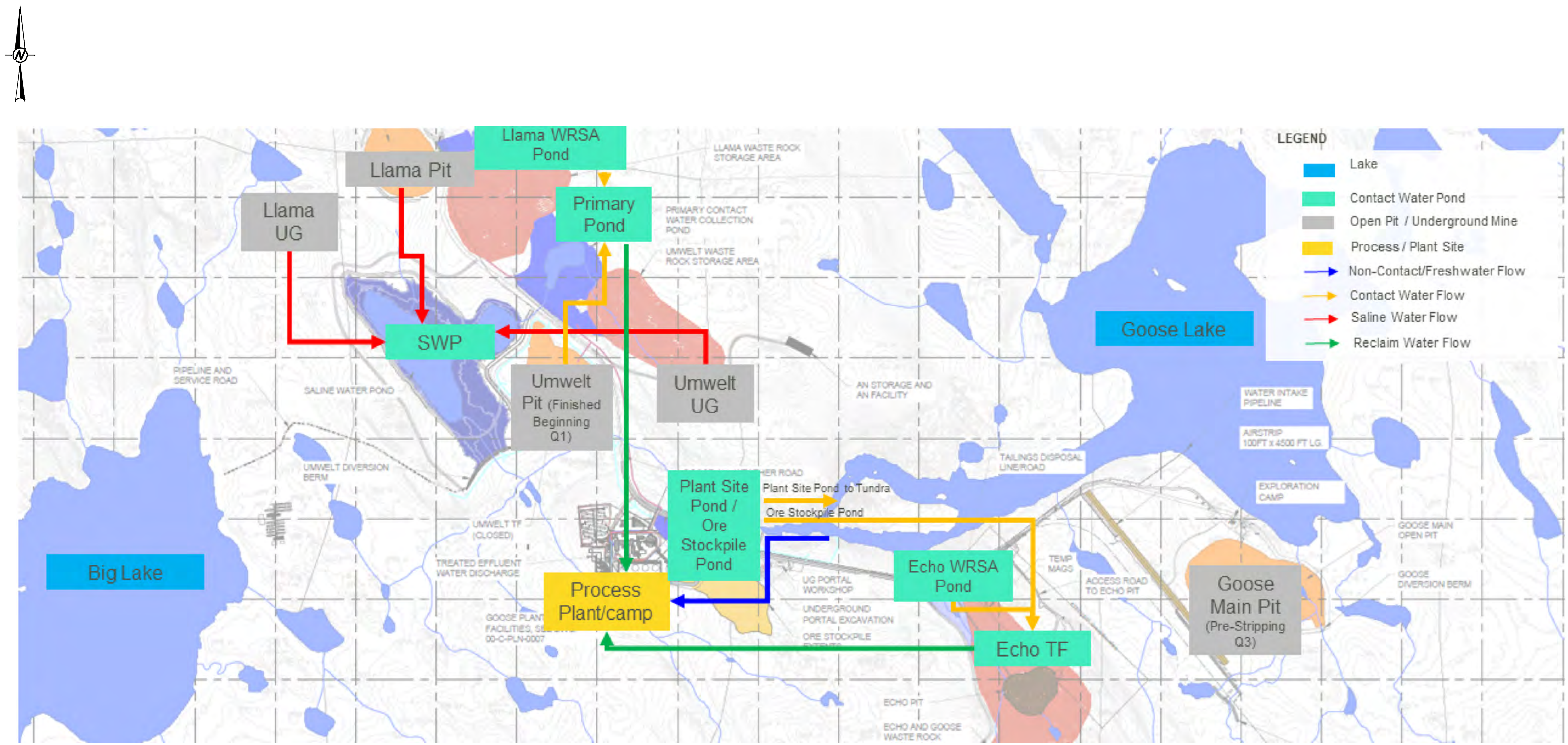

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TITLE
FLOW DIAGRAM
OPERATIONS: YEAR 2

PROJECT NO.	CONTROL	REV.	FIGURE
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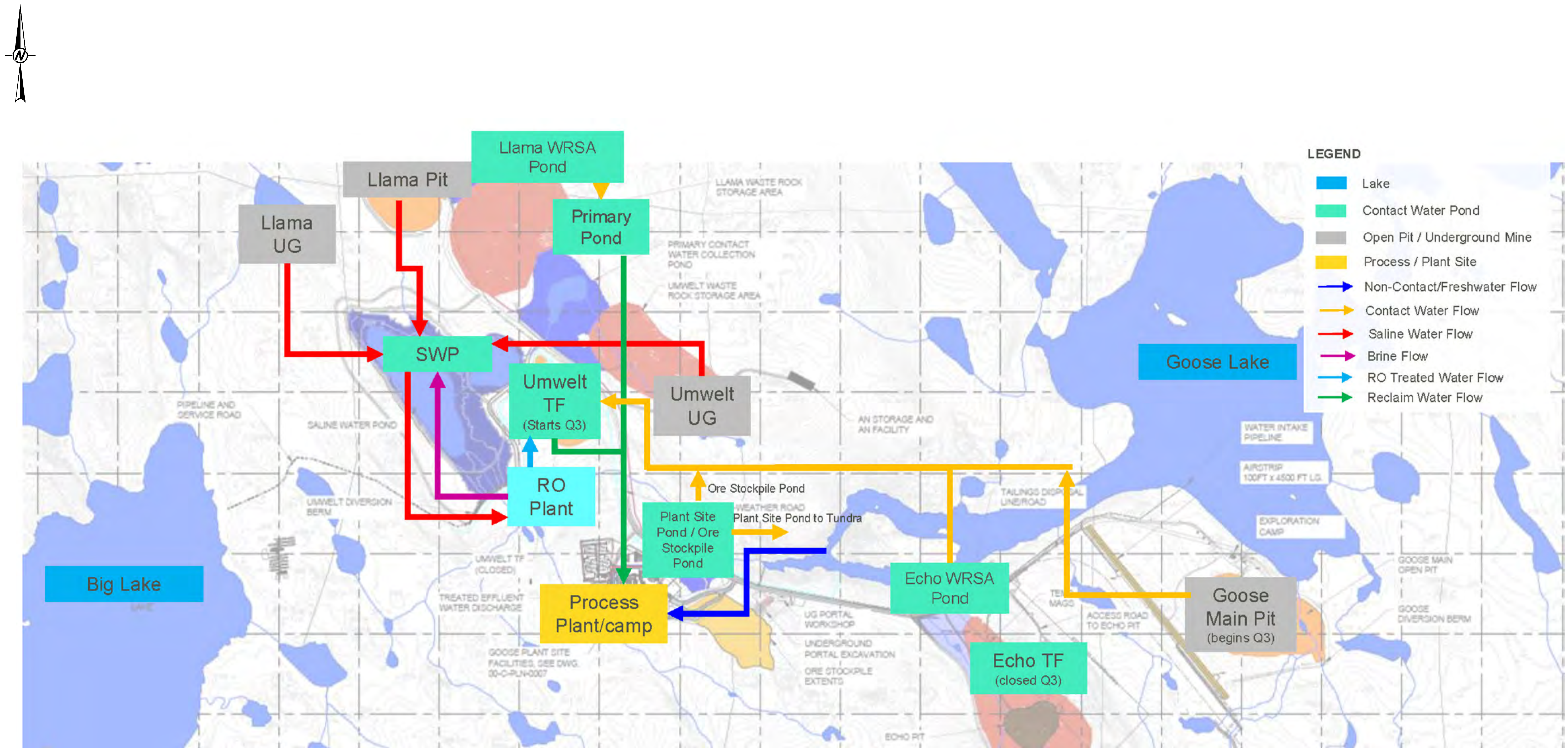

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SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
FLOW DIAGRAM
OPERATIONS: YEAR 3

PROJECT NO.	CONTROL	REV.	FIGURE
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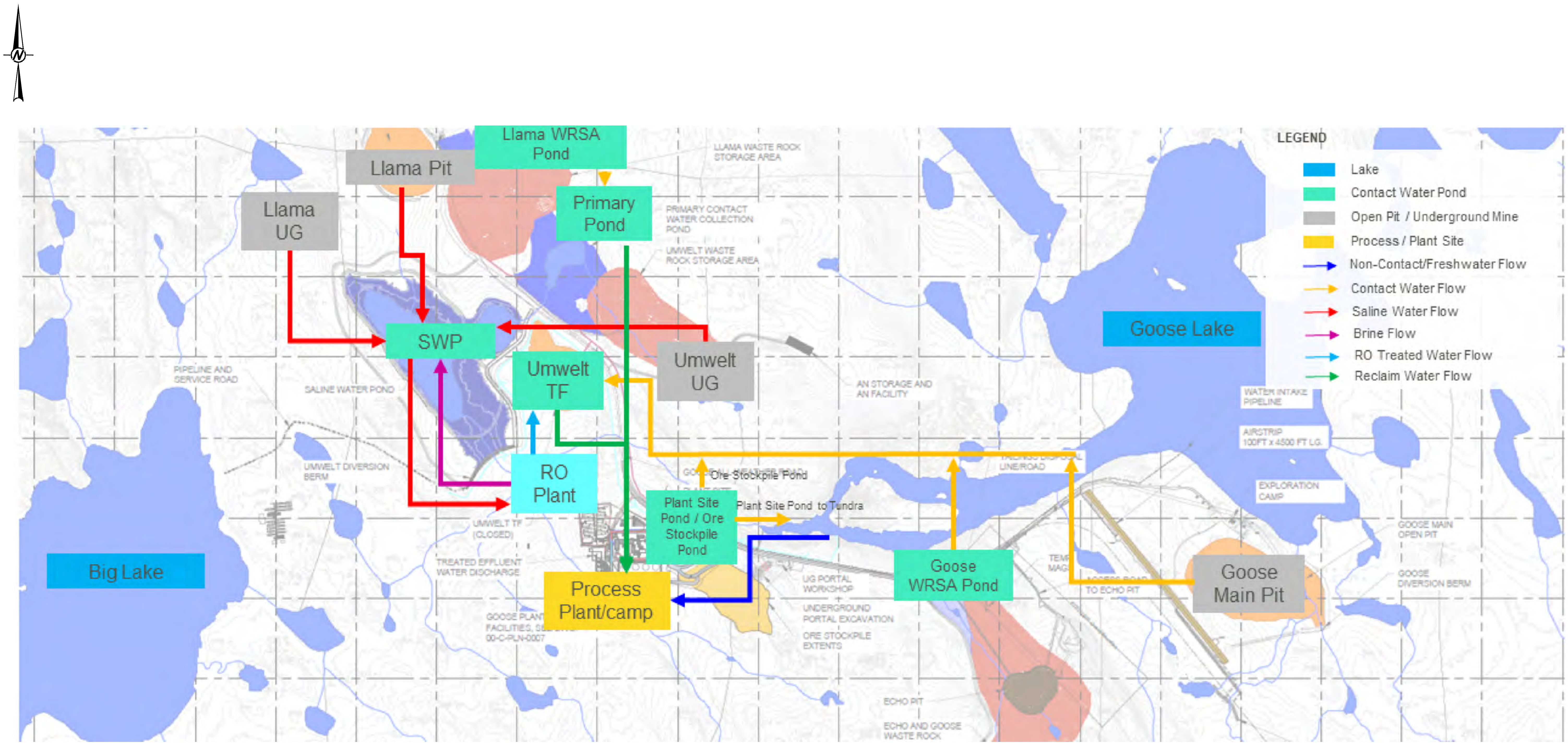

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TITLE

FLOW DIAGRAM
OPERATIONS: YEAR 4

PROJECT NO.	CONTROL	REV.	FIGURE
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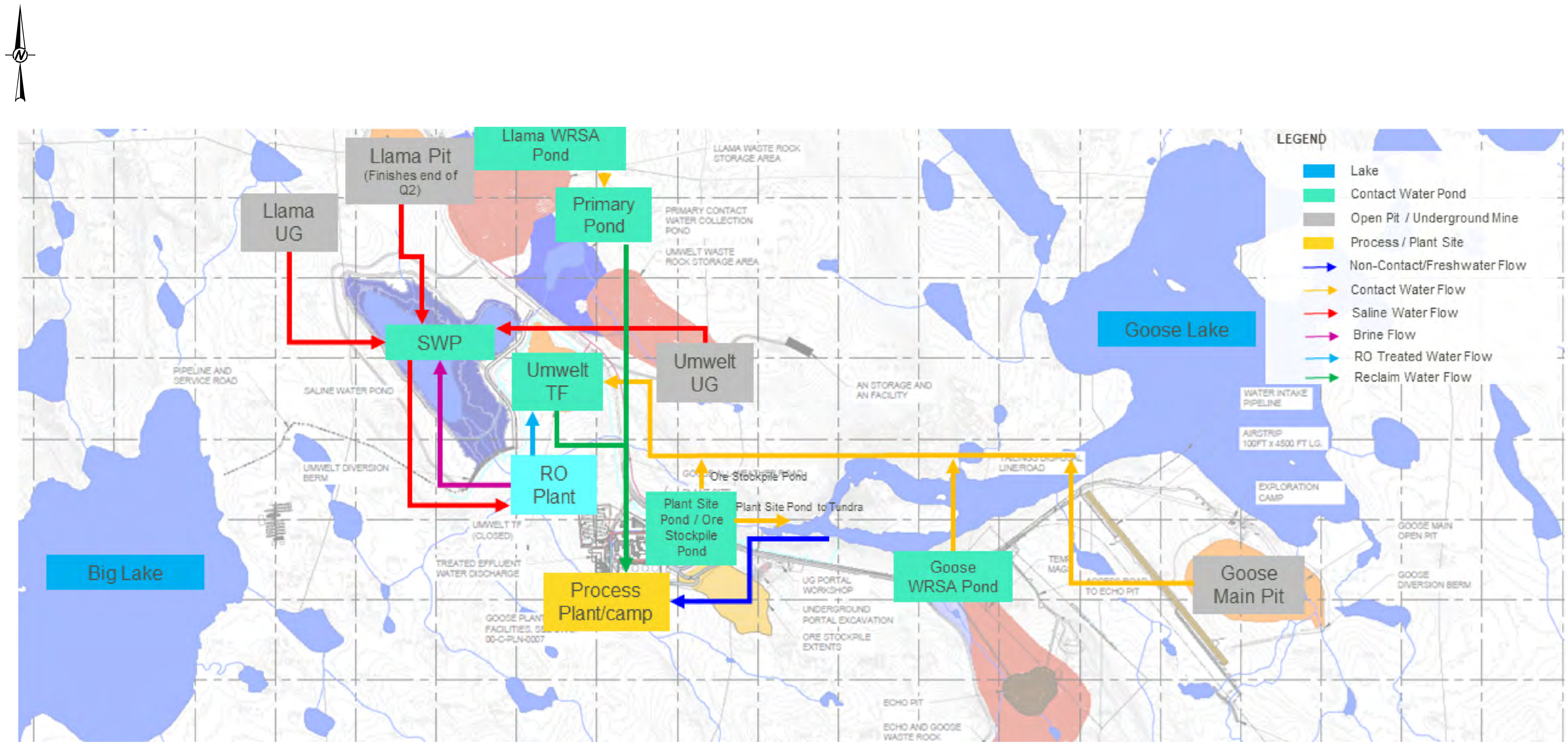

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APPROVED	PC

SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE

FLOW DIAGRAM
OPERATIONS: YEAR 5

PROJECT NO.	CONTROL	REV.	FIGURE
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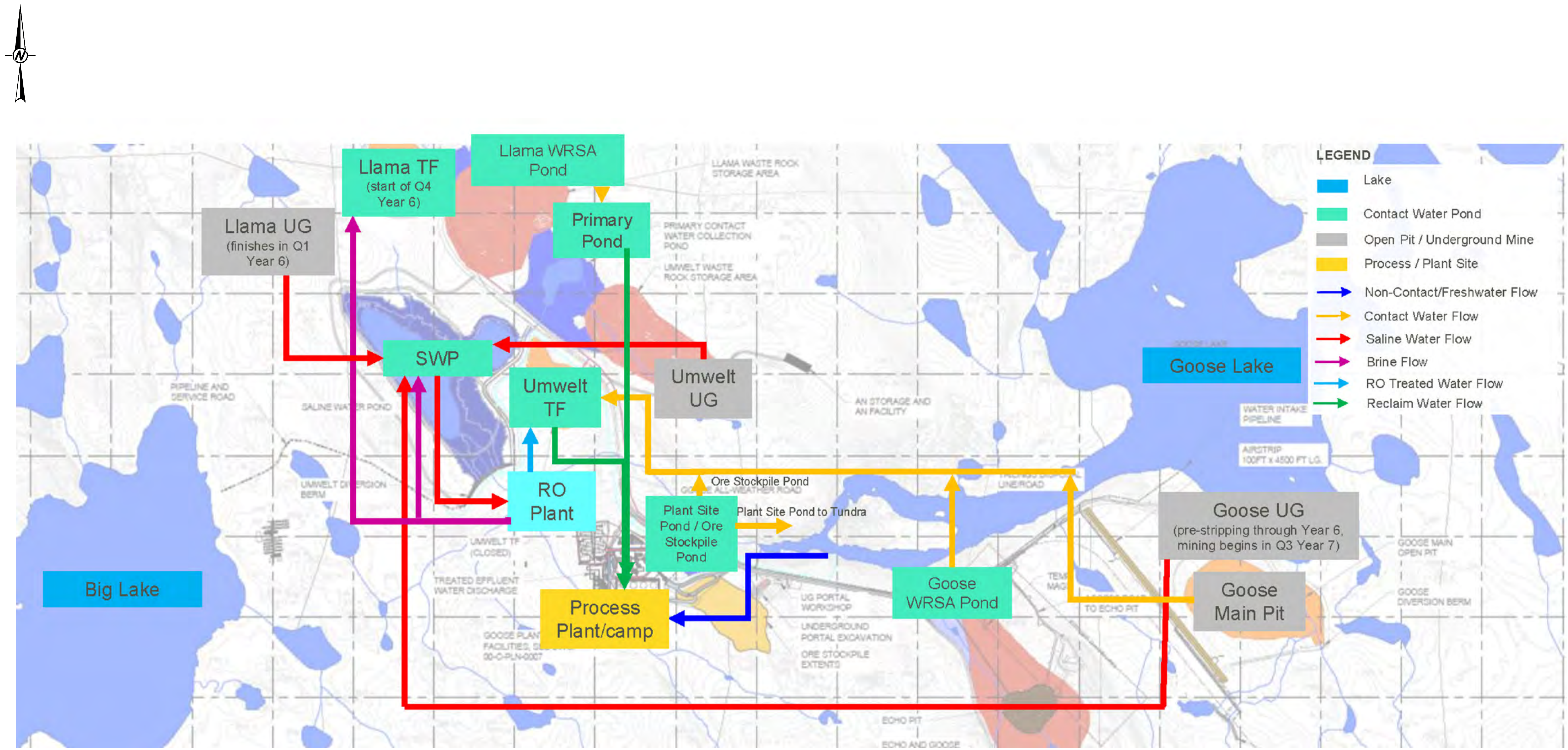

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SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
FLOW DIAGRAM
OPERATIONS: YEAR 6 - 12

PROJECT NO.	CONTROL	REV.	FIGURE
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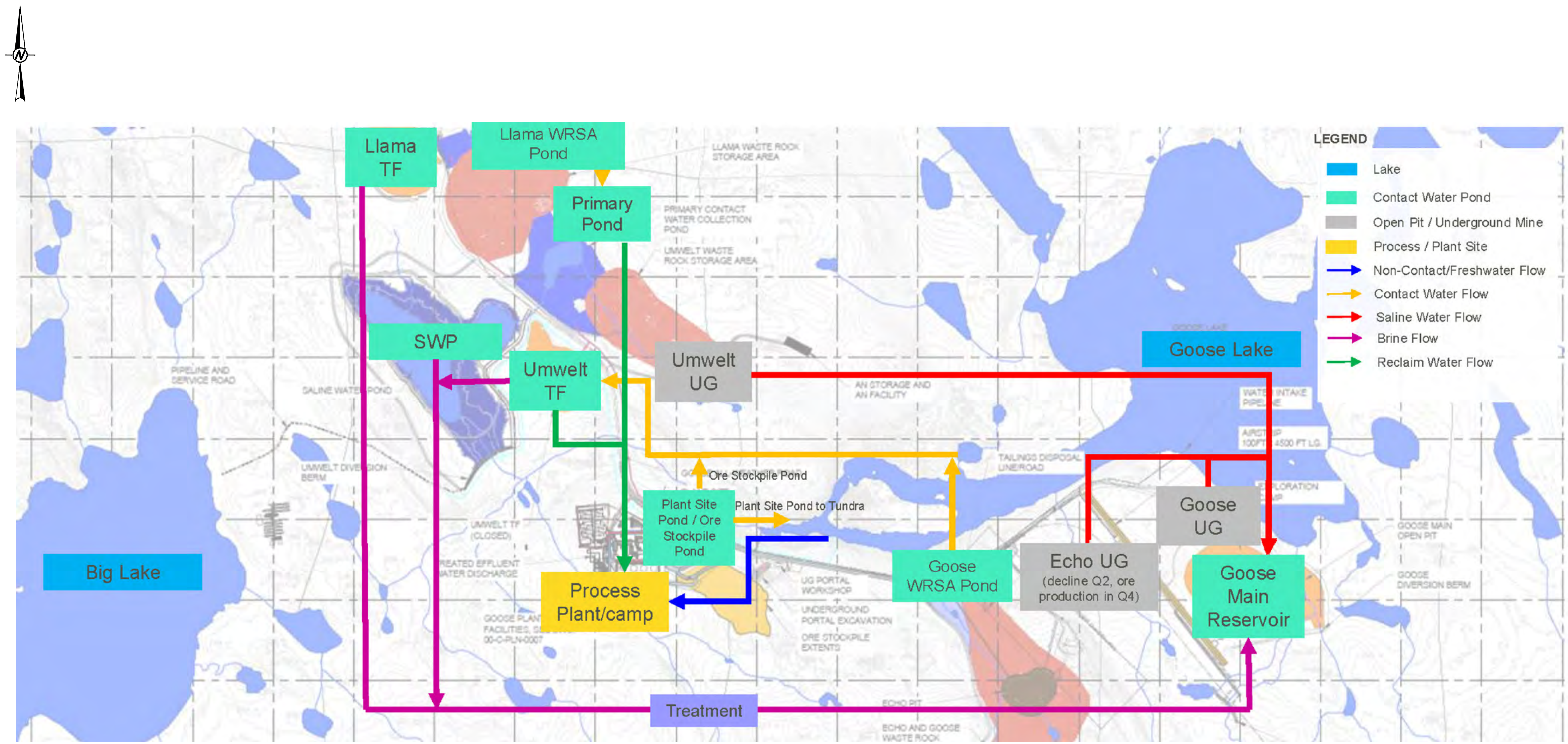

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SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
FLOW DIAGRAM
OPERATIONS: YEAR 13

PROJECT NO.	CONTROL	REV.	FIGURE
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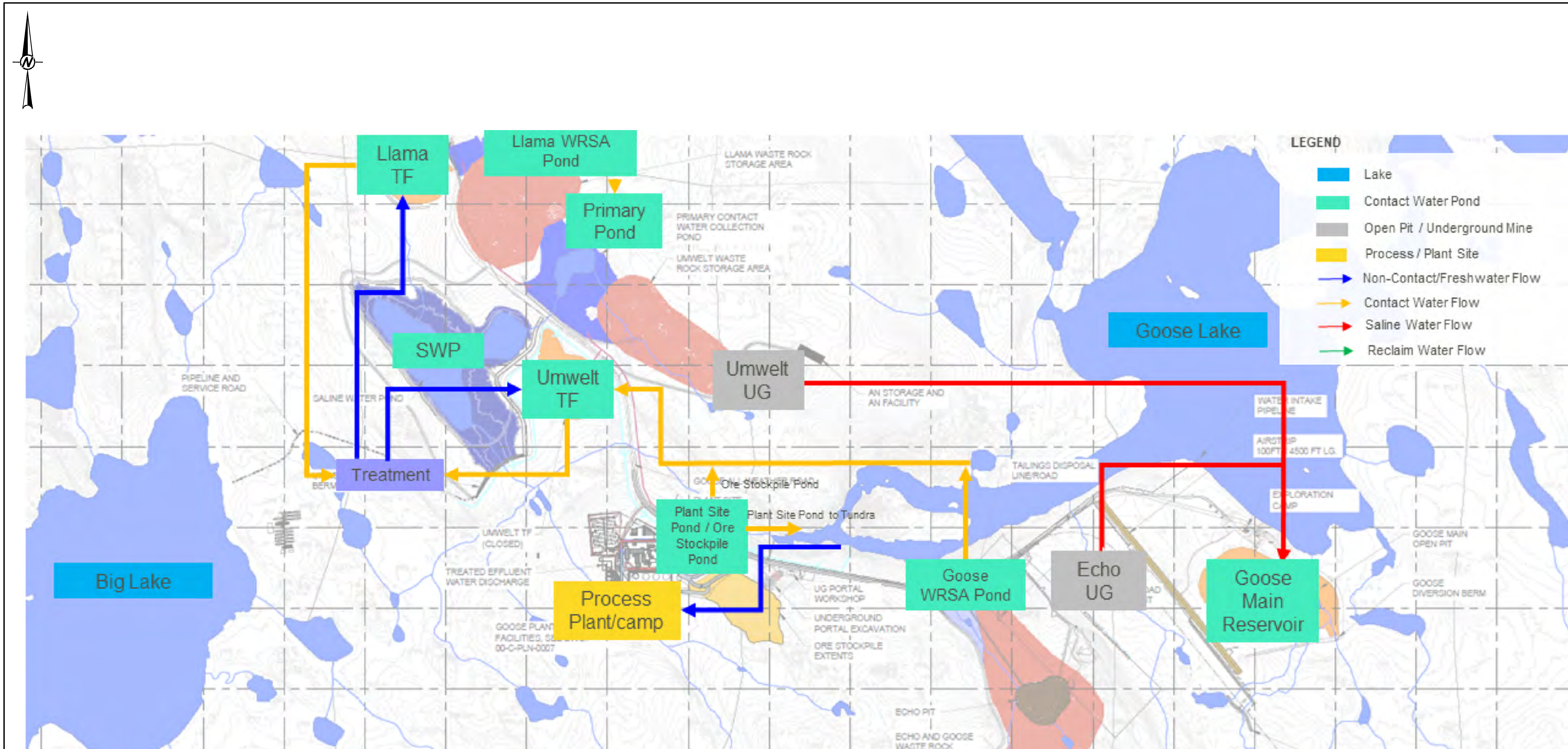

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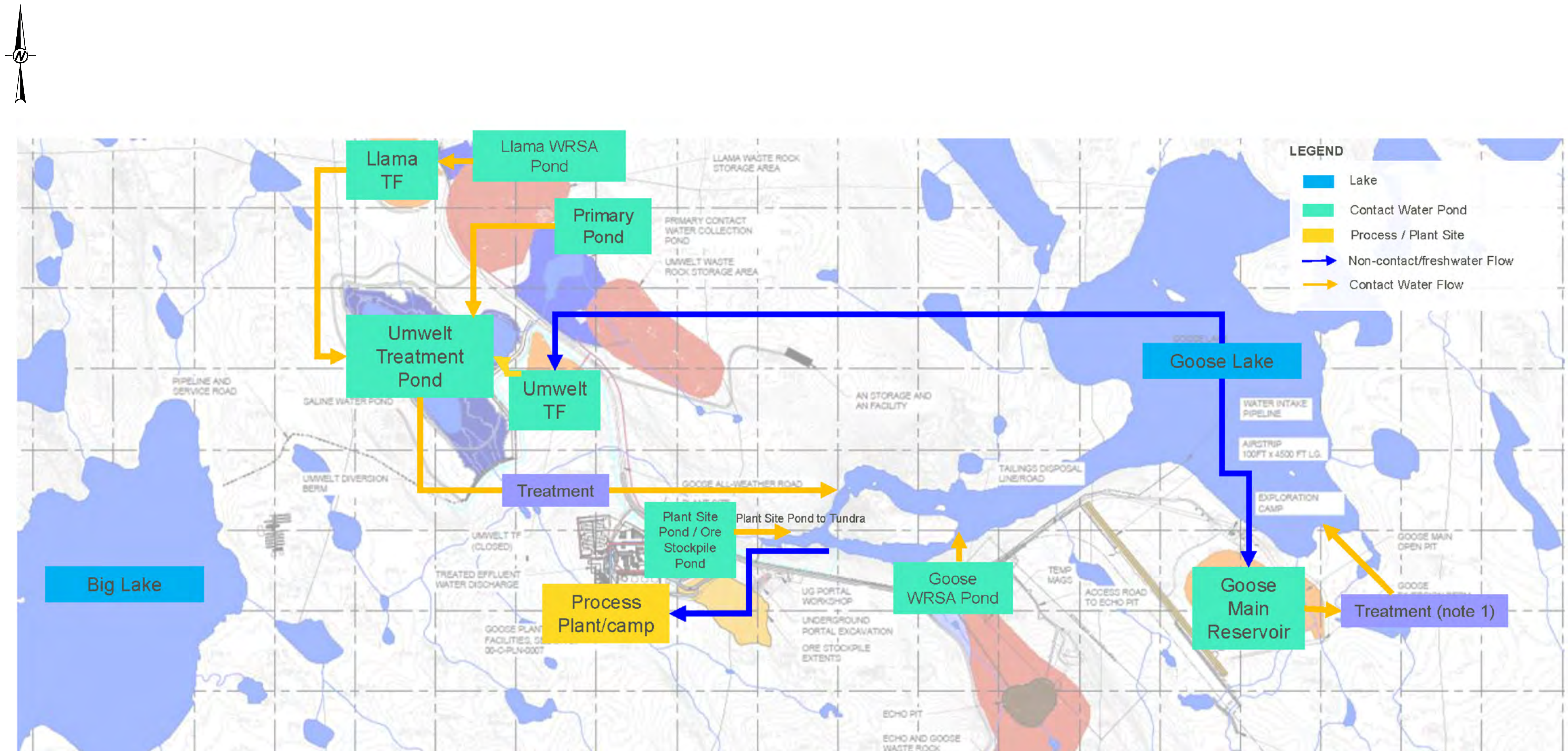
REVIEWED	PC
APPROVED	PC

SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
FLOW DIAGRAM
OPERATIONS: YEAR 14 - 15

PROJECT NO.	CONTROL	REV.	FIGURE
21505757	-	0	B-11



NOTE(S)

1. TREATMENT STARTS IN APPROXIMATELY YEAR 19 WHEN GOOSE RESERVOIR REACHES CAPACITY.

REFERENCE(S)

DATA OBTAINED FROM SABINA (2022)

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SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

CONSULTANT

WSP GOLDER

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PREPARED	NB
REVIEWED	PC
APPROVED	PC

TITLE

FLOW DIAGRAM
ACTIVE CLOSURE: YEAR 16 - 22

PROJECT NO.	CONTROL	REV.	FIGURE
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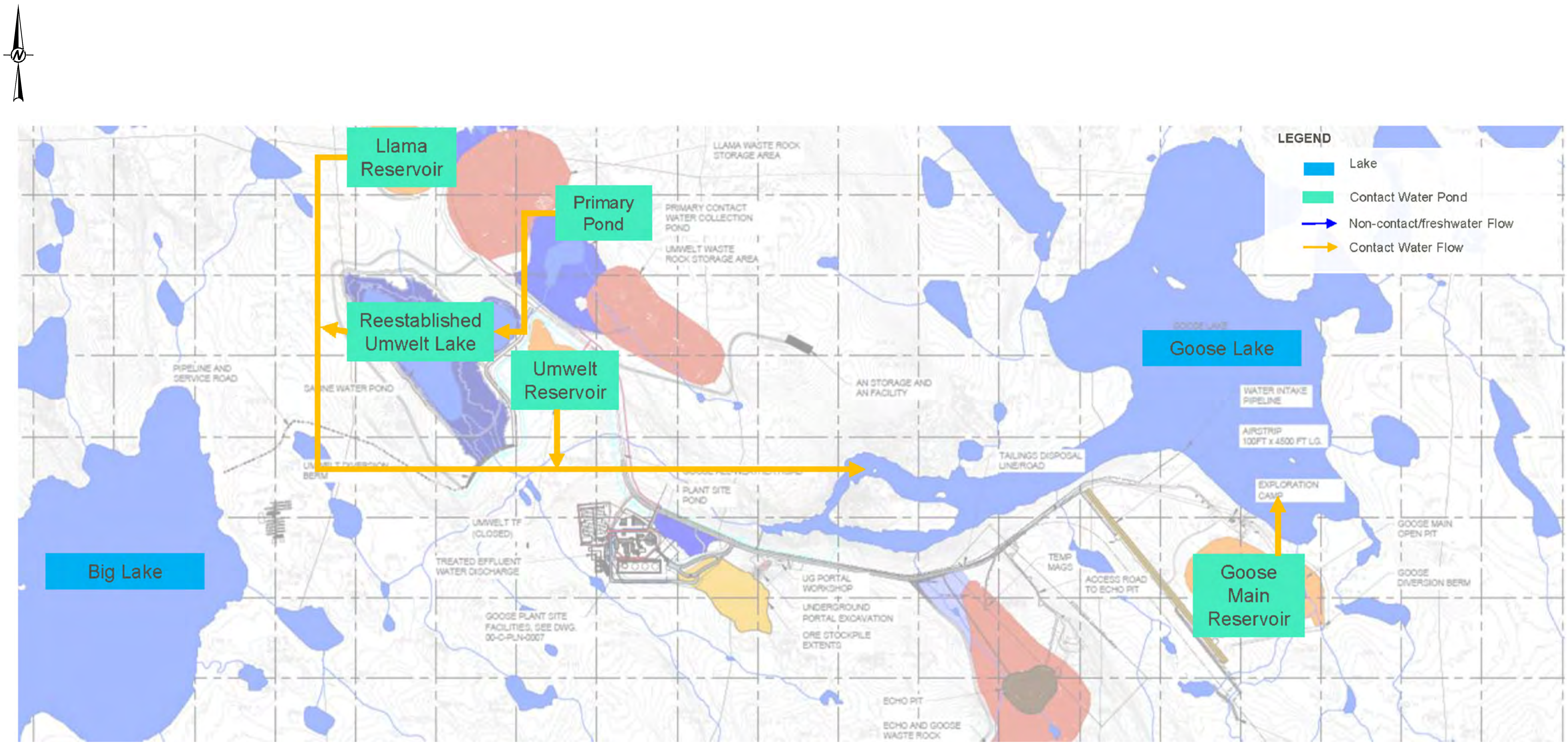

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SABINA BACK RIVER PROJECT, WATER LICENCE PHASE, NUNAVUT CANADA

TITLE
FLOW DIAGRAM
POST CLOSURE: YEAR 23

PROJECT NO.	CONTROL	REV.	FIGURE
21505757	-	0	B-13

APPENDIX C

Updated Predictions of Groundwater Inflows

WSP GOLDER

DATE 30 August 2022

Reference No. 20412211-102-TM-Rev0-3700

TO Merle Keefe
Sabina Gold & Silver Corp.

CC Dionne Filiatrault

FROM Jennifer Levenick, Don Chorley

EMAIL **jennifer.levenick@wsp.com; don.chorley@wsp.com**

UPDATED PREDICTIONS OF GROUNDWATER INFLOW – BACK RIVER PROJECT

1.0 INTRODUCTION

This technical memorandum documents the results of an updated hydrogeological assessment for the Back River Project (Project). The assessment utilized a previously developed three-dimensional (3D) numerical model by SRK Consulting (Canada) Inc. that was developed for the Final Environmental Impact Statement (FEIS; Sabina 2015) and 6,000 tpd mine plan.

2.0 FEFLOW MODEL DESCRIPTION

In 2015, SRK developed a 3D groundwater model for the Project using FEFLOW v6.2 to support the FEIS. A full summary of the model development and the conceptual and numerical model is presented in SRK's Hydrogeological Characterization and Modeling Report (SRK 2015).

For this assessment, Golder continued to utilize the existing FEFLOW model, updated to FEFLOW v7.3. FEFLOW code was used as it is capable of simulating transient saturated-unsaturated and variable density groundwater flow and mass transport in heterogeneous and anisotropic porous media under a variety of hydrogeologic boundaries and stresses. This software is widely used in support of groundwater mining projects to provide predictions of groundwater inflow quantity and quality.

Prior to utilizing the model, Golder Associates Ltd. (Golder) reviewed the model to assess its suitability for use in this assessment. Following this review Golder made the modifications to the model to reflect the changes in the mine plan (e.g., boundary conditions and numerical mesh) and changes to the assumed bedrock hydraulic conductivity and storage properties. These modifications are outlined in Sections 2.1 to 2.3.

2.1 Numerical Mesh

The following modifications were made to the numerical mesh to simulate the new mine plan:

- Model elements were locally refined near the Llama Open Pit and the Llama, Goose Main, and Echo undergrounds to improve predictions of hydraulic head and the transport of total dissolved solids near the mine developments.
- Two additional model layers were added to the base of model to increase the distance between the deepest underground and the previous base of the model to reduce the effect of the boundary conditions on model predictions. The base of the model is now at -1025 metres above sea level (masl), which is over 500 m below the deepest underground.
- Slice 2 and 3 of the original SRK model were removed. These layers were present in the SRK model to simulate thin lakebed sediments with assumed lower permeability than the surrounding material. The removal of the thin layers (i.e., lakebed sediments) in the updated model improved numerical stability and model mass balance error and is overall more conservative for the prediction of groundwater inflow (i.e., there is no restriction in the exchange of groundwater-surface).

2.2 Model Boundaries

The following modifications were made to the model boundaries to simulate the new mine plan:

- The boundary conditions within the model were updated to reflect the mine workings and schedule for the updated mine plan for the Project. The mine workings were represented using specified head boundaries constrained to only allow the removal of water from the model domain. The mine plan was generally implemented on an annual basis according to the information presented in the mine plan provided by Sabina. (!UFS Geochem Design Pit Quantities by Bench 20211116.xlsx and the yearly underground development provided in dxf format). Of the proposed developments, groundwater inflow during Operations is only expected at the Llama Open Pit, and the Llama, Goose Main, and Echo undergrounds, as the other developments are expected to be fully within permafrost.

2.3 Bedrock Properties

Golder reviewed the hydrogeological parameters assigned in the SRK model to assess their suitability for the current assessment.

In reviewing the data presented in the FEIS, Golder replotted the measured hydraulic conductivity values and excluded tests likely completed in permafrost because inclusion of these tests could result in an underestimation of the geometric and arithmetic averages of hydraulic conductivity for the unfrozen rock. Tests inferred to be completed in unfrozen rock are presented in Figure 1. In calculating geometric and arithmetic averages, tests with measured results less than 5×10^{-10} metres per second (m/s) were conservatively assumed to be equal to 5×10^{10} m/s, which reflects the lower limit of likely data reliability and the decreasing ability to accurately measure lower hydraulic conductivities.

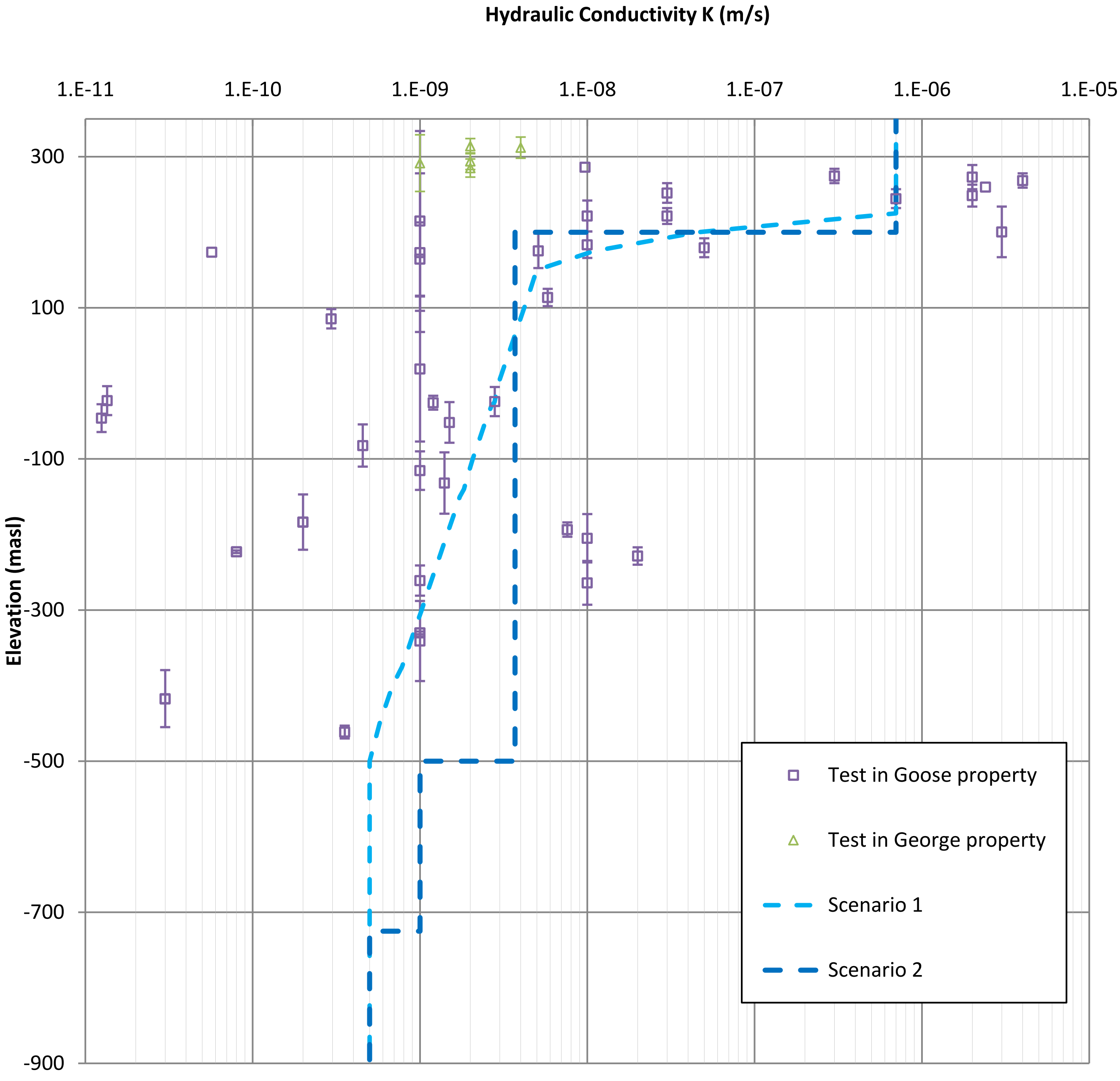


Figure 1: Hydraulic Conductivity Profile

Based on the presented data in Figure 1, Golder adopted 2 profiles for assessment of groundwater inflows:

Scenario 1:

- 0 to 200 masl - Near surface hydraulic conductivity assumed to equal to the arithmetic average of packer test results
- Below 200 masl – Equivalent to the bedrock hydraulic conductivity profile adopted in the SRK model (SRK 2015). The hydraulic conductivity reduction was truncated at a minimum hydraulic conductivity of 5×10^{-10} m/s

Scenario 2:

- 0 to 200 masl - Near surface hydraulic conductivity assumed to be equal to the arithmetic average of packer test results
- 200 masl to -500 masl – hydraulic conductivity assumed to be three times the geometric average
- Below -500 masl – assumed to progressively reduce to 5×10^{-10} m/s

In addition to changes in the hydraulic conductivity, Golder modified the specific storage assigned to the model. The specific storage was reduced from 1×10^{-4} m/s to 1×10^{-6} m/s. The original value of 1×10^{-4} m/s was possible left unchanged from the default model setting and is unrealistically high for bedrock (i.e., it is more representative of unconsolidated deposits). The porosity of the model remained unchanged from 0.1%.

The total dissolved solids (TDS) profile adopted by SRK was maintained for the base case and because the model was deepened, the TDS profile was extrapolated to the deeper model layers.

3.0 MODEL PREDICTIONS

Table 1 and Table 2 presents a summary of the predicted average groundwater inflow to the Llama open pit and the Llama, Goose Main, and Echo undergrounds for Scenario 1 and Scenario 2. Other developments are expected to be fully within permafrost.

Groundwater inflows to the Llama Open Pit are expected to be minimal (i.e., less than 50 metres cuped per day [m^3/day]) as the area is under drained by the dewatered Llama Underground. If the underground were not present, some of the flow predicted to the Llama Underground would instead flow to the Llama Open Pit. Because of the low flows, a supplemental sensitivity run was completed where the specific storage of the bedrock near surface was increased from 1×10^{-6} m/s to 5×10^{-6} m/s, and the porosity was increased to 1%. The near surface bedrock has higher hydraulic conductivity, which could result from higher fracturing or weathering, which would potentially increase storage properties. For this revised scenario (Scenario 2b), a maximum inflow of 75 m^3/day was predicted to the Llama Open Pit. Other flows and predicted TDS concentrations were unchanged from Scenario 2.

The highest groundwater inflows were predicted for the Umwelt Underground which is the deepest underground development proposed. For this development groundwater inflows peak in Year 4 at rate of between 170 m^3/day (Scenario 1) and 410 m^3/day (Scenario 2 and Scenario 2b) and then decrease as storage effects diminish. Overall flows are lower than predicted by SRK, which is primarily the result of the more appropriate specific storage value being applied to bedrock (i.e., the previous model used a value more representative of unconsolidated material; Section 2.3).

TDS concentrations predicted for the Llama Open Pit are difficult to resolve accurately because of the low groundwater inflows and under drainage by the Llama Underground. Overall, the TDS is inferred to be less than 10,000 mg/L based on the TDS profile and the modelling simulation results. Like the predicted inflow, the highest TDS concentrations are predicted for the deepest development (i.e., Umwelt Underground). TDS concentrations increase over time to a maximum concentration of between 85,700 mg/L and 99,800 mg/L due to the progressive upwelling of deeper and higher TDS saline groundwater to the underground development that will be left open for a longer time. The predicted TDS concentrations are generally higher than the maximum concentrations presented in SRK (2015) because of the deeper depth of development and to a lesser extent, through the extension of the maximum depth of the model (i.e., removal of boundary effects) to better represent the potential saline upwelling.

Table 1: Predicted Groundwater Inflow

Year	Scenario 1 Groundwater Inflow (m^3/day)					Scenario 2 Groundwater Inflow (m^3/day)					Scenario 2b Groundwater Inflow (m^3/day)				
	Llama Open Pit	Llama UG	Umwelt UG	Goose UG	Echo Underground	Llama Open Pit	Llama UG	Umwelt UG	Goose UG	Echo Underground	Llama Open Pit	Llama UG	Umwelt UG	Goose UG	Echo Underground
1	<50	130	0	0	0	<50	190	0	0	0	75	190	0	0	0
2	<50	100	70	0	0	<50	130	120	0	0	<50	130	120	0	0
3	<50	70	160	0	0	<50	100	350	0	0	<50	100	350	0	0
4	<50	60	170	0	0	<50	90	410	0	0	<50	90	410	0	0
5	<50	50	140	0	0	<50	80	350	0	0	<50	80	350	0	0
6		50	130	0	0		80	330	0	0		80	330	0	0
7		50	130	10	0		80	310	10	0		80	310	10	0
8		50	130	50	0		80	300	80	0		80	300	80	0
9		50	120	<50	0		80	290	70	0		80	290	70	0
10		50	120	<50	0		80	280	70	0		80	280	70	0
11		50	120	<50	0		70	280	70	0		70	280	70	0
12		50	120	<50	0		70	270	70	0		70	270	70	0
13		50	110	<50	0		70	270	60	0		70	270	60	0
14		50	110	<50	<50		70	260	60	<50		70	260	60	<50
15		50	110	<50	<50		70	260	60	<50		70	260	60	<50

Table 2: Predicted TDS in Groundwater Inflow

Year	Scenario 1 TDS (mg/L)					Scenario 2 Groundwater Inflow (m^3/day)					Scenario 2b Groundwater Inflow (m^3/day)				
	Llama Open Pit	Llama UG	Umwelt UG	Goose UG	Echo Underground	Llama Open Pit	Llama UG	Umwelt UG	Goose UG	Echo Underground	Llama Open Pit	Llama UG	Umwelt UG	Goose UG	Echo Underground
1	<10000	6400	0	0	0	<10000	2900	0	0	0	<10000	2900	0	0	0
2	<10000	17200	25600	0	0	<10000	11300	16600	0	0	<10000	11300	16600	0	0
3	<10000	22900	39700	0	0	<10000	15200	32200	0	0	<10000	15200	32200	0	0
4	<10000	26100	55200	0	0	<10000	17500	47300	0	0	<10000	17500	47300	0	0
5	<10000	29500	63100	0	0	<10000	19500	54800	0	0	<10000	19500	54800	0	0
6		31100	68400	0	0		20600	59300	0	0		20600	59300	0	0
7		32300	71900	26400	0		21600	62700	14900	0		21600	62700	14900	0
8		33400	75100	25600	0		22800	66100	15900	0		22800	66100	15900	0
9		34300	79500	32300	0		23800	70000	19500	0		23800	70000	19500	0
10		33800	79000	33800	0		24700	73300	21500	0		24700	73300	21500	0
11		34700	82600	35900	0		25700	76300	23000	0		25700	76300	23000	0
12		37100	89400	39000	0		26500	78700	24300	0		26500	78700	24300	0
13		38000	93100	40400	0		27400	81700	25400	0		27400	81700	25400	0
14		38800	96600	41600	15900		28200	83700	26300	9200		28200	83700	26300	9200
15		39500	99800	42700	20200		28900	85700	27200	10700		28900	85700	27200	10700

4.0 SUMMARY

This technical memorandum documents the results of an updated hydrogeological assessment for the Back River Project. The assessment utilized a previously developed model for the FEIS with modifications to reflect the updated mine plan and interpretation of bedrock properties.

Overall, groundwater flow predictions are generally lower than previous predictions in the FEIS: however, TDS concentrations have increased as a result of the deeper mine depth and potential upwelling of higher TDS saline groundwater.

5.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

Golder Associates Ltd.

REGISTERED PROFESSIONAL ENGINEER
J.L. LEVENICK
LICENSEE
NT/NU
30 August 2022

Jennifer Levenick, M.Sc., P.Eng.
Principal, Senior Hydrogeologist

Don Chorley
Senior Hydrogeology Specialist

JL/DC

https://golderassociates.sharepoint.com/sites/136792/project files/6 deliverables/1.0 working/20412211-102-tm-rev0-hydrogeology memo/20412211-102-tm-rev0-3700-sabina_hydrogeology 30aug2022.docx

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature ________________
Date 2022-08-30
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REFERENCES

Sabina Gold & Silver Corp. 2015. The Back River Project Final Environmental Impact Statement. Submitted to the Nunavut Impact Review Board on 23 November 2015.

SRK Consulting (Canada) Inc. 2015. Hydrogeological Characterization and Modeling of the Proposed Back River Project. Dated October 2015 [Appendix V2-7A of the FEIS].

APPENDIX D

Source Term Concentrations

Table D-1: Model Input Source Term Concentrations

Constituent	Unit	Baseline	Groundwater	Process Water	Sewage	Pad	Ore Stockpile - Construction	Ore Stockpile - Operations	Ore Stockpile - Closure	WR - Umwelt Operations Max	WR - Umwelt Closure Max	WR - Llama Operations Max	WR - Llama Closure Max	WR - Echo/Goose Operations Max	WR - Echo/Goose Closure Max	PW Umwelt Max	PW Llama Max	PW Echo Max	PW Goose Max	HW Umwelt Max	HW Llama Max	HW Goose Max
Alkalinity	mg/L	2.0	13	35	0	25	0.093	0.094	0.096	62	0.094	87	87	63	63	60	68	52	62	25	17	14
Aluminum	mg/L	0.011	0.082	0.5	0.021	1.7	0.39	0.39	0.39	0.39	0.39	0.39	0.28	0.39	0.13	0.39	0.39	0.39	0.23	0.39	0.39	0.39
Ammonia	mg-N/L	0.005	0.2	5.1	8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antimony	mg/L	0.00005	0.0044	0.0018	0	0.001	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.00081	0.00062	0.00023
Arsenic	mg/L	0.0002	0.0071	2.4	0.0001	0.044	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.22	0.21	0.14	0.14	0.15	0.1	0.12	0.11	0.043
Barium	mg/L	0.0051	6.1	0.011	0	0.0089	0.015	0.0094	0.0041	0.022	0.022	0.021	0.021	0.011	0.011	0.022	0.022	0.022	0.016	0.058	0.069	0.038
Beryllium	mg/L	0.0002	0.0011	0.00015	0	0	0.00022	0.00038	0.00025	0.0012	0.00021	0.0022	0.0002	0.0024	0.000032	0.0002	0.0002	0.0002	0.0002	0.00056	0.00063	0.00032
Bismuth	mg/L	0.0005	0.044	0.00022	0	0.000004	0.00075	0.00077	0.00011	0.096	0.0005	0.2	0.0005	0.06	0.0005	0.0015	0.0031	0.0007	0.00072	0.0005	0.0005	0.0005
Boron	mg/L	0.005	3.9	0.026	0	0.0003	0.87	1.5	1.0	3.6	0.63	7.1	0.36	6.7	2.1	0.2	0.21	0.21	0.16	0.2	0.2	0.12
Cadmium	mg/L	0.00001	0.00089	0.00002	0.0001	0.0000013	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.000097	0.00010	0.000099	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.000032
Calcium	mg/L	2.1	16000	42	0	16	73	73	73	73	63	73	20	73	51	40	48	30	46	29	44	33
Chloride	mg/L	1.0	Depth dependent[(a)]	5.5	0	0.25	124	94	16	198	18	362	5.2	397	15	17	13	21	4.5	3.0	3.2	2.1
Chromium	mg/L	0.00015	0.0062	0.0058	0.0001	0.003	0.0021	0.0037	0.0024	0.015	0.0015	0.03	0.00042	0.019	0.0049	0.00056	0.00067	0.00051	0.00038	0.00077	0.0007	0.00033
Cobalt	mg/L	0.00012	0.0089	0.013	0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.017	0.018	0.018	0.018	0.018	0.018	0.0042	0.018	0.018	0.0044
Copper	mg/L	0.0014	0.0081	0.1	0.0024	0.0036	0.011	0.011	0.011	0.011	0.011	0.011	0.008	0.011	0.011	0.004	0.003	0.0048	0.0015	0.011	0.011	0.0024
Cyanate	mg/L	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluoride	mg/L	0.02	0	0	0	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.22	0.22	0.22	0.17	0.26	0.24	0.12	0.26	0.24	0.12
Free Cyanide	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardness	mg/L	11	45000	110	0	0	5650	5835	414	2828	428	6029	225	4105	885	152	178	122	160	115	169	122
Iron	mg/L	0.014	3.8	3.1	0.014	2.1	0.42	0.42	0.42	0.42	0.42	0.42	0.26	0.42	0.31	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Lead	mg/L	0.00005	0.0044	0.019	0.0001	0.00012	0.0016	0.0027	0.0018	0.018	0.0024	0.03	0.00038	0.03	0.0043	0.00097	0.00081	0.0011	0.00029	0.0035	0.0022	0.00024
Lithium	mg/L	0.005	7.1	0.003	0	0	0.065	0.11	0.076	2.0	0.037	3.8	0.021	1.6	0.14	0.047	0.071	0.037	0.022	0.02	0.017	0.0076
Magnesium	mg/L	1.3	1000	1.6	0	4.4	11	11	11	11	11	11	7.8	11	11	11	11	11	11	10	11	9.7
Manganese	mg/L	0.0019	2.9	0.011	0	0.15	0.35	0.47	0.41	0.47	0.23	0.47	0.13	0.47	0.47	0.22	0.2	0.25	0.12	0.39	0.47	0.45
Mercury	mg/L	0.00001	0.00001	0.000005	0	0.00001	0.00005	0.00005	0.00005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.00005	0.00005	0.00005	0.00005	0.000041	0.000041	0.000024
Molybdenum	mg/L	0.00005	0.042	0.0083	0.0001	0.00081	0.0052	0.0052	0.0052	0.0052	0.0052	0.0052	0.0046	0.0051	0.0051	0.0027	0.0029	0.0027	0.0016	0.0013	0.00093	0.00039
Nickel	mg/L	0.0033	0.011	0.0035	0.0004	0.059	0.058	0.058	0.058	0.058	0.058	0.058	0.055	0.058	0.057	0.058	0.058	0.058	0.039	0.058	0.055	0.012
Nitrate	mg-N/L	0.0065	0.5	0.12	22	0	5.8	5.9	1.3	4.2	1.4	7.8	0.78	10	2.3	0.33	0.25	0.39	0.12	0.14	0.12	0.077
Nitrite	mg-N/L	0.001	0.1	0.008	0.5	0	1.4	1.5	0.32	15	0.34	30	0.19	10	0.58	0.28	0.49	0.18	0.13	0.034	0.029	0.019
Orthophosphate	mg-P/L	0.001	0.062	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphate	mg-P/L	0	0.22	0	1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus	mg/L	0.0019	3.3	0.1	1.0	0.01	0.73	0.75	0.11	0.37	0.15	0.74	0.088	0.73	0.23	0.021	0.021	0.022	0.016	0.019	0.019	0.012
Potassium	mg/L	0.34	240	11	0	0.35	68	118	79	237	31	442	18	440	109	15	14	17	8.6	11	13	8.3
Selenium	mg/L	0.0001	0.0089	0.0012	0	0.00033	0.002	0.002	0.002	0.002	0.0017	0.002	0.00087	0.002	0.002	0.002	0.002	0.002	0.002	0.00084	0.00088	0.00054
Silicon	mg/L	0.28	0.56	2.9	0	5.5	29	39	34	40	23	38	14	40	40	7.6	7.3	8.0	5.3	13	15	9.0
Silver	mg/L	0.00001	0.00089	0.00017	0	0.000015	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.000037	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.000023	0.000024	0.000014
Sodium	mg/L	0.66	6800	69	0	0.25	10	18	12	88	8.8	188	11	129	12	5.0	5.6	4.3	4.7	1.7	1.5	0.83
Strontium	mg/L	0.0094	330	0.13	0	0.00028	0.28	0.48	0.32	9.2	0.16	7.7	0.085	8.6	0.62	0.36	0.65	0.21	0.19	0.073	0.1	0.073
Sulphate	mg/L	4.1	50.0	150	0	36	157	274	183	2244	103	4681	56	3119	218	125	144	105	121	239	356	236
TDS	mg/L	23	Depth dependent[(a)]	414	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tellurium	mg/L	0.002	0	0.0003	0	0	0.003	0.0031	0.00041	0.002	0.002	0.0028	0.002	0.0028	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Thallium	mg/L	0.00005	0.0044	0.000015	0	0.000004	0.00013	0.00023	0.00016	0.00044	0.000081	0.00081	0.00005	0.00092	0.00033	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Thiocyanate	mg/L	0	0	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thorium	mg/L	0	0	0.00017	0	0	0.00082	0.00084	0.00013	0.00086	0.00015	0.0017	0.000091	0.0011	0.00027	0.00003	0.000037	0.000027	0.000019	0.000039	0.000036	0.000017
Tin	mg/L	0.0001	0.0089	0.00026	0	0	0.0044	0.0076	0.0051	0.018	0.0031	0.037	0.0018	0.031	0.011	0.00096	0.001	0.00091	0.00082	0.00085	0.00084	0.00051
Titanium	mg/L	0.01	0.11	0.0095	0	0.052	0.086	0.088	0.013	0.044	0.016	0.086	0.01	0.087	0.026	0.01	0.01	0.01	0.01	0.01	0.01	0.01
TOC	mg/L	4.0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Cyanide	mg/L	0.0023	0	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TSS	mg/L	3.0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uranium	mg/L	0.00001	0.00089	0.0003	0.0001	0.000025	0.028	0.05	0.031	0.045	0.013	0.078	0.0074	0.11	0.057	0.0035	0.0025	0.0044	0.00088	0.0033	0.0023	0.00061
Vanadium	mg/L	0.000053	0.033	0.0013	0	0.00088	0.025	0.044	0.029	0.27	0.015	0.54	0.0071	0.27	0.054	0.0063	0.0096	0.0047	0.0041	0.0026	0.0019	0.0021
WAD Cyanide	mg/L	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zinc	mg/L	0.003	0.30	0.0088	0.002	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.014	0.016	0.015	0.016	0.015	0.016	0.004	0.016	0.016	0.0078
Zirconium	mg/L	0.0004	0	0.0003	0	0	0.014	0.015	0.002	0.0096	0.0025	0.019	0.0015	0.015	0.0043	0.00044	0.00048	0.00042	0.0004	0.0004	0.0004	0.0004

(a) For TDS concentrations see Appendix C, Table 2. Chloride concentrations = 60% of TDS Concentrations.
Ore stockpile, WR, and PW source terms are calculated based on "live" amounts of material in the piles/exposed, thus they have changing values over the modelled period. Maximum values for phases where they are active are included.
WR = waste rock; PW = pitwall; HW = highwall; TDS = total dissolved solids; TSS = total suspended solids; mg/L = milligrams per liter; mg-N/L = milligrams of nitrogen per liter; mg-P/L = milligrams phosphorus per liter; WAD= weak acid dissociable

APPENDIX E

Initial Lake Water Quality

Table E-1: Initial Lake Water Quality Applied in the Load Balance Model

Constituent	Unit	Umwelt Lake (n=2)	Llama Lake (n=2)	Goose Lake (n=6)
Alkalinity	mg/L	33	9.9	8.3
Aluminum	mg/L	0.0075	0.0054	0.021
Ammonia	mg-N/L	0.067	0.013	0.041
Antimony	mg/L	0.0005	0.00005	0.000028
Arsenic	mg/L	0.00057	0.0003	0.00044
Barium	mg/L	0.042	0.013	0.0099
Beryllium	mg/L	0.0002	0.0002	0.0000051
Bismuth	mg/L	0.0005	0.0005	0.0000031
Boron	mg/L	0.008	0.0073	0.005
Cadmium	mg/L	0.00001	0.00001	0.0000063
Calcium	mg/L	18	6.2	5.1
Chloride	mg/L	23	9.4	3.9
Chromium	mg/L	0.00025	0.00015	0.00015
Cobalt	mg/L	0.00012	0.00012	0.000096
Copper	mg/L	0.0031	0.0017	0.0028
Cyanate	mg/L	0	0	0
Fluoride	mg/L	0.037	0.024	0.031
Free Cyanide	mg/L	0	0	0
Hardness	mg/L	82	27	27
Iron	mg/L	0.014	0.014	0.013
Lead	mg/L	0.00005	0.00005	0.000013
Lithium	mg/L	0.005	0.005	0.0012
Magnesium	mg/L	9.2	2.9	3.3
Manganese	mg/L	0.015	0.0021	0.0042
Mercury	mg/L	0.00001	0.00001	0.0000022
Molybdenum	mg/L	0.000062	0.000062	0.000015
Nickel	mg/L	0.0073	0.0026	0.0082
Nitrate	mg-N/L	0.053	0.059	0.046
Nitrite	mg-N/L	0.001	0.001	0.001
Orthophosphate	mg-P/L	0.0005	0	0
Phosphate	mg-P/L	0.01	0.0028	0
Phosphorus	mg/L	0.0039	0.0039	0.0039
Potassium	mg/L	2.2	0.97	0.58
Selenium	mg/L	0.0001	0.0001	0.000036
Silicon	mg/L	1.5	0.61	0.99
Silver	mg/L	0.00001	0.00001	0
Sodium	mg/L	3.8	1.3	1.2
Strontium	mg/L	0.082	0.047	0
Sulphate	mg/L	13	7.2	14
TDS	mg/L	94	36	43
Tellurium	mg/L	0	0	0
Thallium	mg/L	0.00005	0.00005	0
Thiocyanate	mg/L	0	0	0
Thorium	mg/L	0	0	0
Tin	mg/L	0.0001	0.0001	0
Titanium	mg/L	0.01	0.01	0
TOC	mg/L	11	4.1	6.8
Total Cyanide	mg/L	0	0	0
TSS	mg/L	2.4	1.5	3.0
Uranium	mg/L	0.00001	0.00001	0
Vanadium	mg/L	0.000053	0.000053	0
WAD Cyanide	mg/L	0	0	0
Zinc	mg/L	0.003	0.003	0
Zirconium	mg/L	0	0	0

Metals are dissolved concentrations.

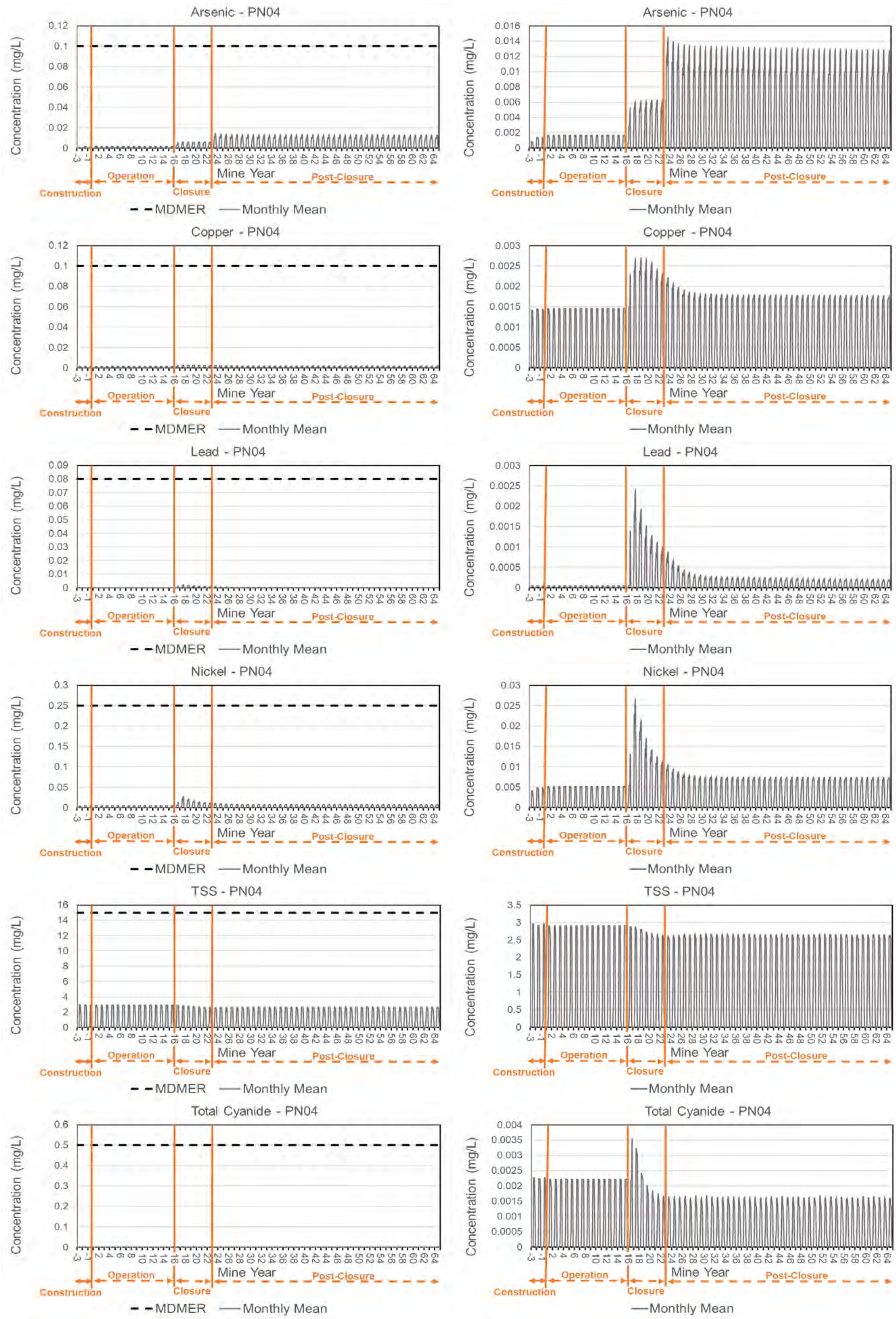
TDS = total dissolved solids; TSS = total suspended solids; WAD = weak acid-dissociable; TOC = total organic carbon; n= number of samples; WAD= weak acid dissociable

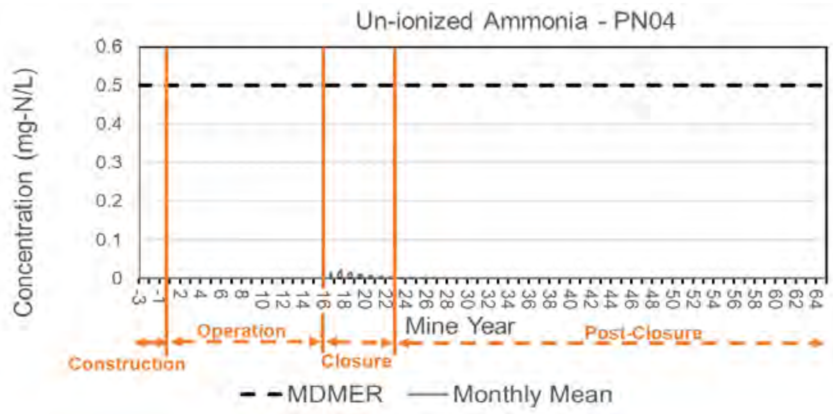
APPENDIX F

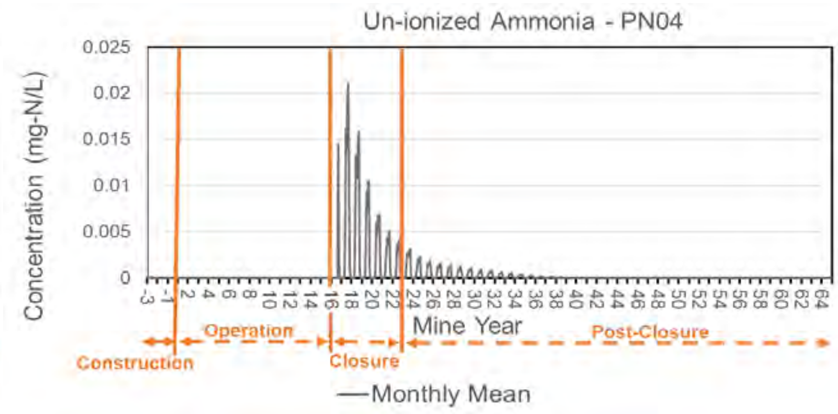
Timeseries of Predicted Monthly Average Constituent Concentrations at the Prediction Nodes Under Average Hydrological Conditions

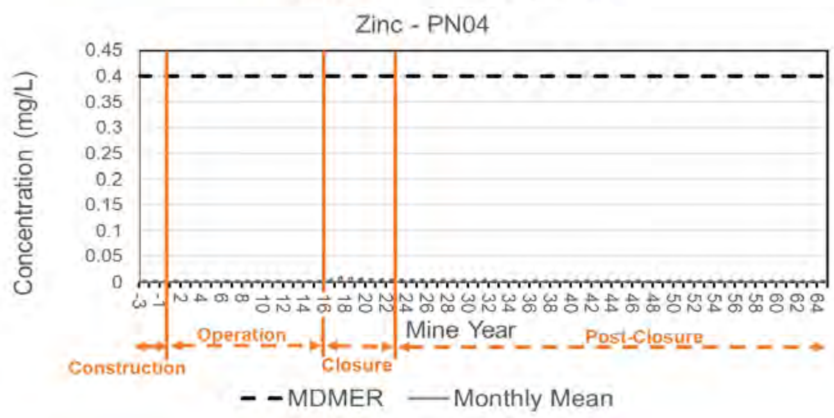
Please note that for the constituents with MDEMR limits, the timeseries are separately plotted with and without the MDMER discharge limits because some constituent concentrations are so far below the corresponding limit that changes, or lack of changes, in concentrations are not detectable at coarser scales if the limit is co-presented.

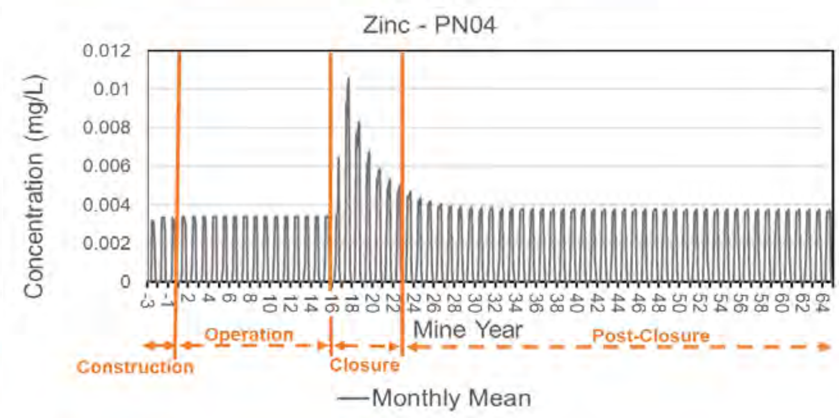
Figure F-1: Predicted Timeseries of Monthly Mean Constituent Concentrations at PN04 for all Mine Phases

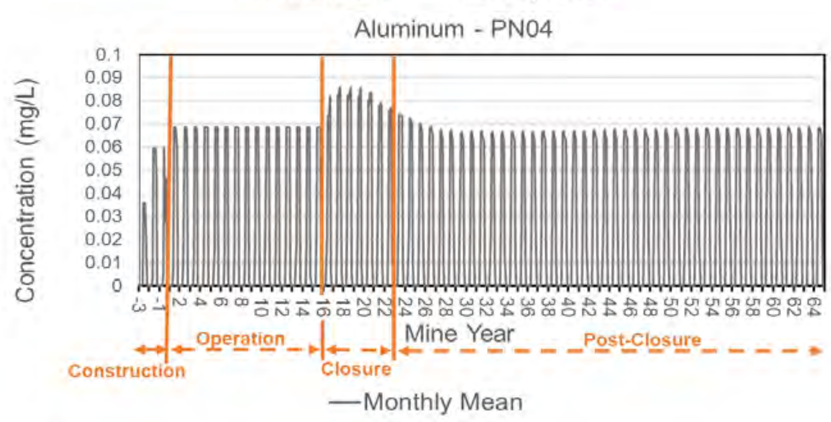


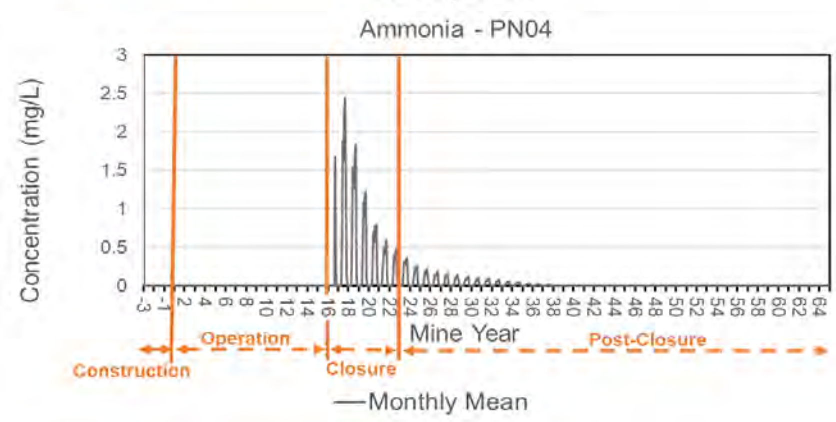

Un-ionized Ammonia - PN04
Concentration (mg-N/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

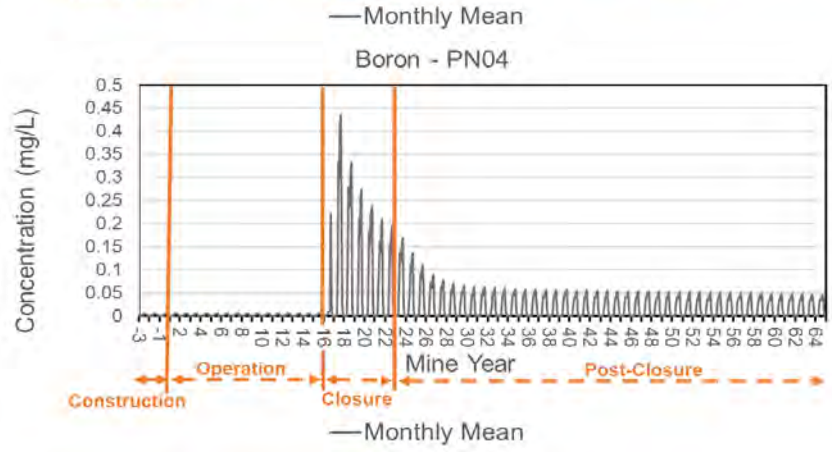

Un-ionized Ammonia - PN04
Concentration (mg-N/L)
0.025
0.02
0.015
0.01
0.005
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

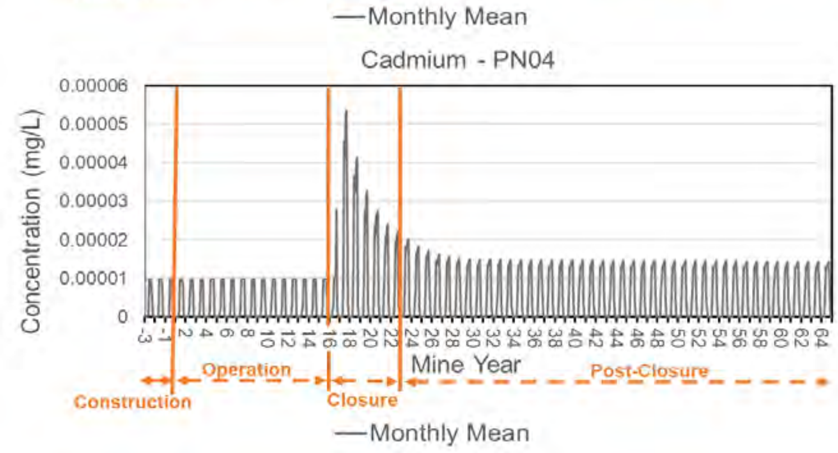

Zinc - PN04
Concentration (mg/L)
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

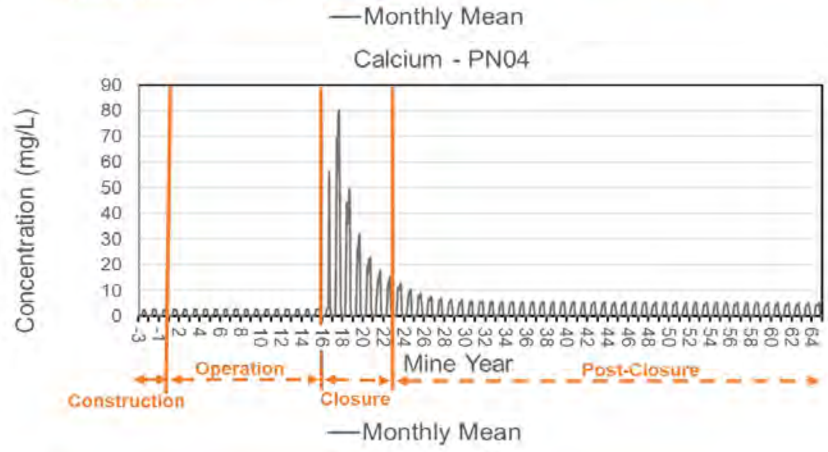

Zinc - PN04
Concentration (mg/L)
0.012
0.01
0.008
0.006
0.004
0.002
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

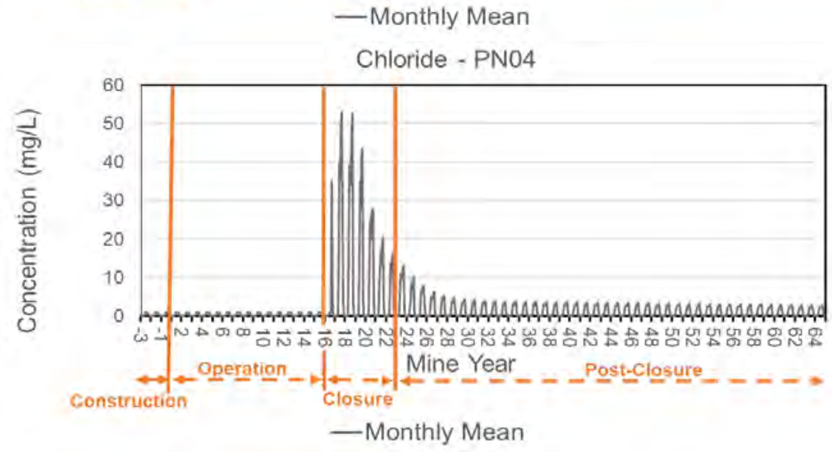

Aluminum - PN04
Concentration (mg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

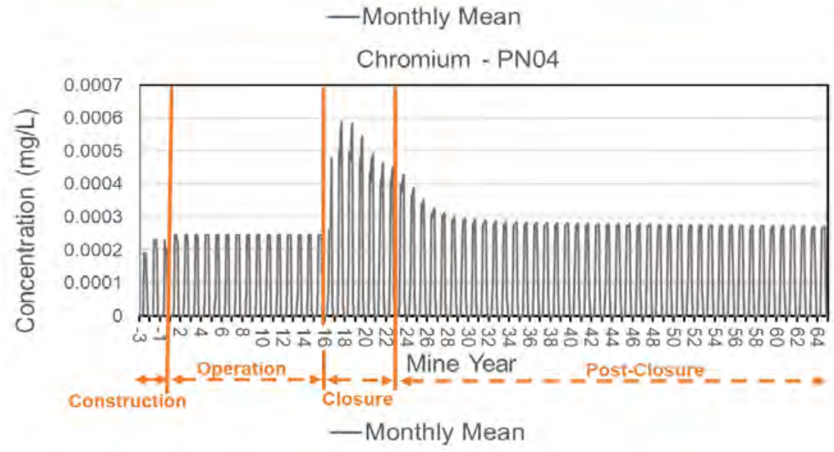

Ammonia - PN04
Concentration (mg/L)
3
2.5
2
1.5
1
0.5
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

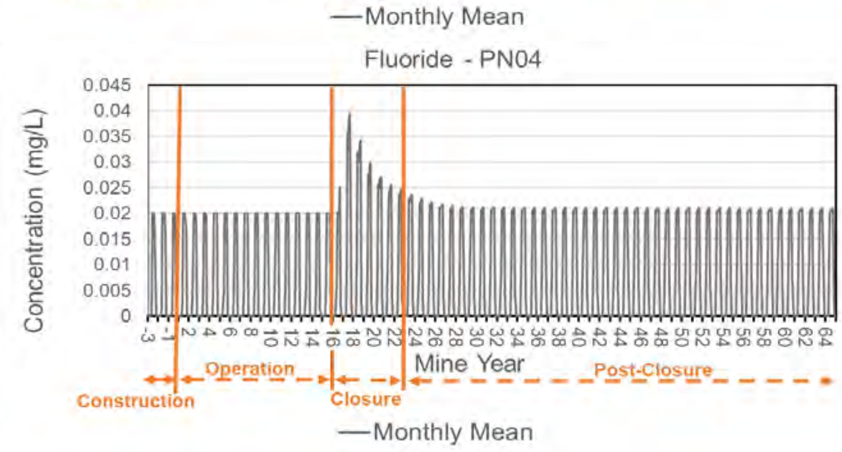

Boron - PN04
Concentration (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

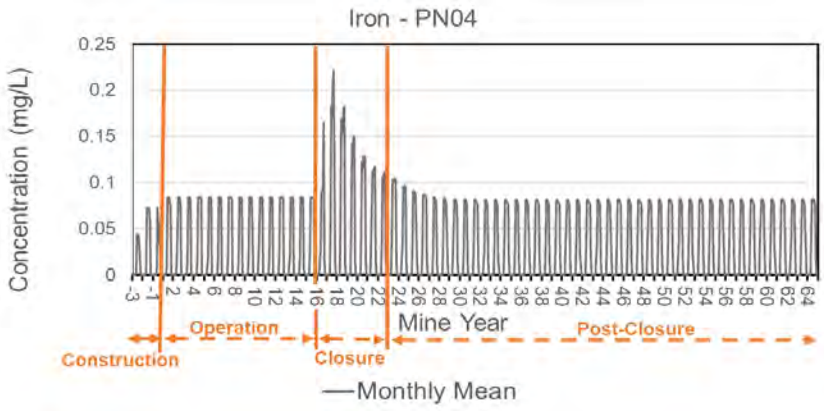

Cadmium - PN04
Concentration (mg/L)
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

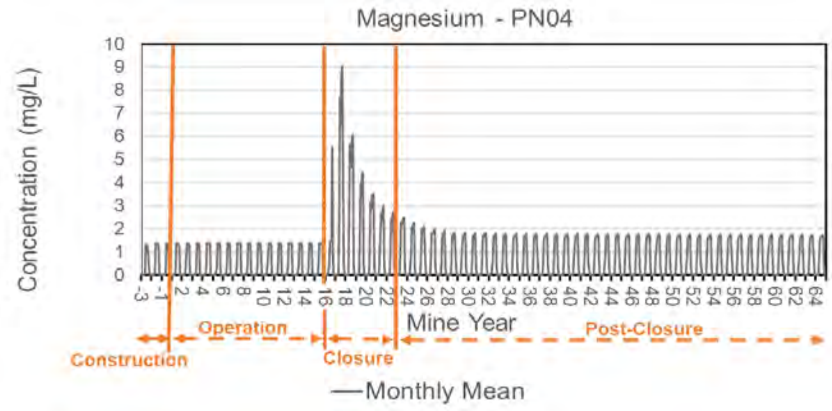

Calcium - PN04
Concentration (mg/L)
90
80
70
60
50
40
30
20
10
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

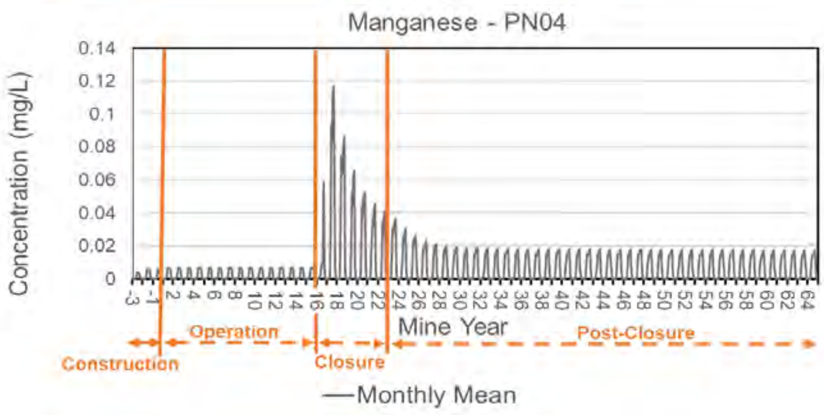

Chloride - PN04
Concentration (mg/L)
60
50
40
30
20
10
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

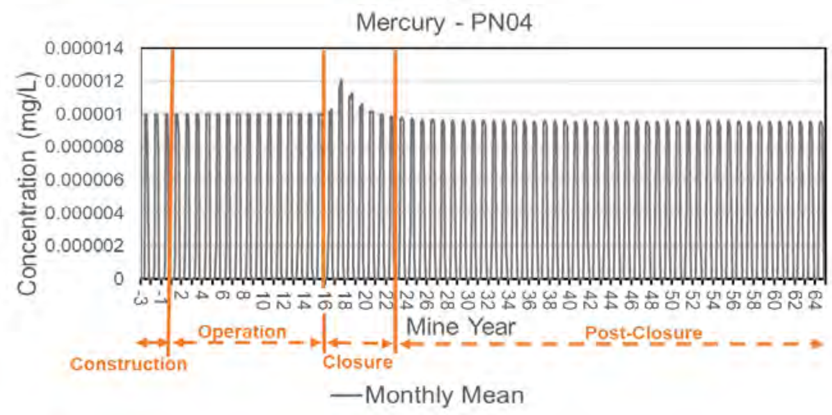

Chromium - PN04
Concentration (mg/L)
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

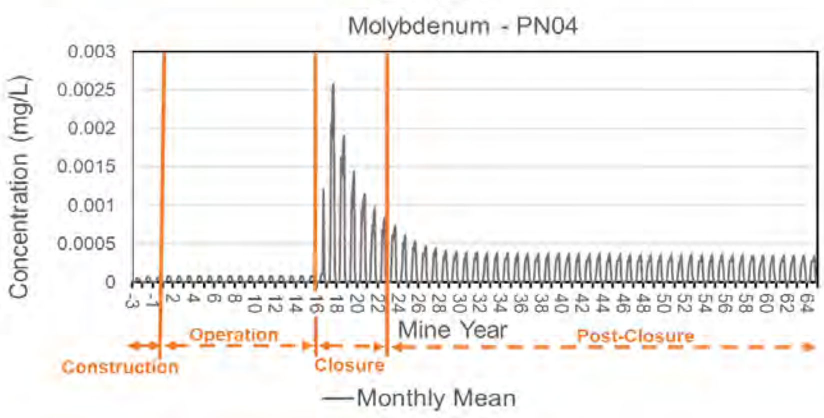

Fluoride - PN04
Concentration (mg/L)
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

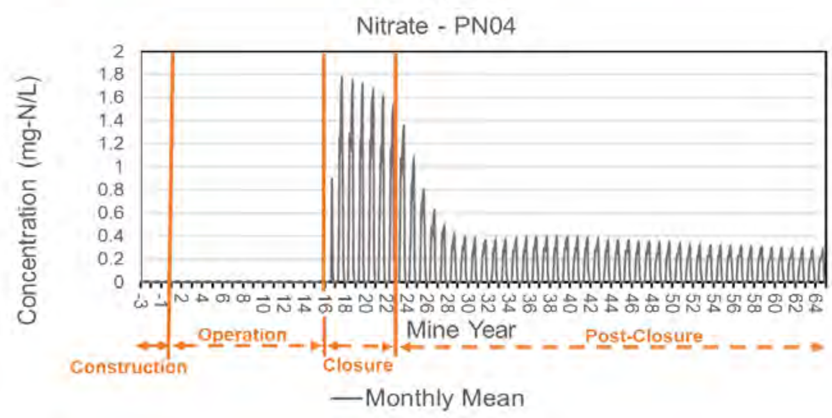

Iron - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

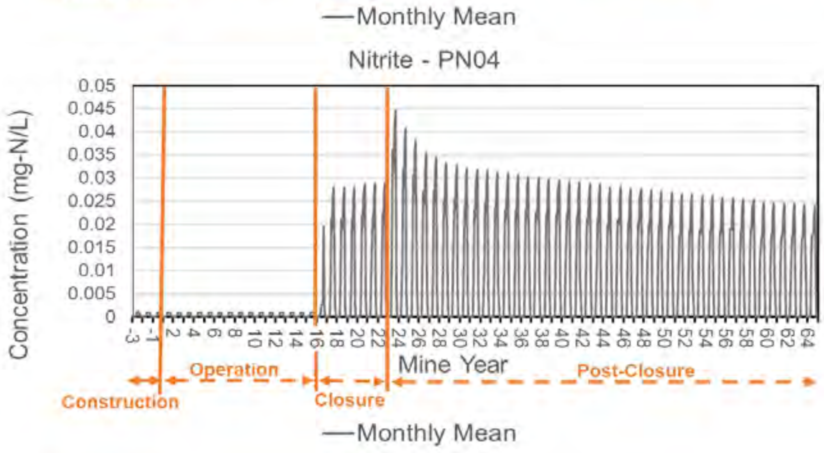

Magnesium - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

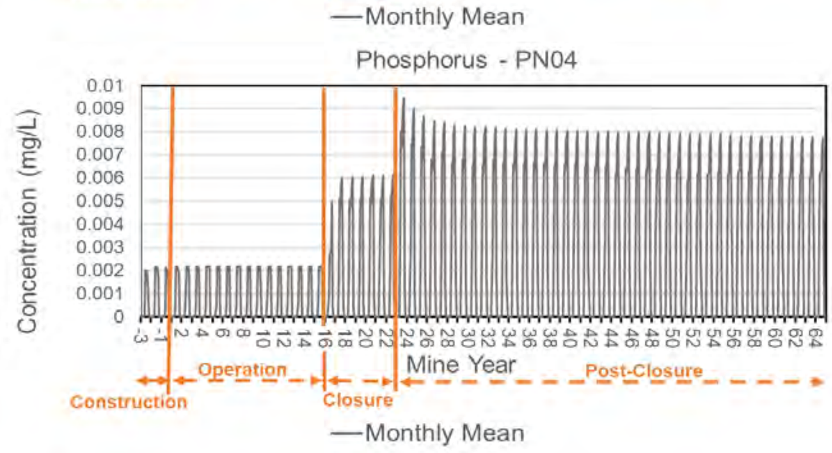

Manganese - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

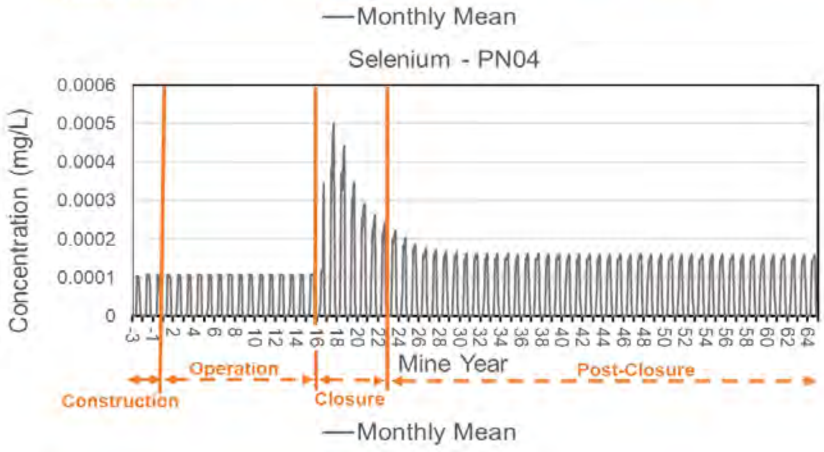

Mercury - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

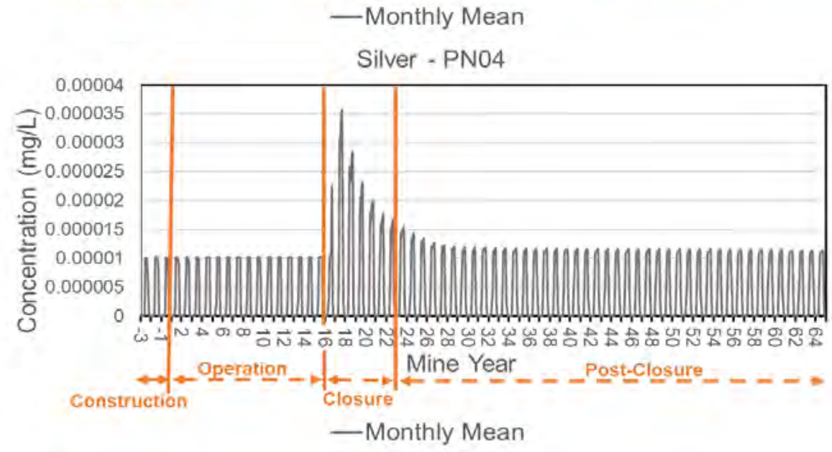

Molybdenum - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

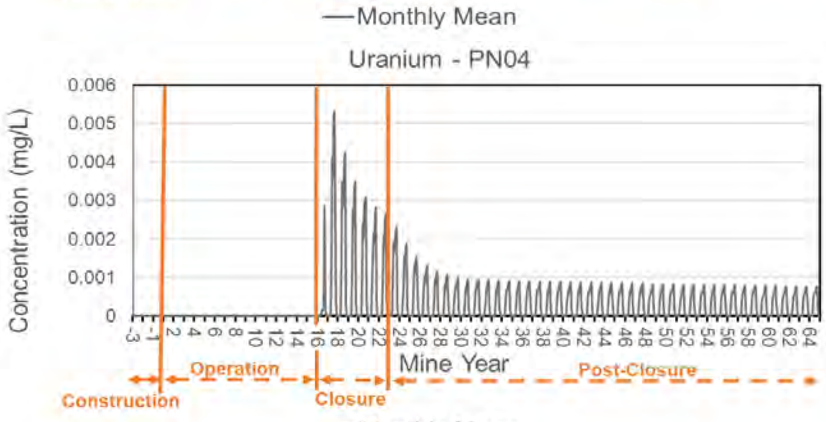

Nitrate - PN04
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

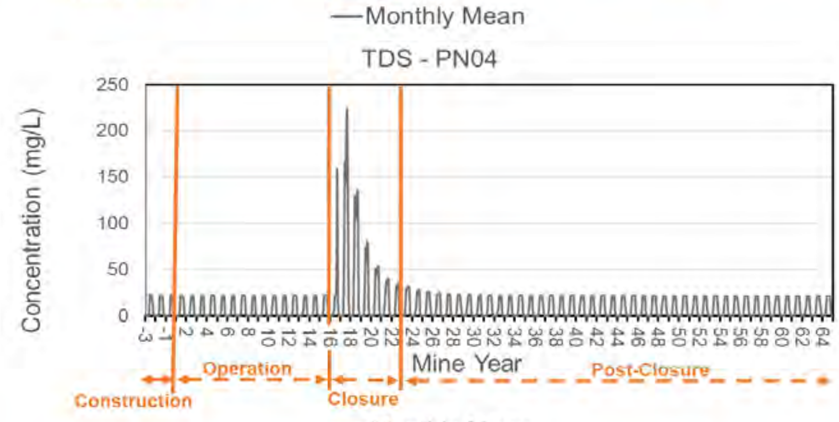

Nitrite - PN04
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Phosphorus - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Selenium - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Silver - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Uranium - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


TDS - PN04
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

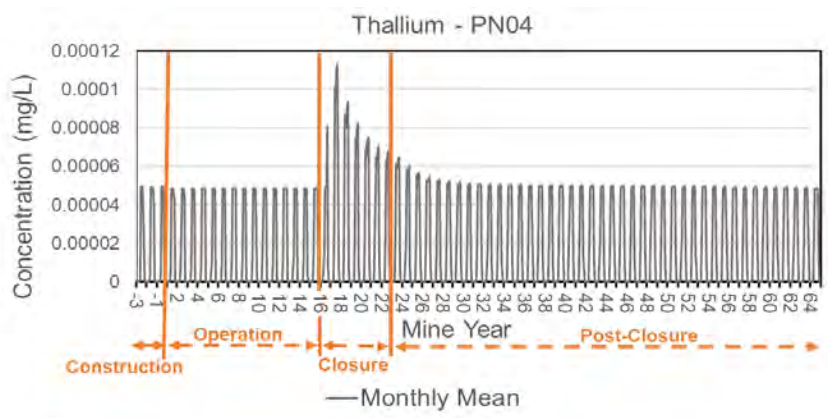
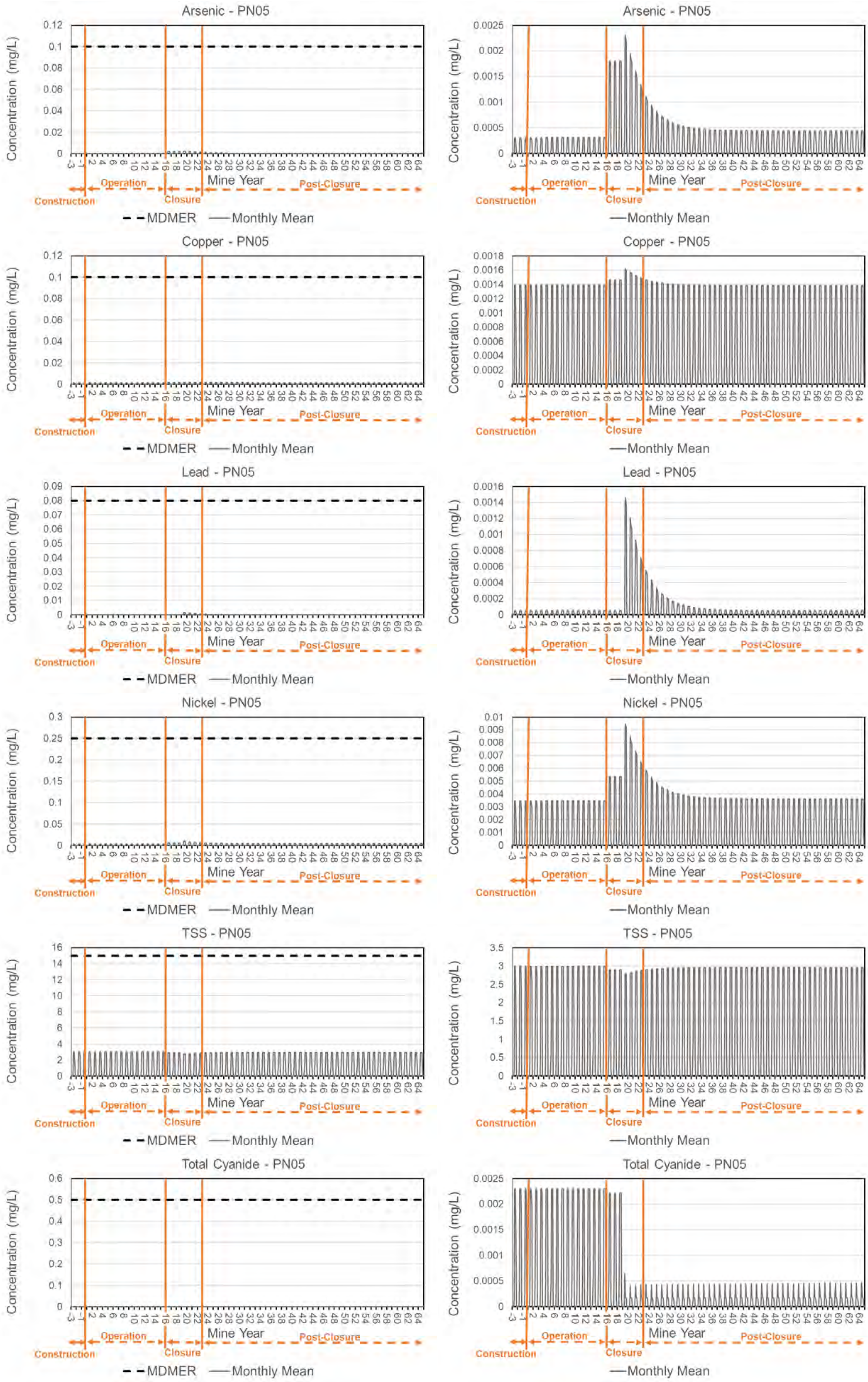
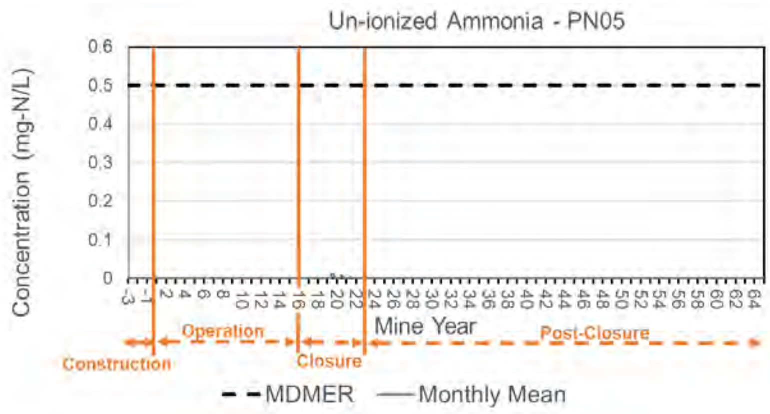
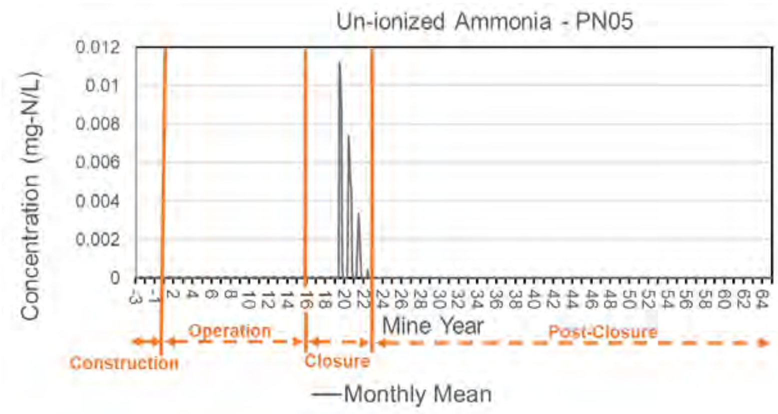
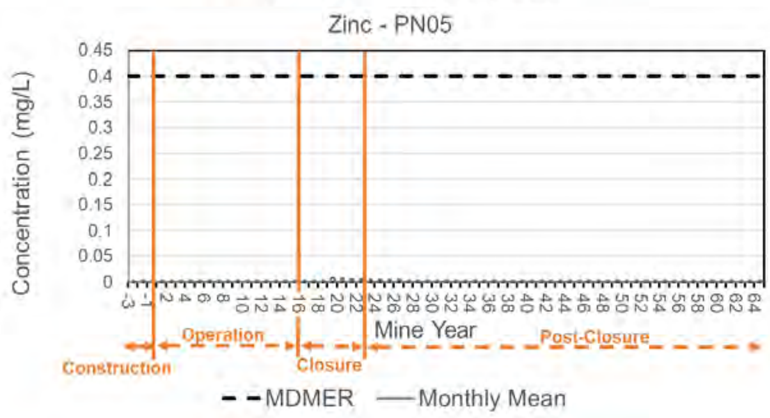

Thallium - PN04
Concentration (mg/L)
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

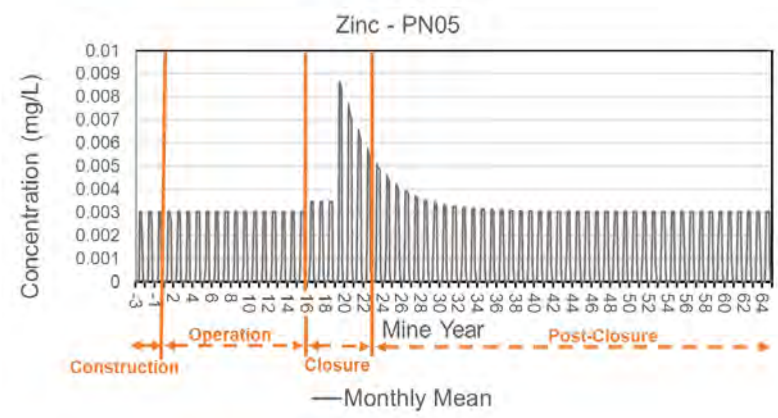
Figure F-2: Predicted Timeseries of Monthly Mean Constituent Concentrations at PN05 for all Mine Phases

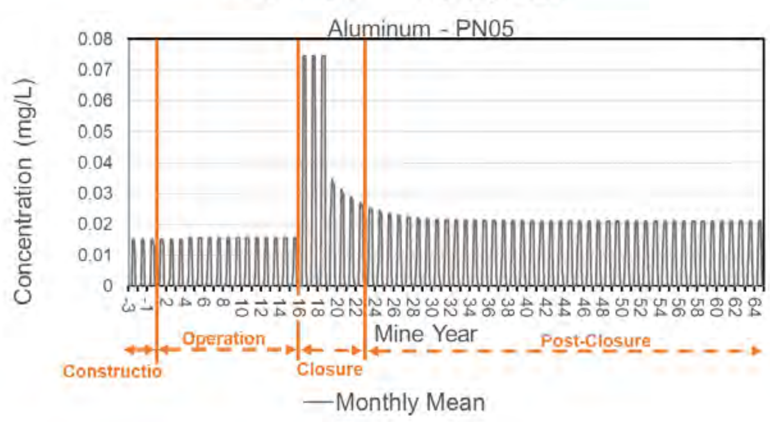


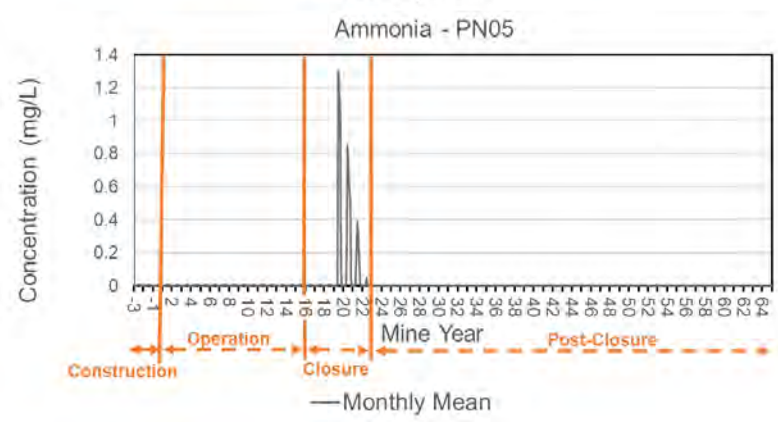

Un-ionized Ammonia - PN05
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

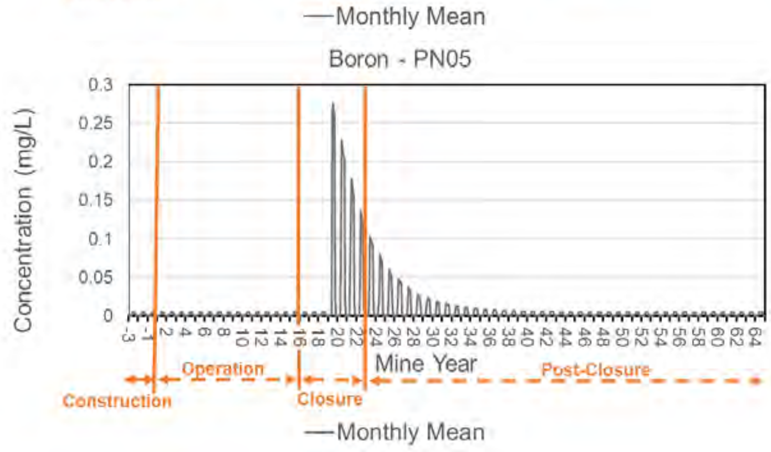

Un-ionized Ammonia - PN05
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

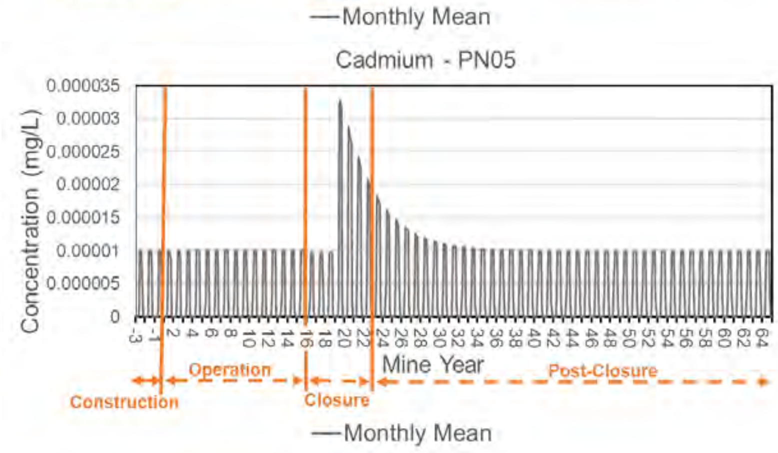

Zinc - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

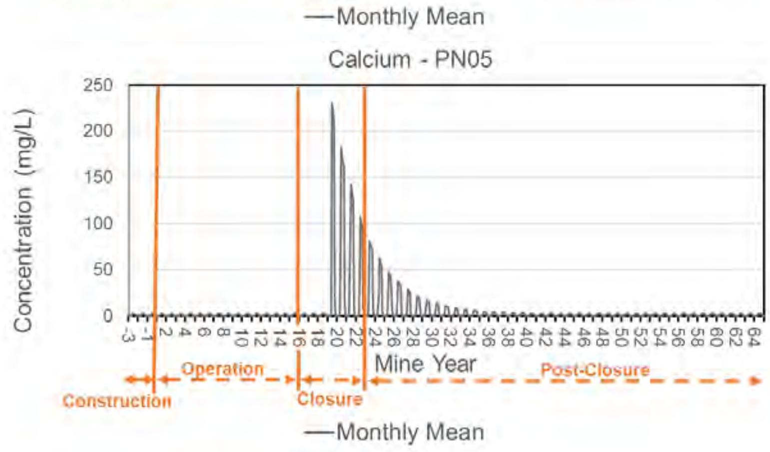

Zinc - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

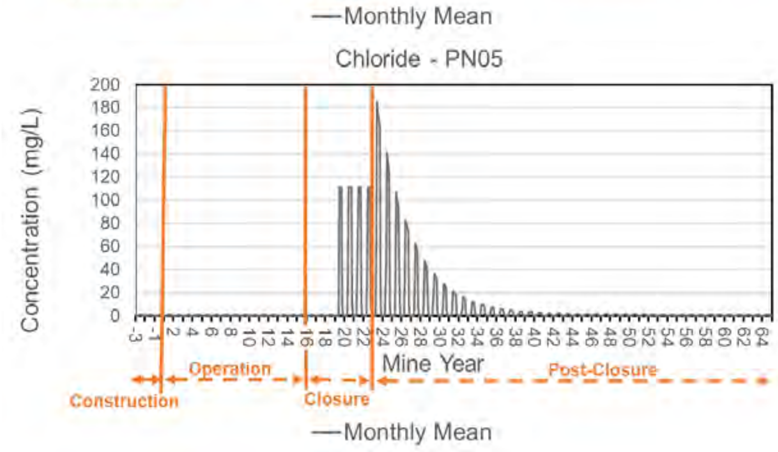

Aluminum - PN05
Concentration (mg/L)
Mine Year
Constructio
Operation
Closure
Post-Closure
Monthly Mean

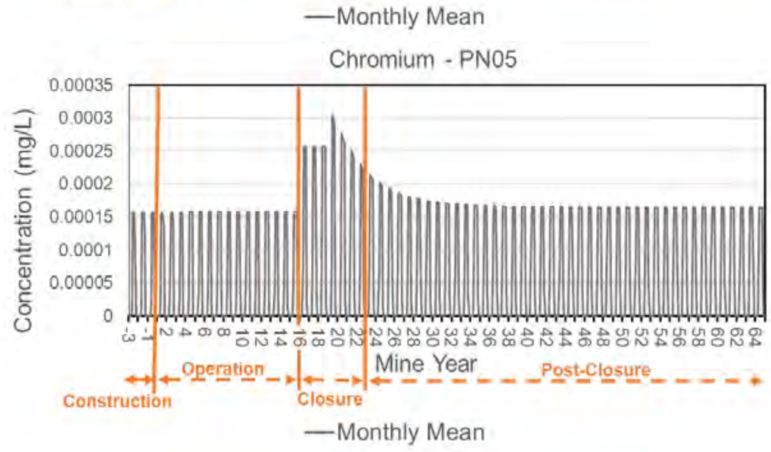

Ammonia - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

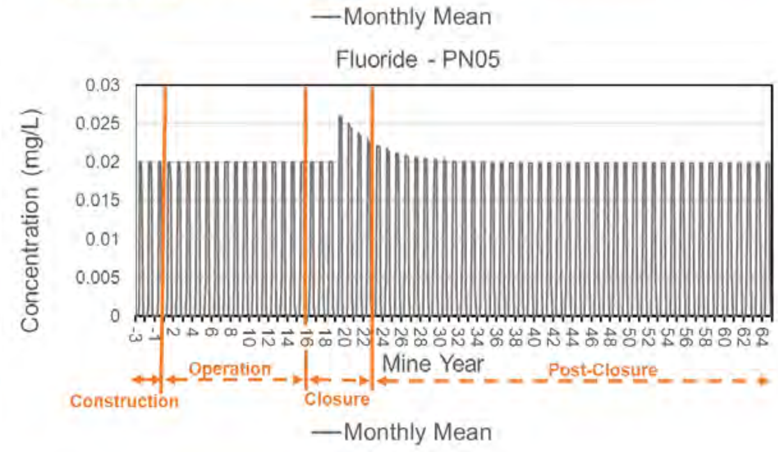

Boron - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

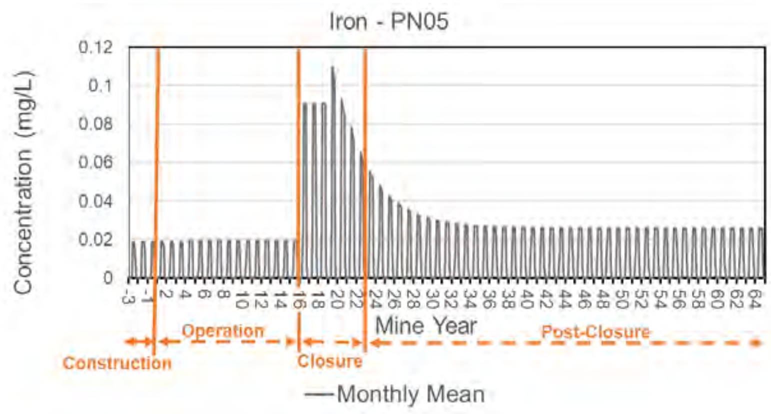

Cadmium - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

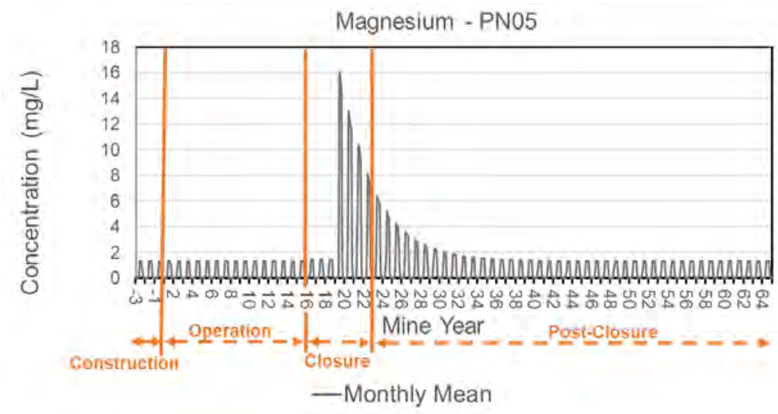

Calcium - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

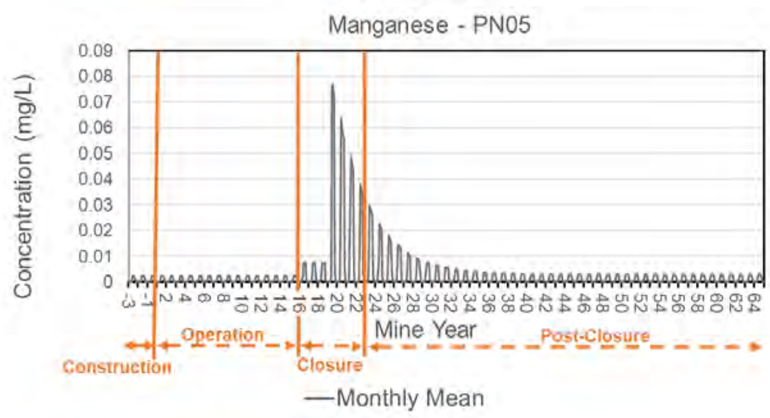

Chloride - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

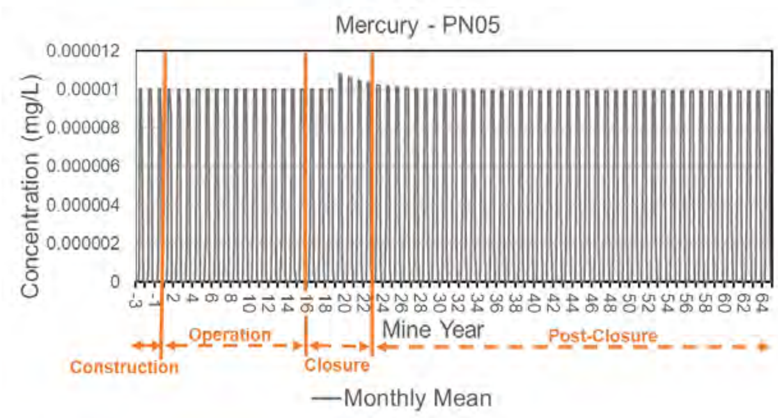

Chromium - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

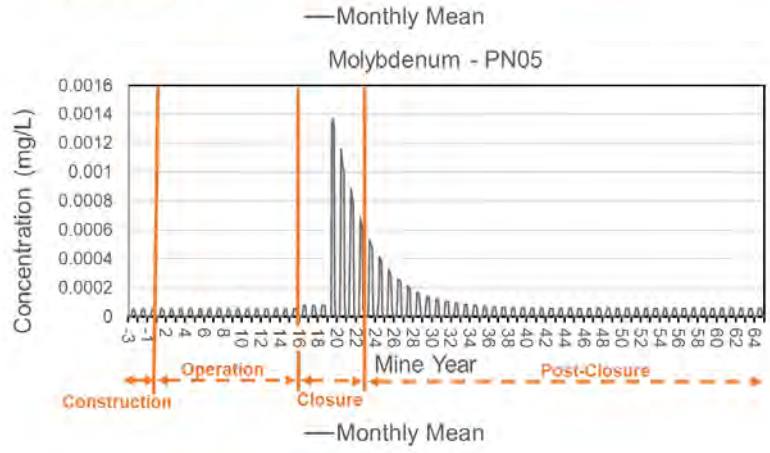

Fluoride - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

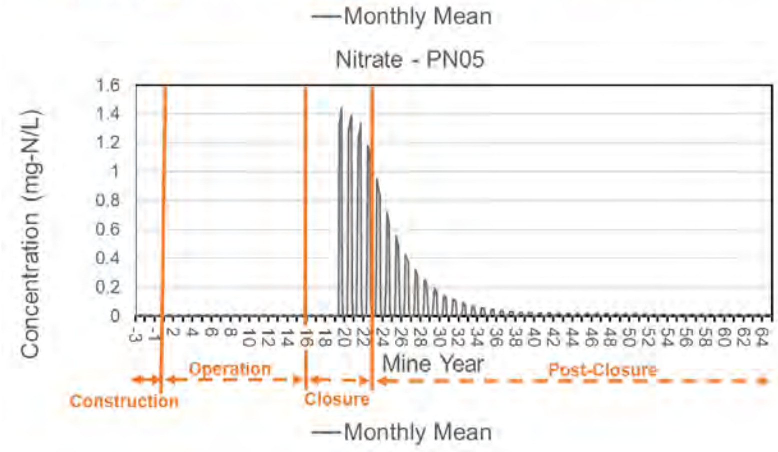

Iron - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

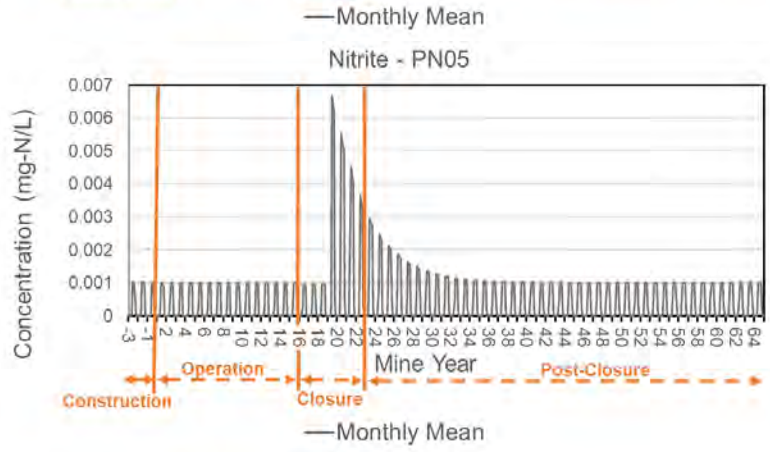

Magnesium - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

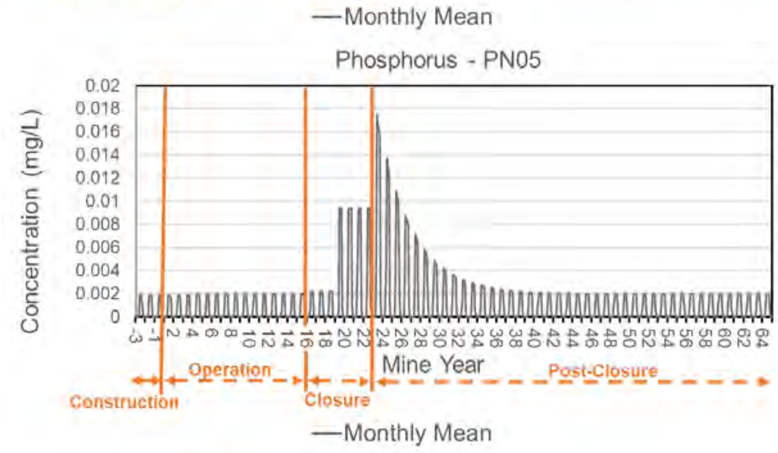

Manganese - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

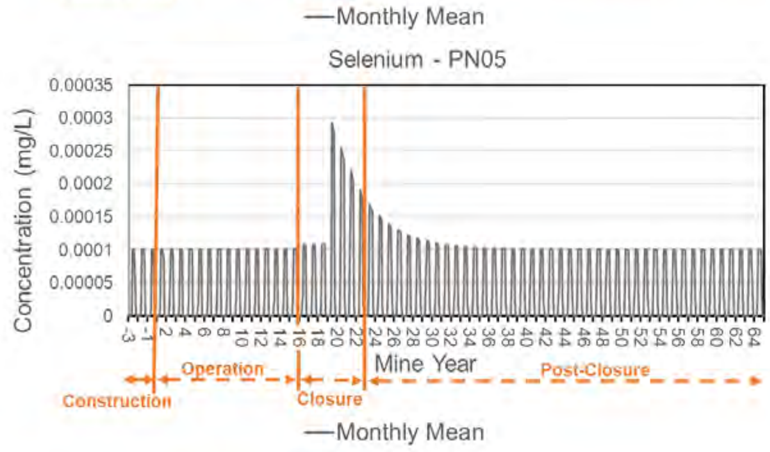

Mercury - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

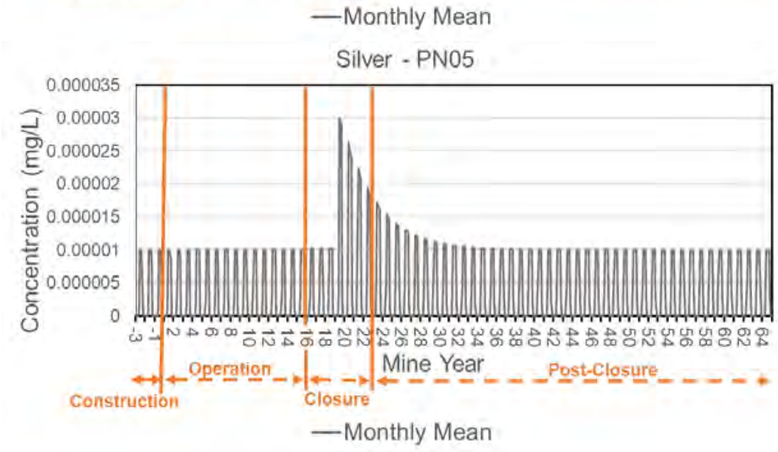

Molybdenum - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

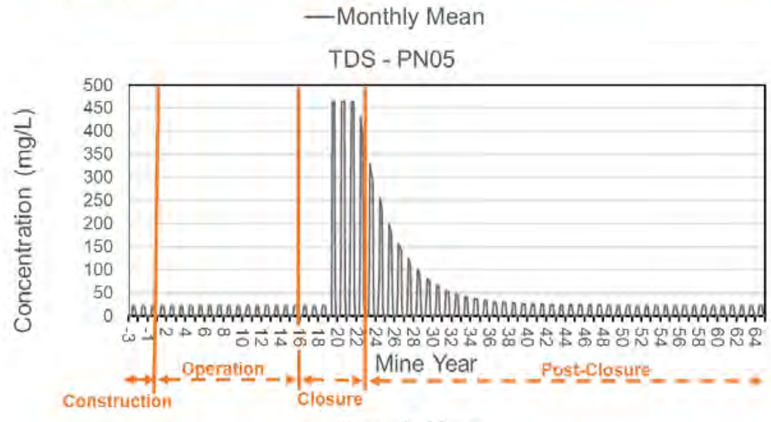

Nitrate - PN05
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

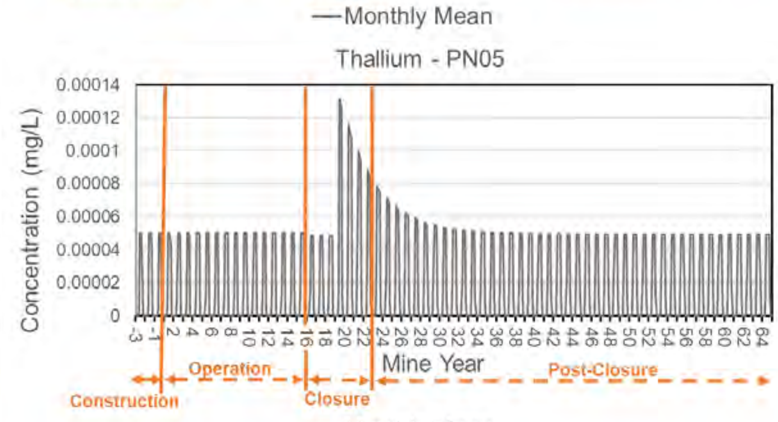

Nitrite - PN05
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Phosphorus - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Selenium - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Silver - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


TDS - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Thallium - PN05
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

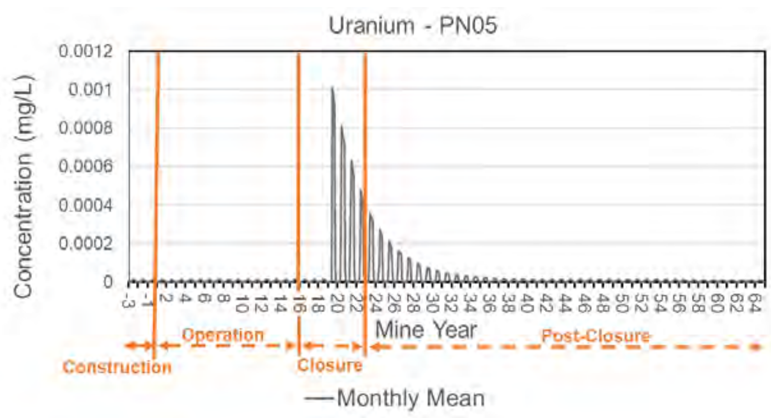
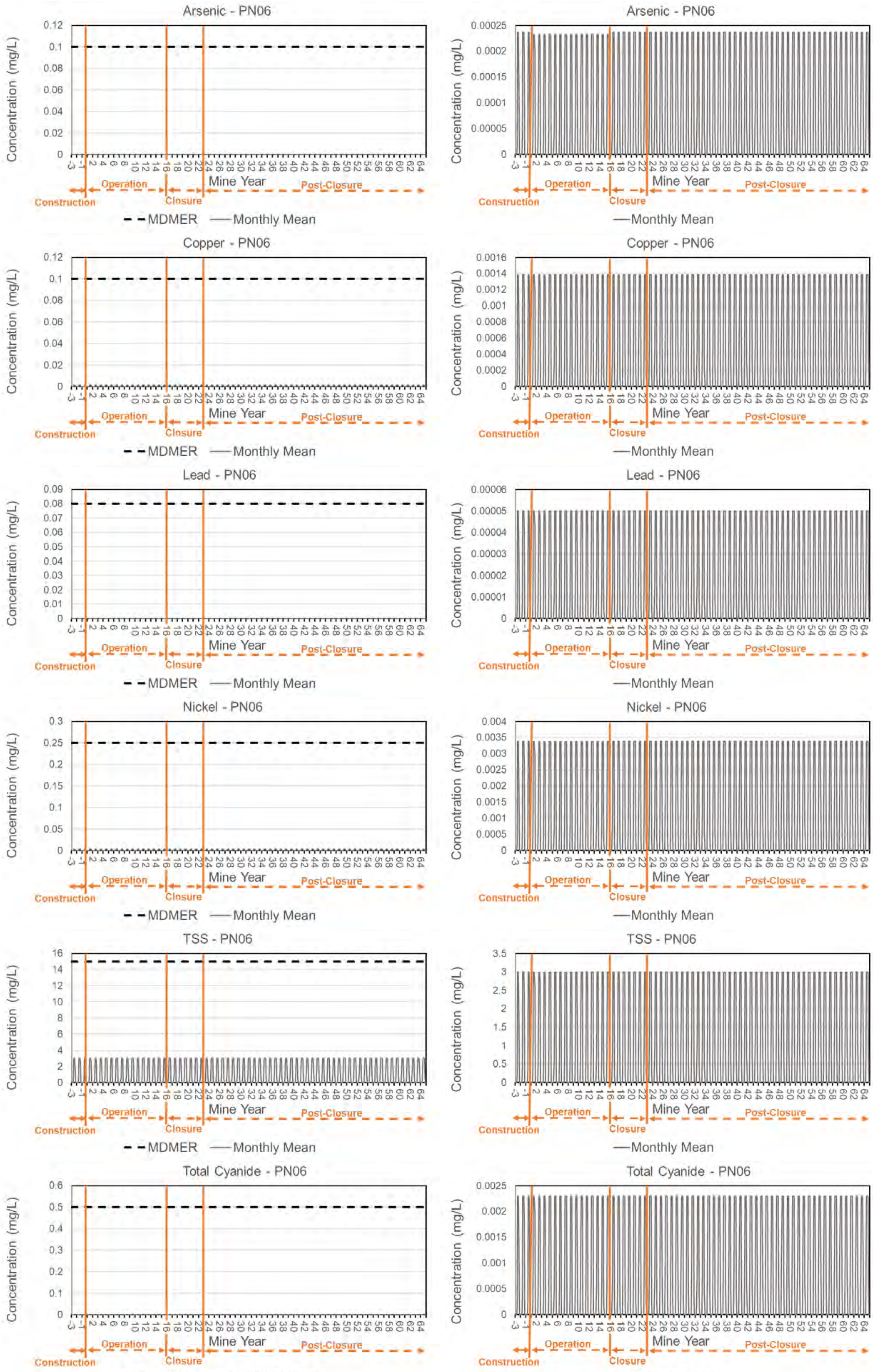
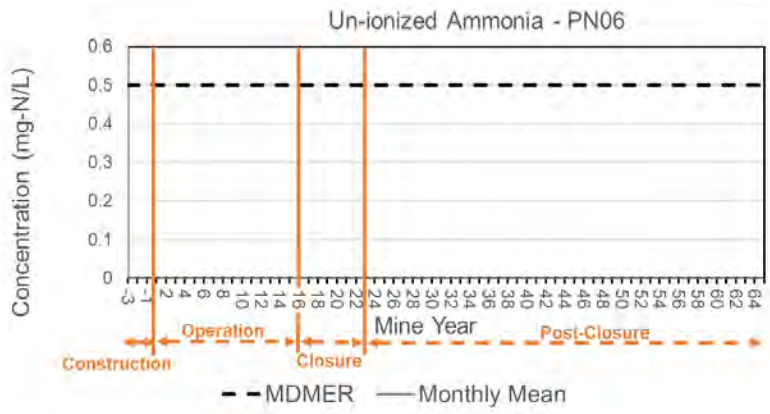
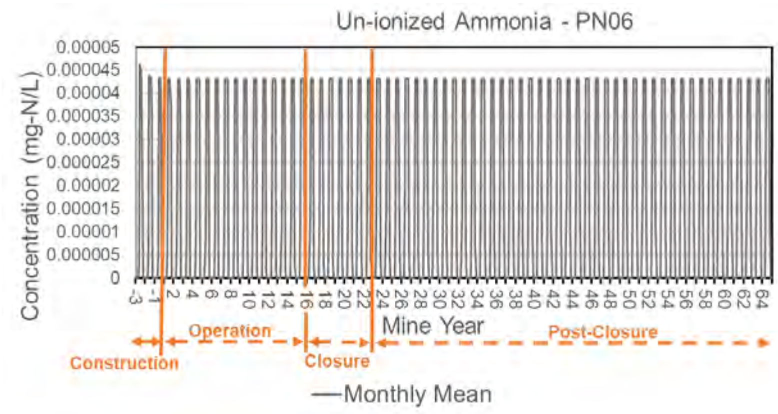
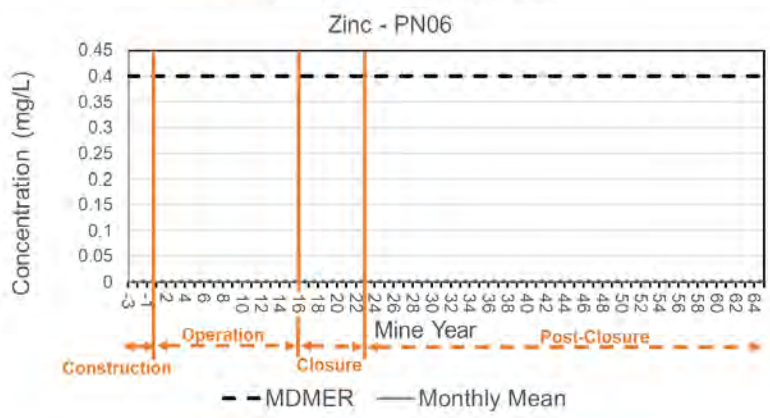

Uranium - PN05
Concentration (mg/L)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

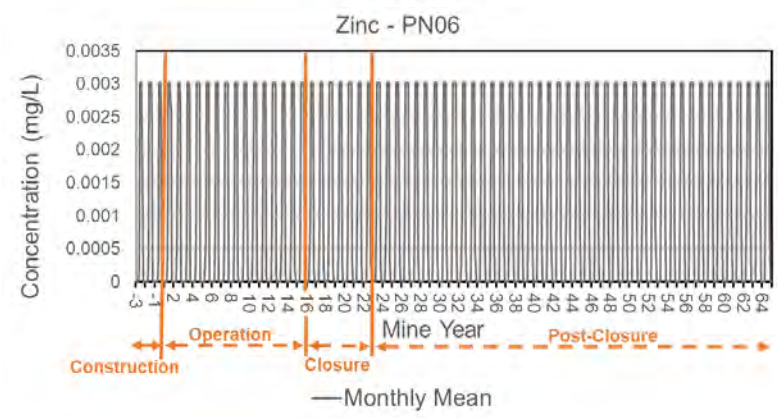
Figure F-3: Predicted Timeseries of Monthly Mean Constituent Concentrations at PN06 for all Mine Phases

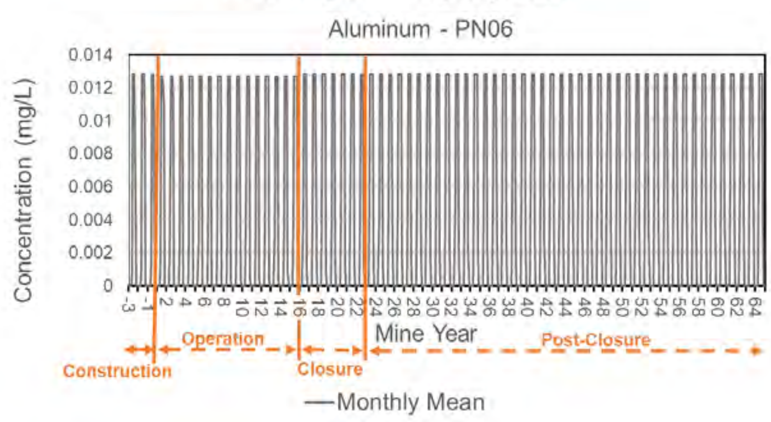


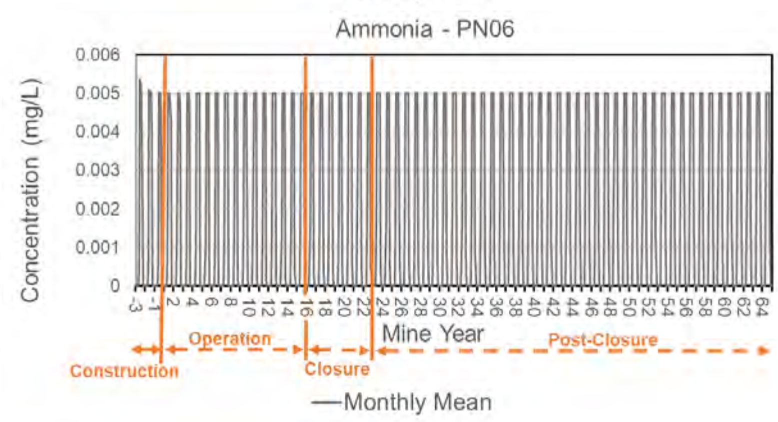

Un-ionized Ammonia - PN06
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

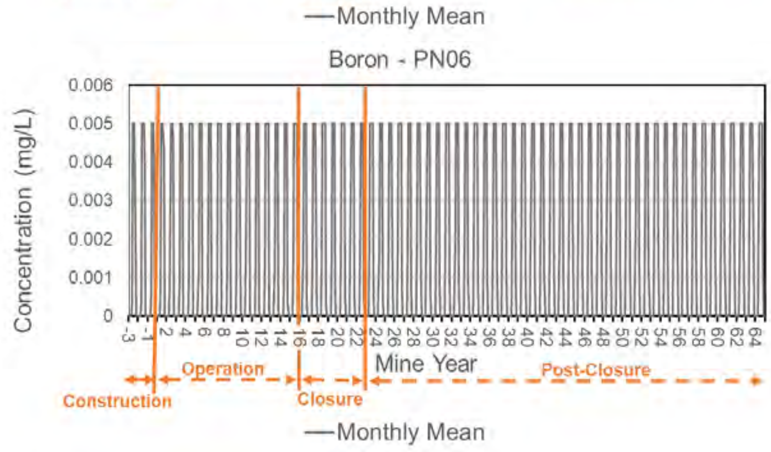

Un-ionized Ammonia - PN06
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

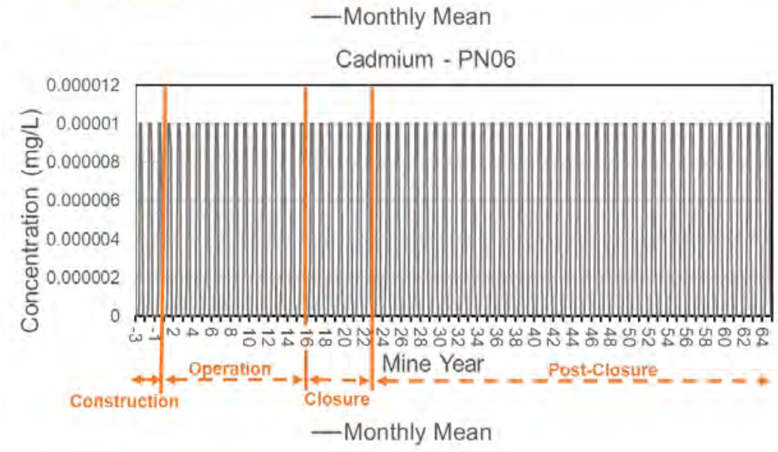

Zinc - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

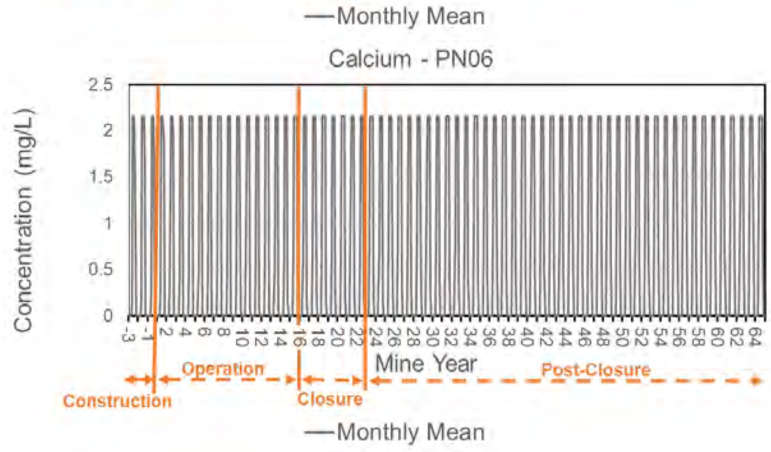

Zinc - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

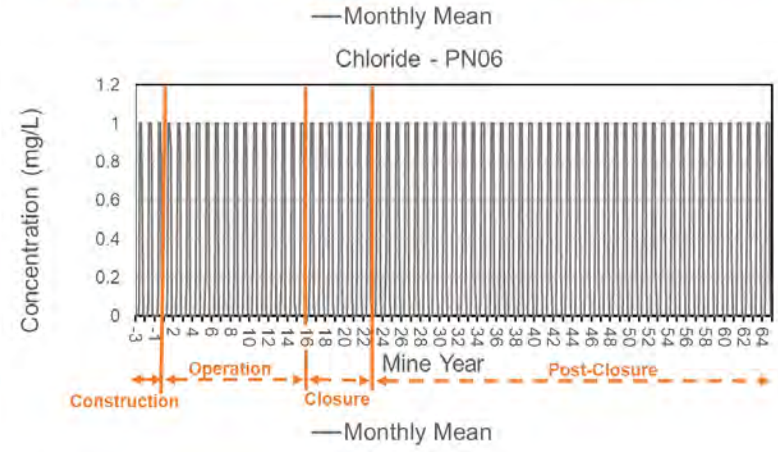

Aluminum - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

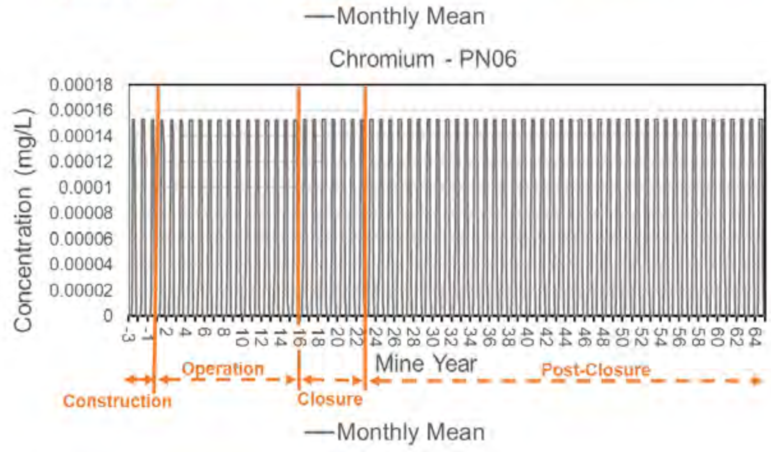

Ammonia - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

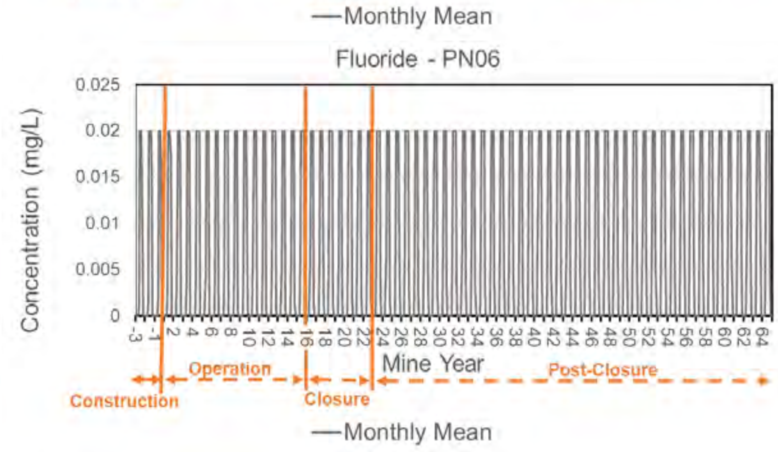

Boron - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

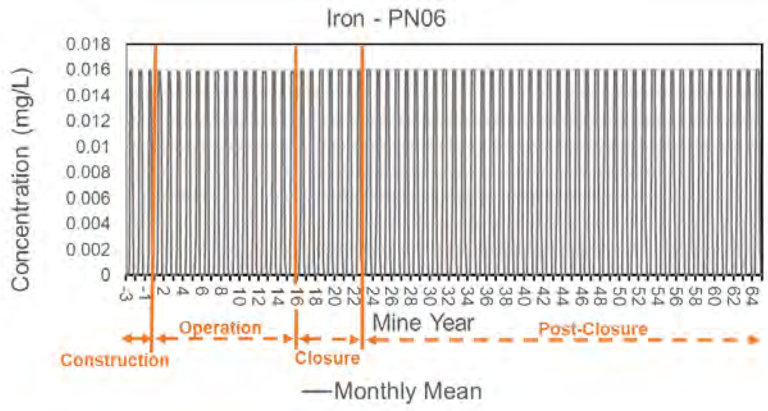

Cadmium - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

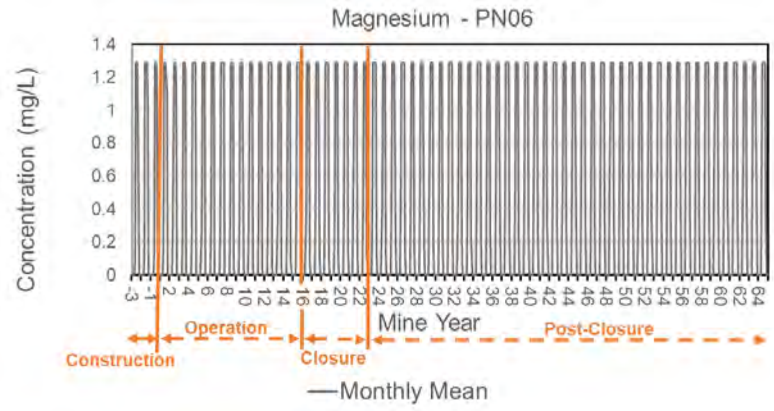

Calcium - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

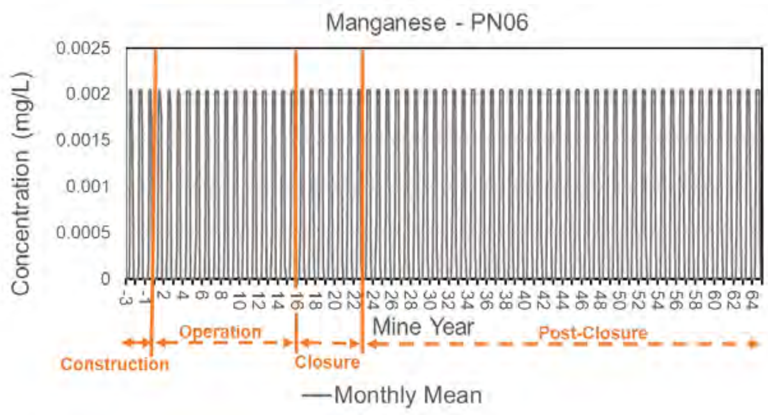

Chloride - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

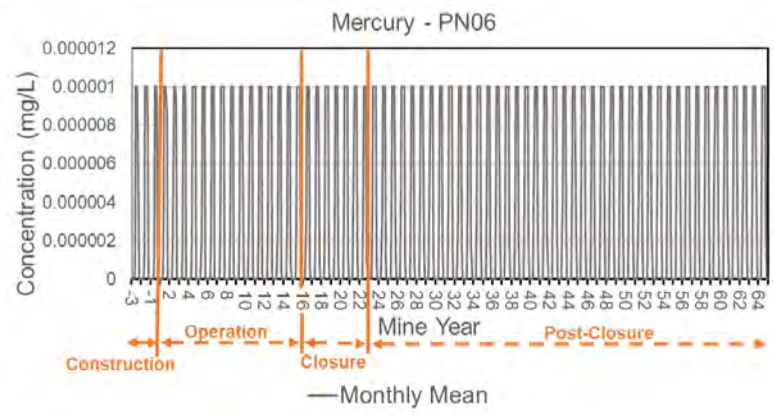

Chromium - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

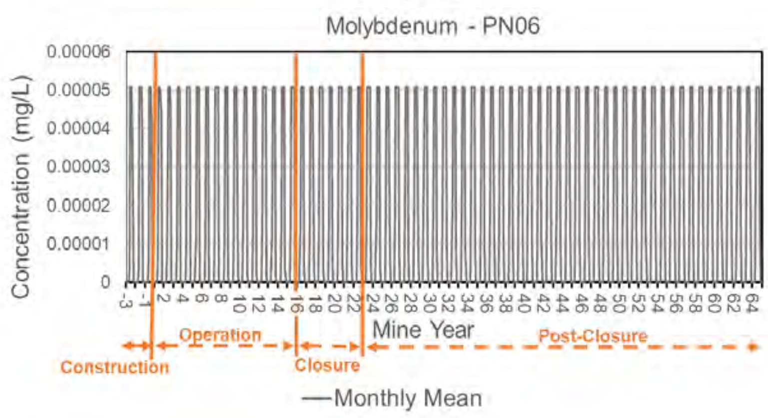

Fluoride - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

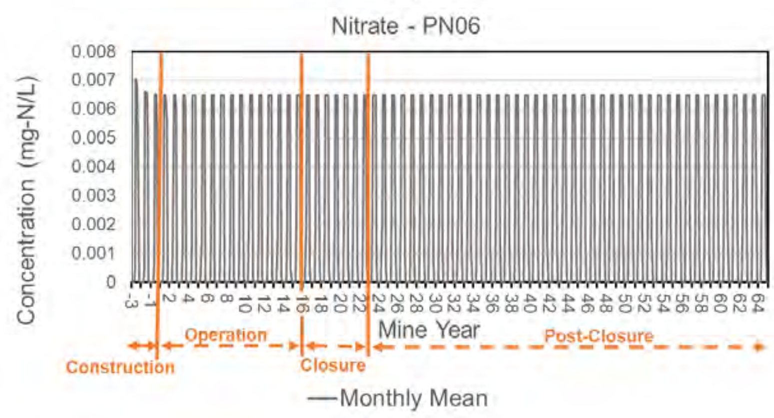

Iron - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

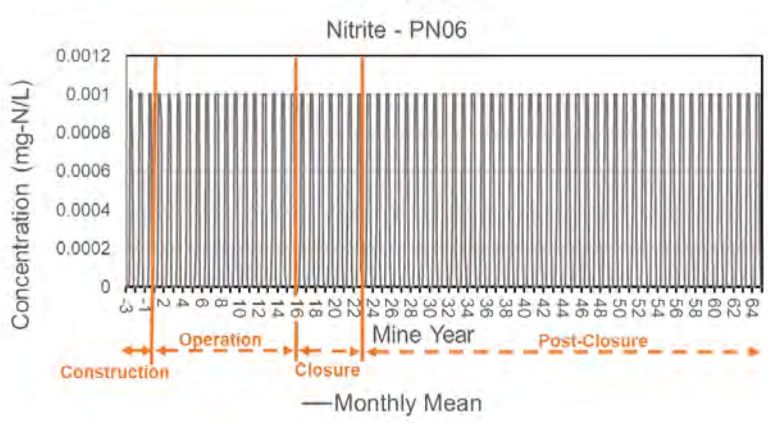

Magnesium - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

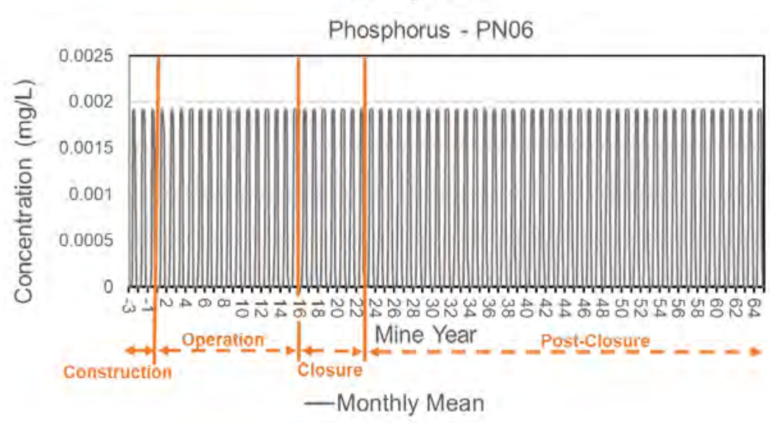

Manganese - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

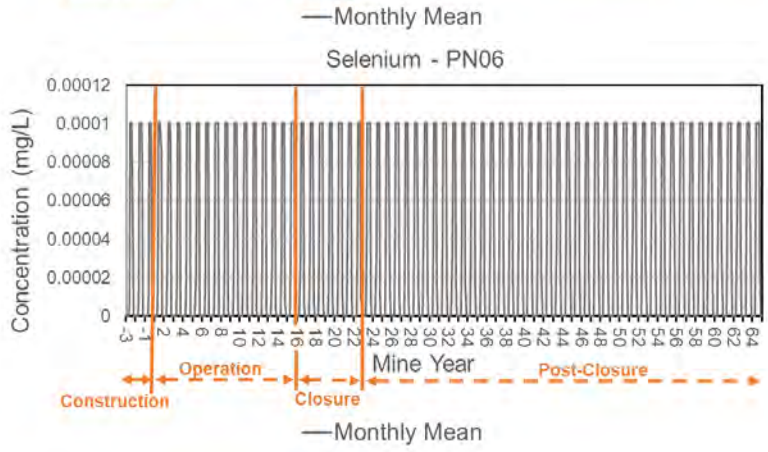

Mercury - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

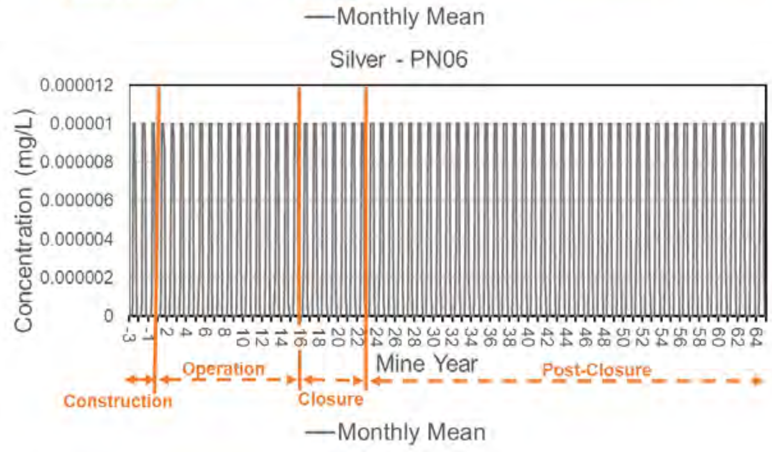

Molybdenum - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

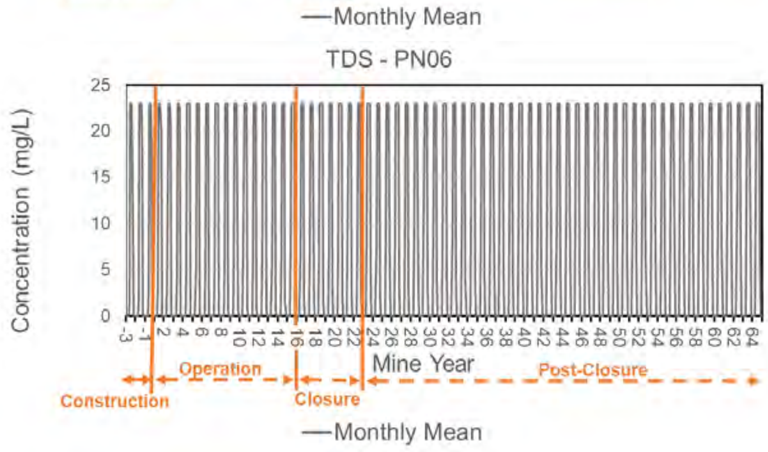

Nitrate - PN06
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

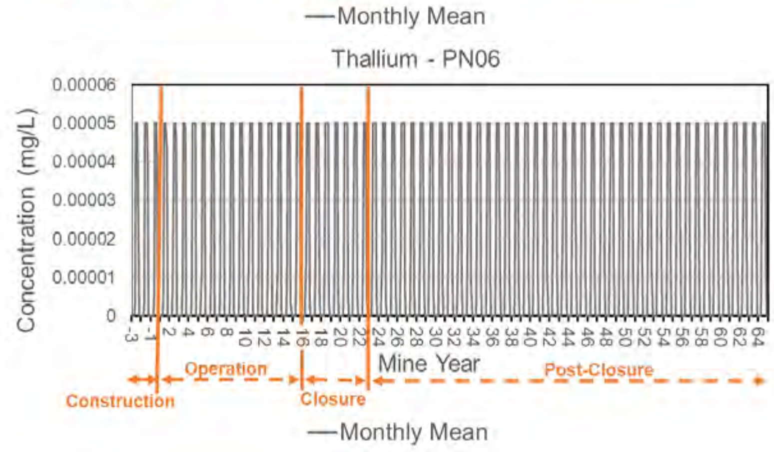

Nitrite - PN06
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean


Phosphorus - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean


Selenium - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean


Silver - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean


TDS - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean


Thallium - PN06
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

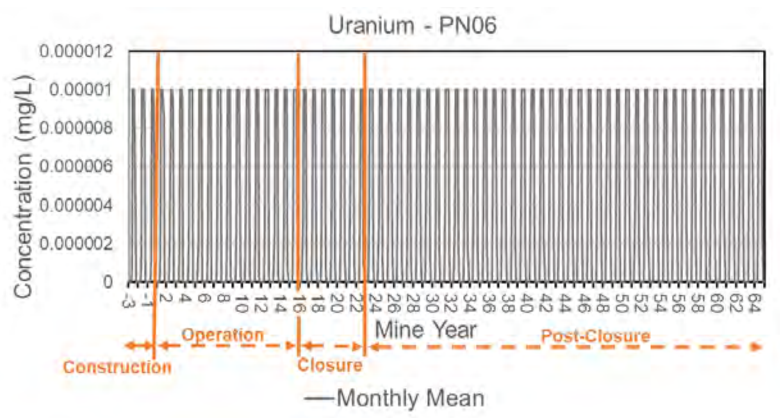
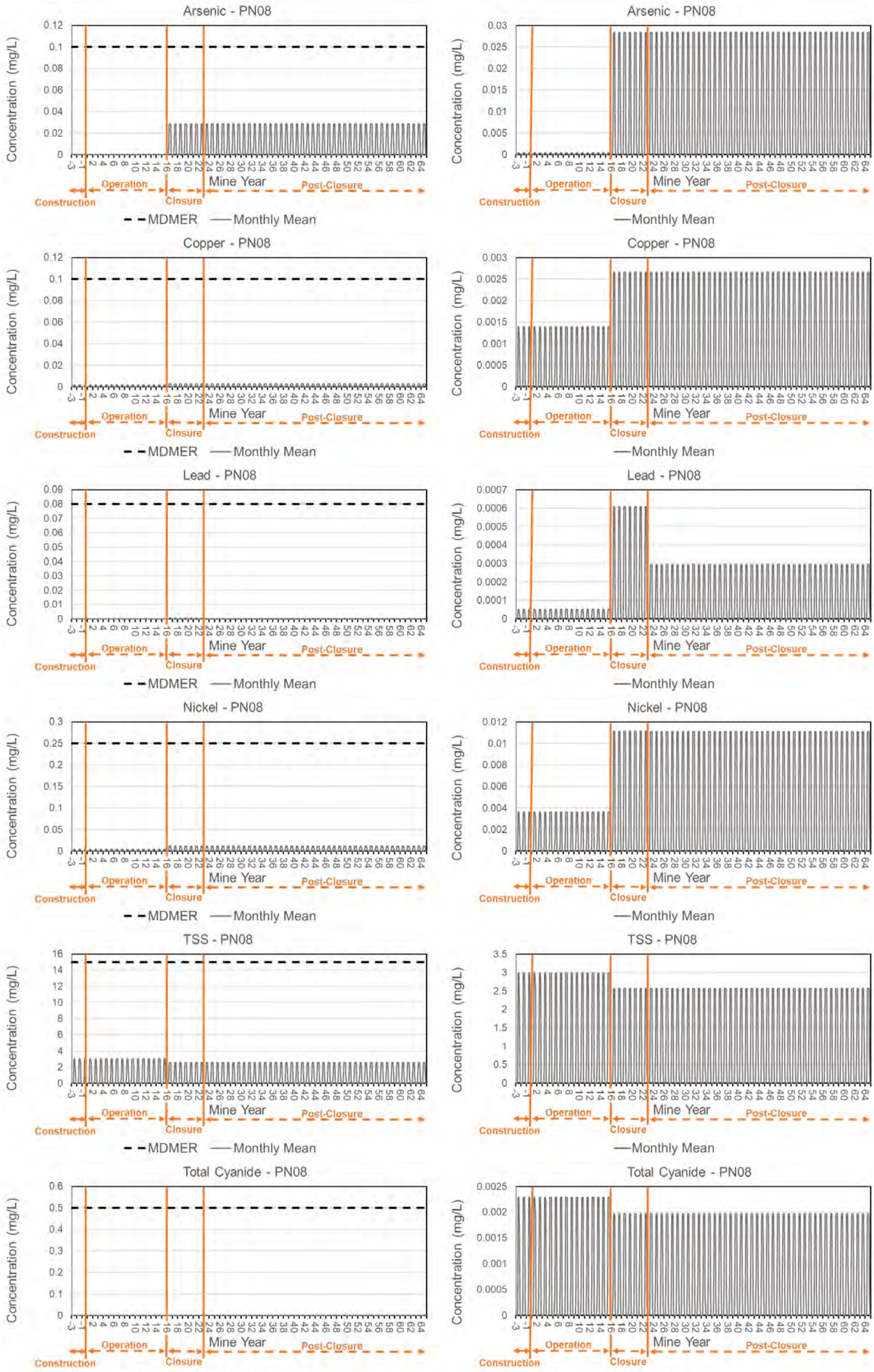
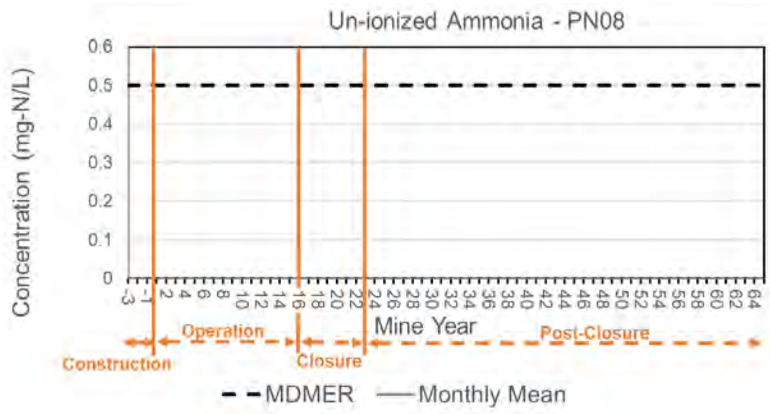
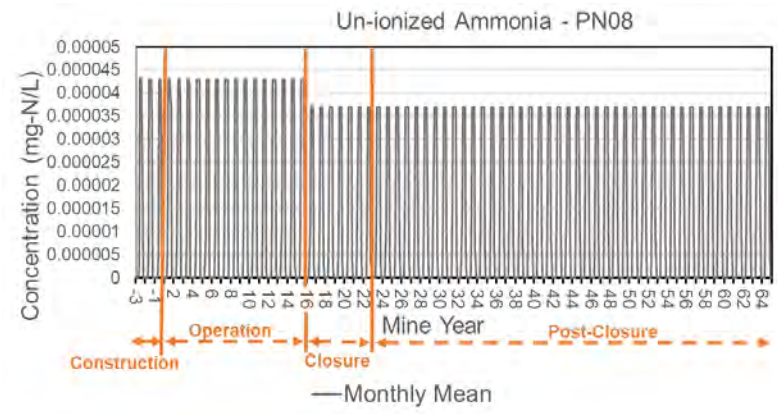
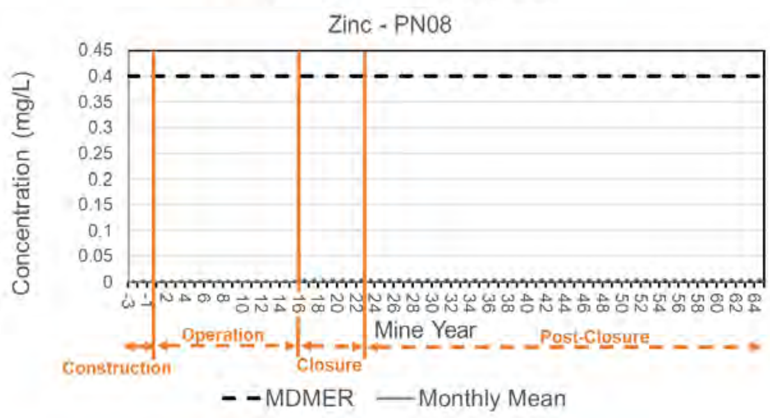

Uranium - PN06
Concentration (mg/L)
0.000012
0.00001
0.000008
0.000006
0.000004
0.000002
0
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

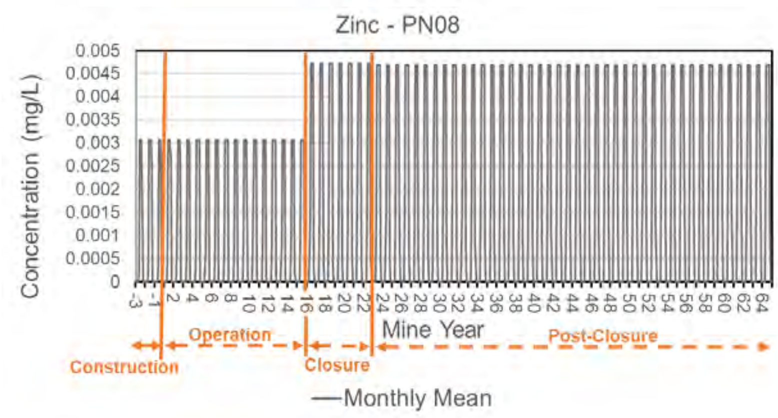
Figure F-4: Predicted Timeseries of Monthly Mean Constituent Concentrations at PN08 for all Mine Phases

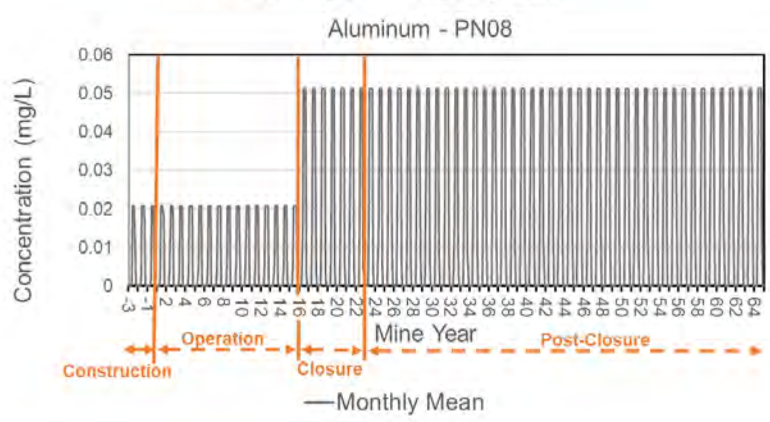


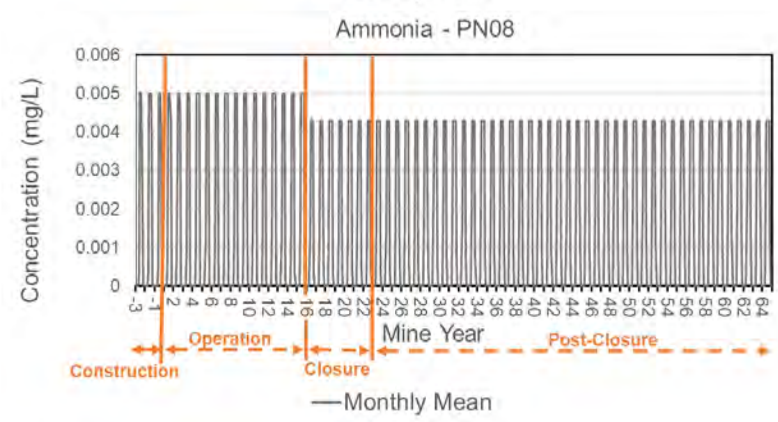

Un-ionized Ammonia - PN08
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

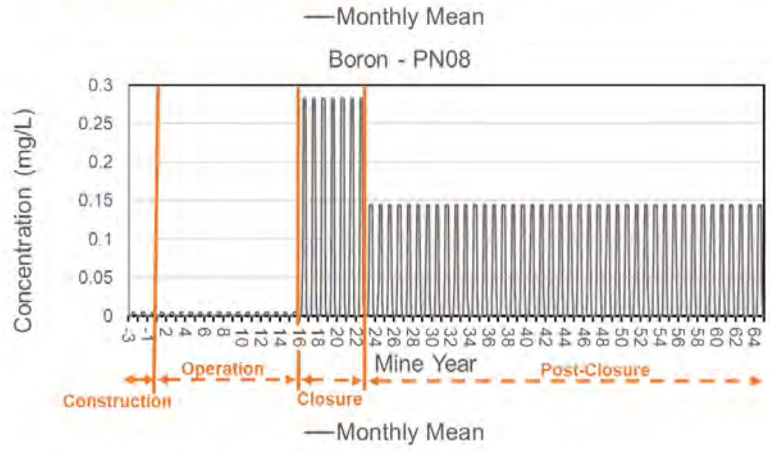

Un-ionized Ammonia - PN08
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

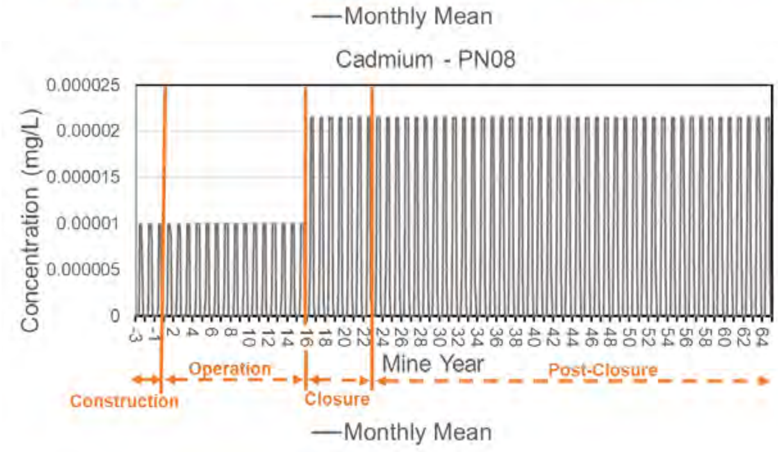

Zinc - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

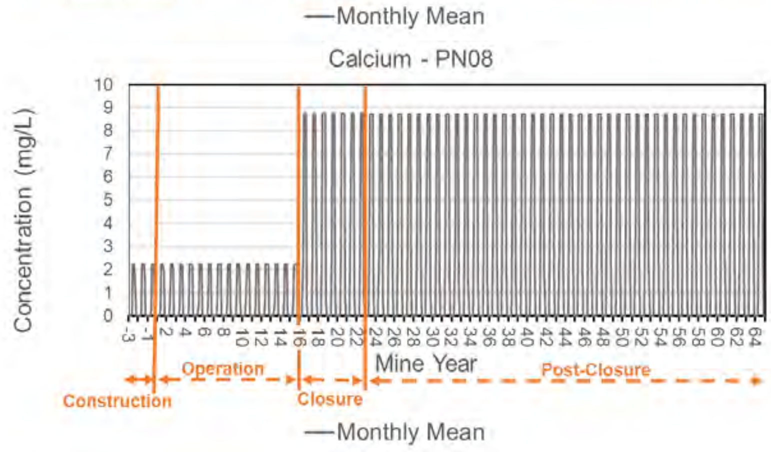

Zinc - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

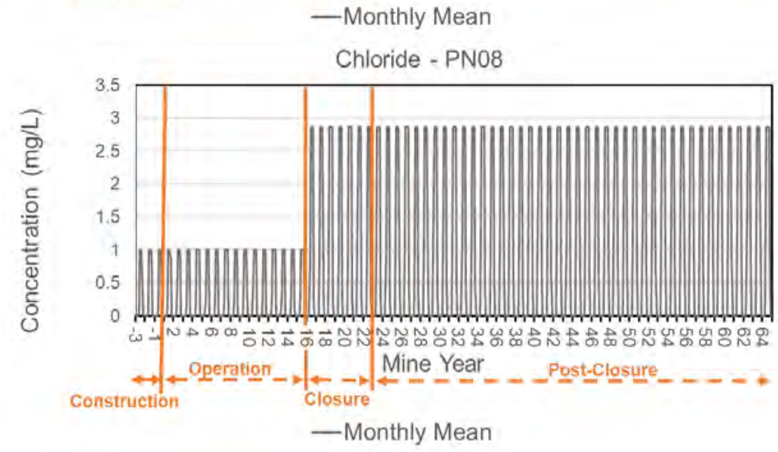

Aluminum - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

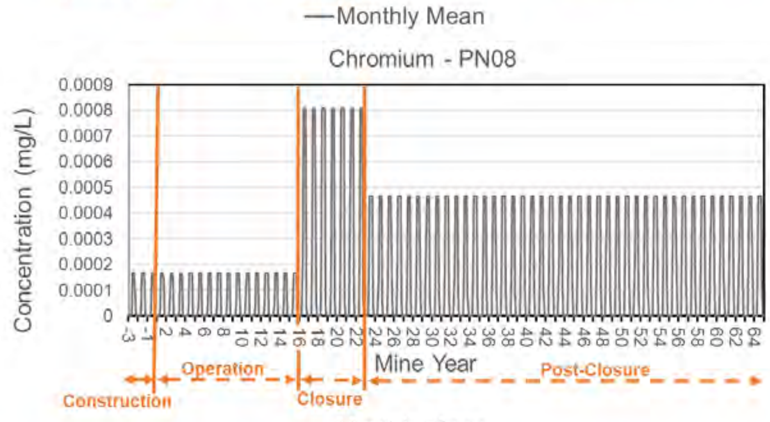

Ammonia - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

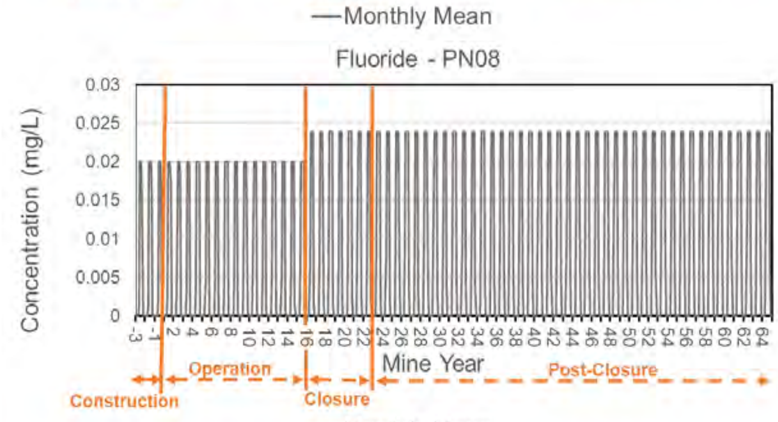

Boron - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

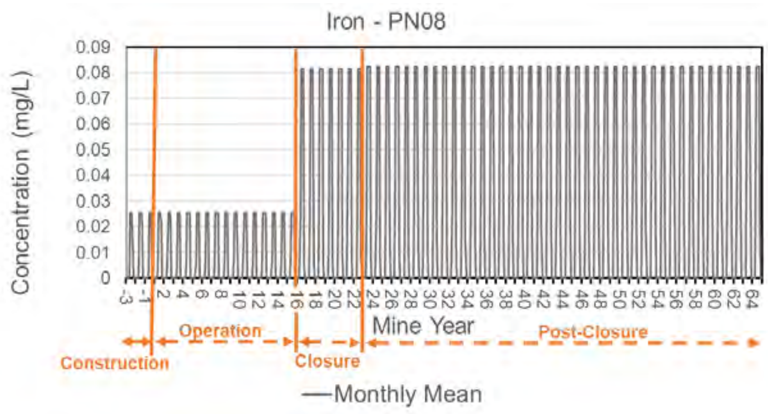

Cadmium - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

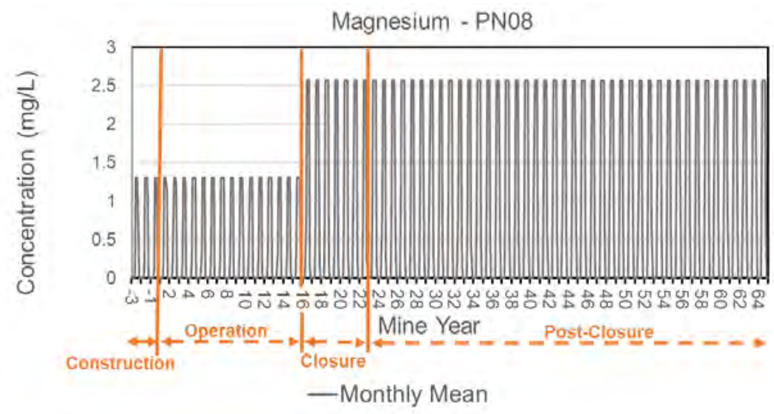

Calcium - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

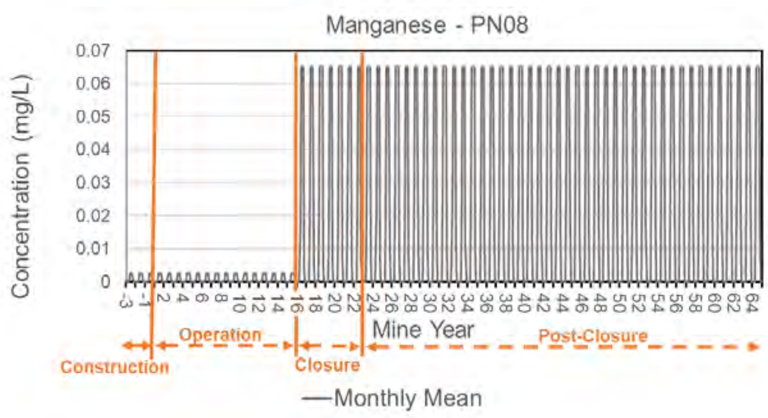

Chloride - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

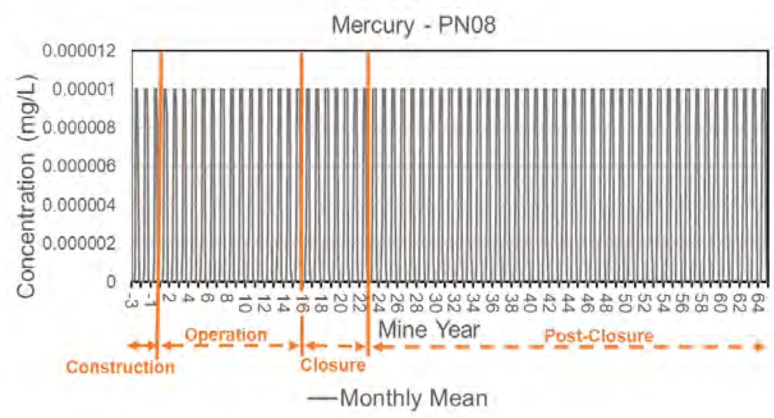

Chromium - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

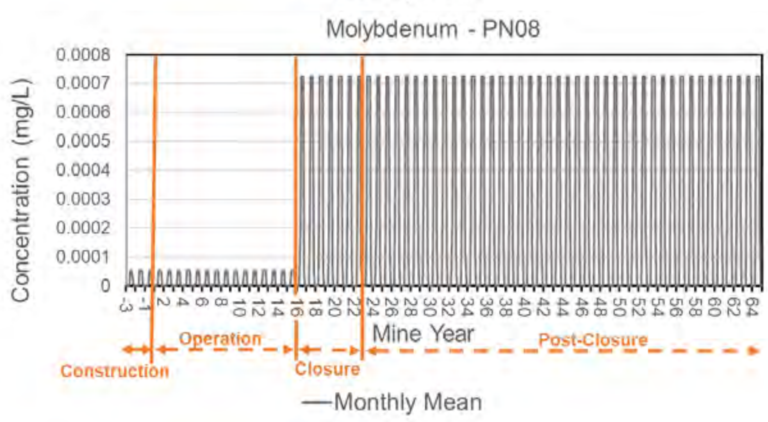

Fluoride - PN08
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

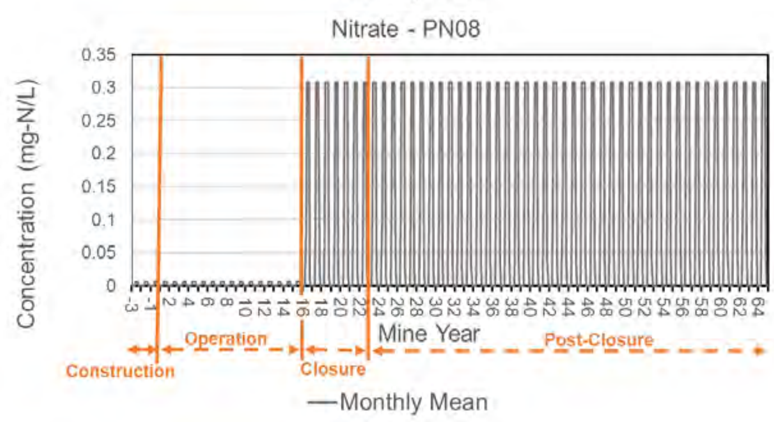

Iron - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean

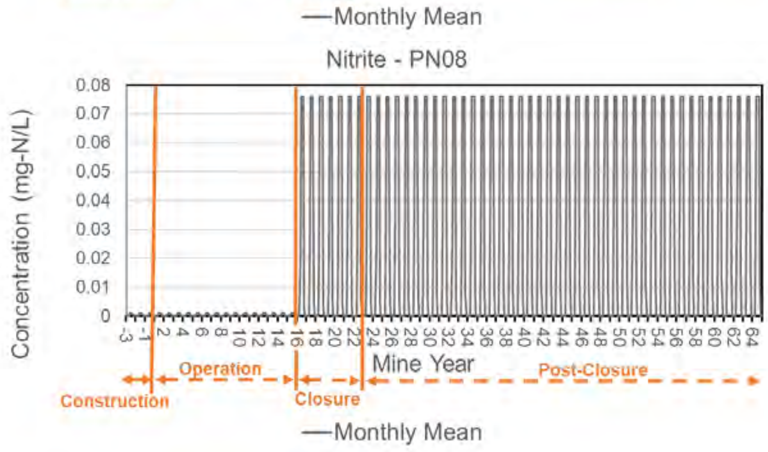

Magnesium - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean

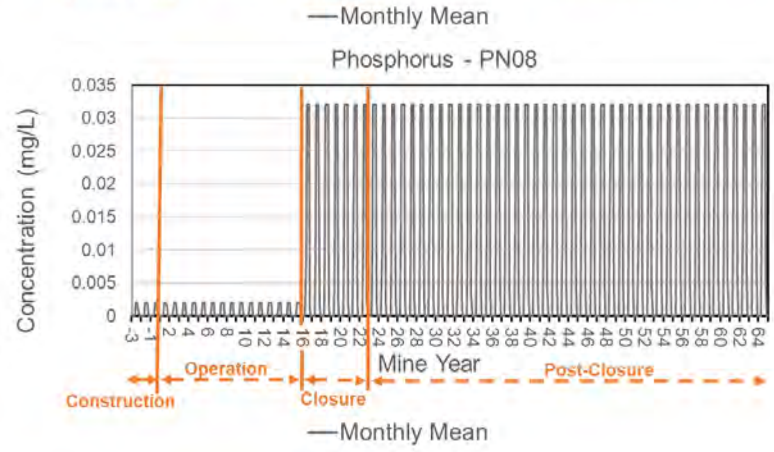

Manganese - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean

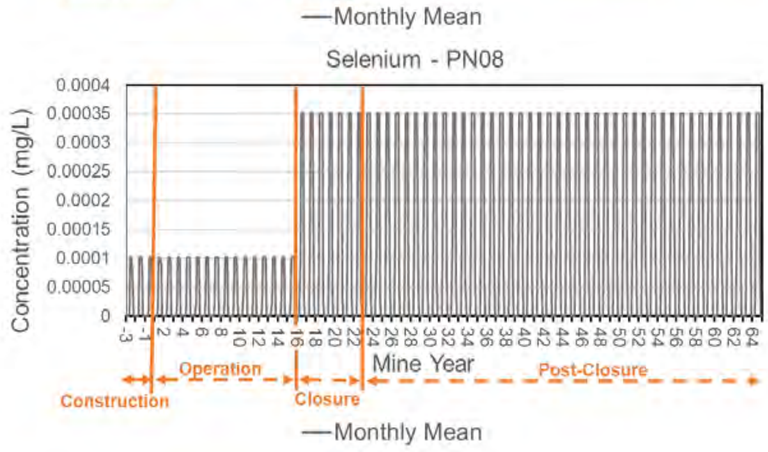

Mercury - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean

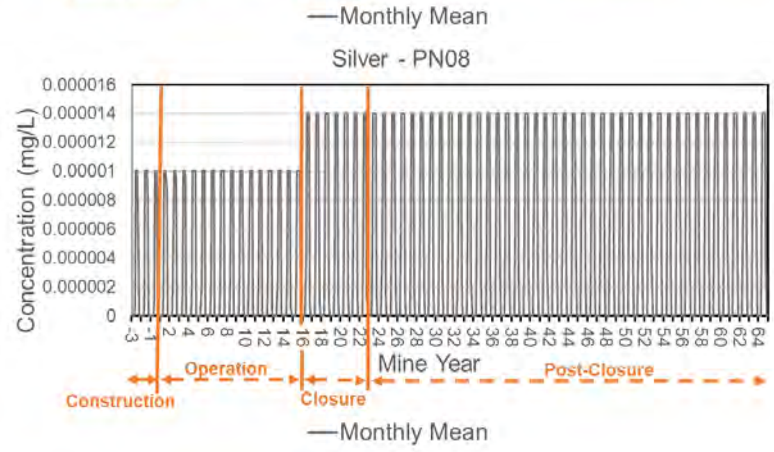

Molybdenum - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean

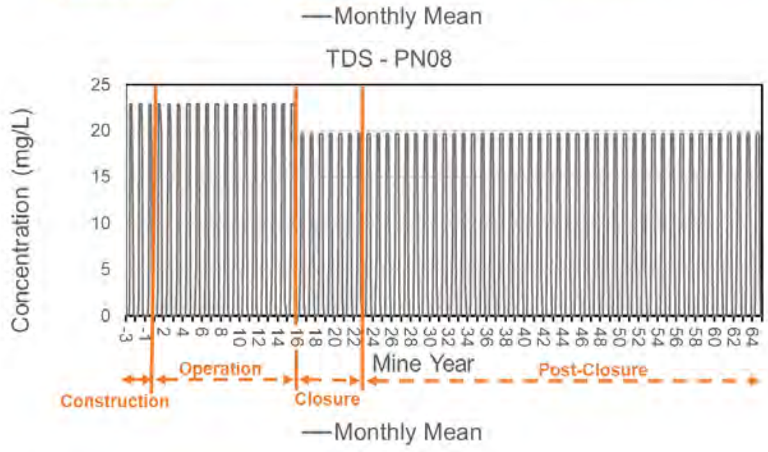

Nitrate - PN08
Concentration (mg-N/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean

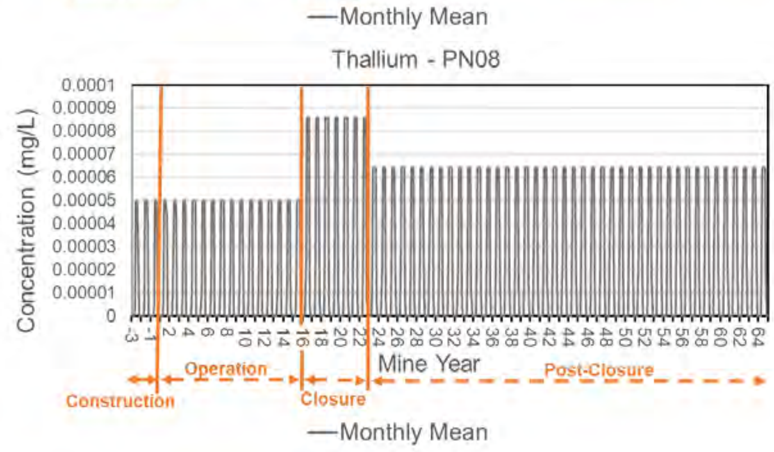

Nitrite - PN08
Concentration (mg-N/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean


Phosphorus - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean


Selenium - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean


Silver - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean


TDS - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean


Thallium - PN08
Concentration (mg/L)
Mine Year
Operation
Construction
Closure
Post-Closure
—Monthly Mean

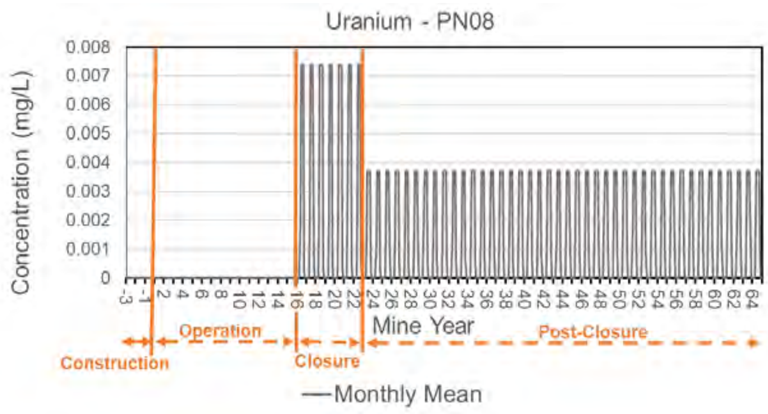
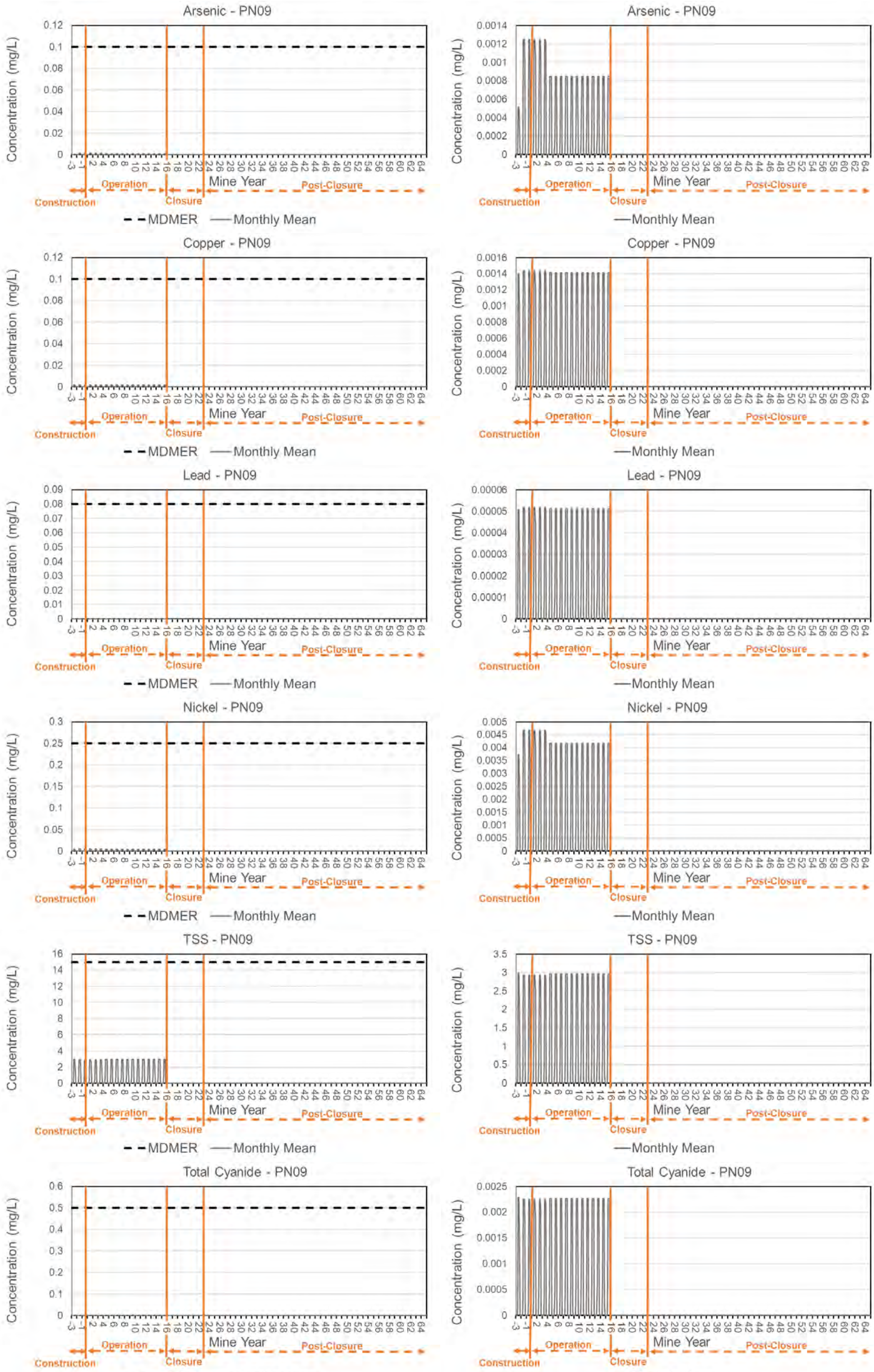
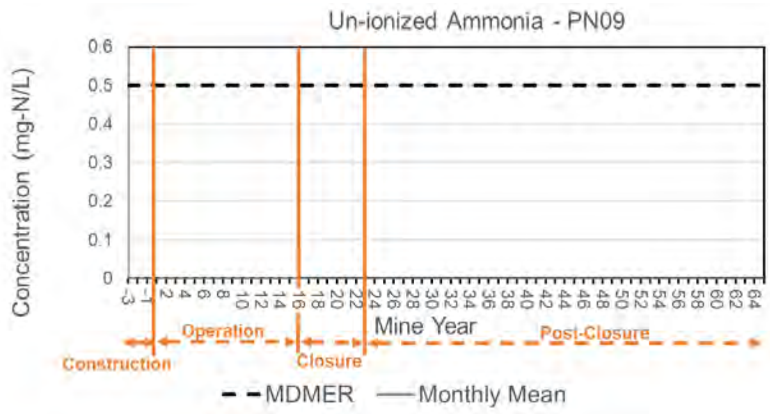
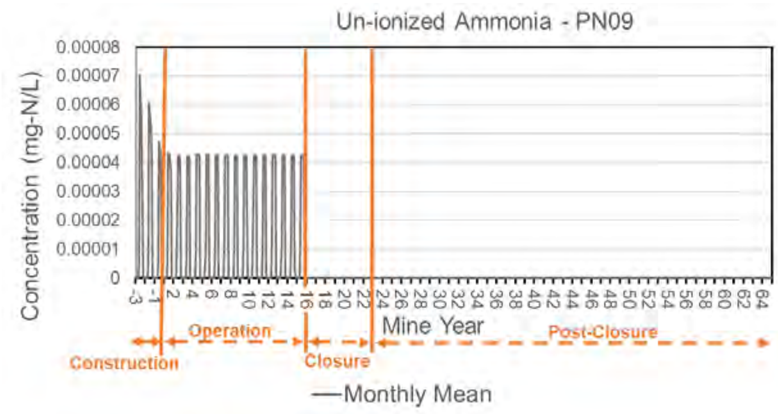
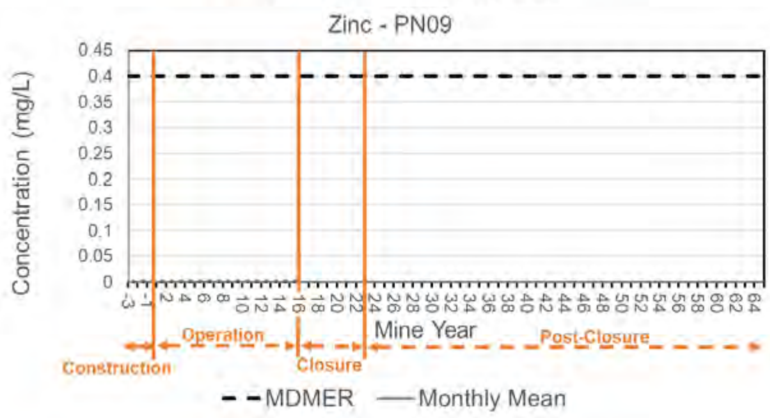

Uranium - PN08
Concentration (mg/L)
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

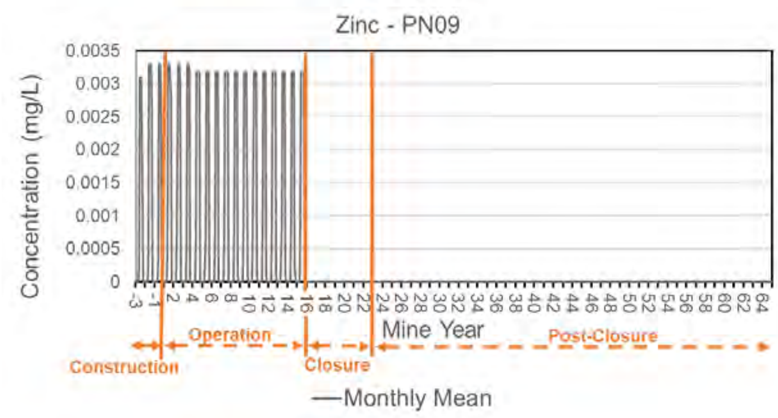
Figure F-5: Predicted Timeseries of Monthly Mean Constituent Concentrations at PN09 for all Mine Phases

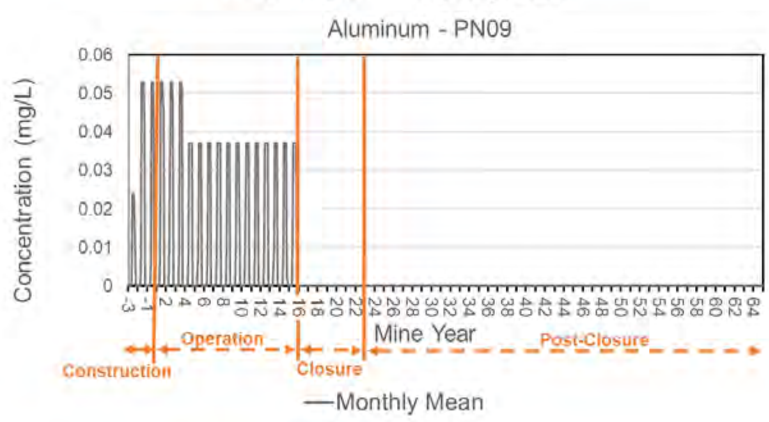


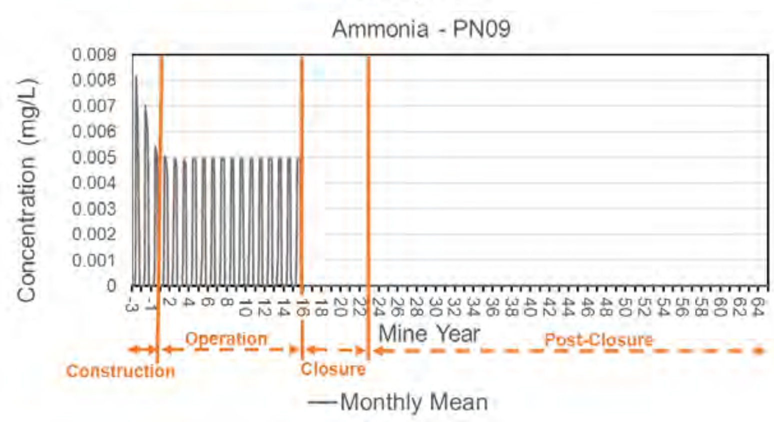

Un-ionized Ammonia - PN09
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

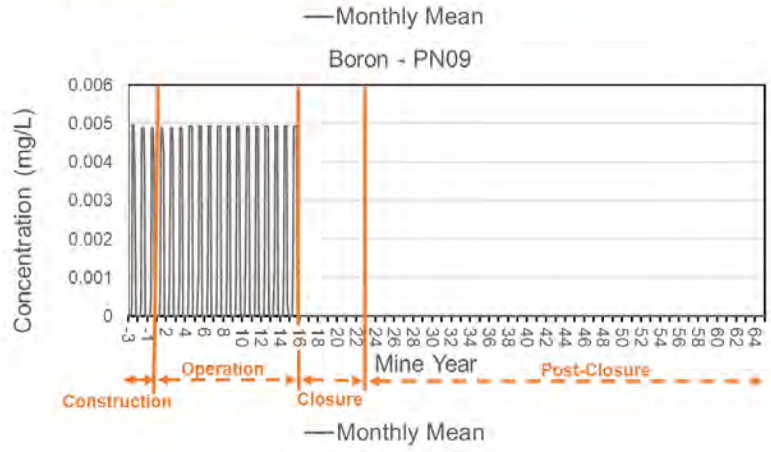

Un-ionized Ammonia - PN09
Concentration (mg-N/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

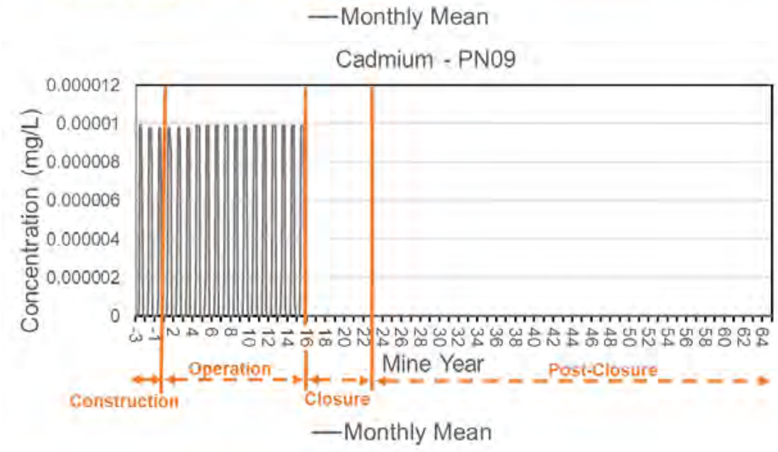

Zinc - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
MDMER
Monthly Mean

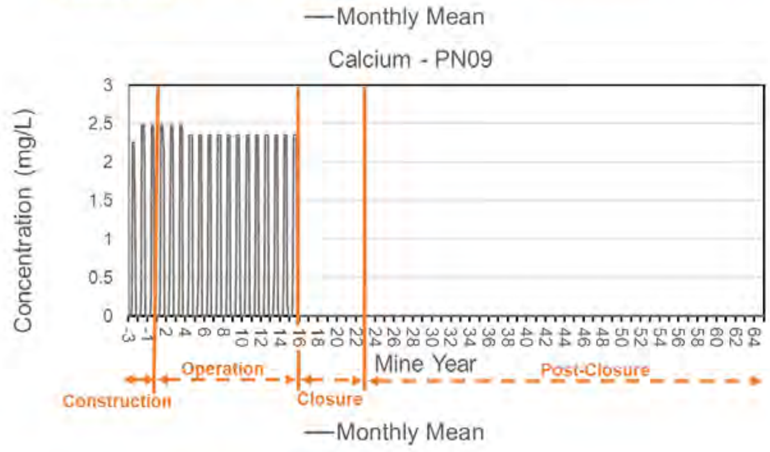

Zinc - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

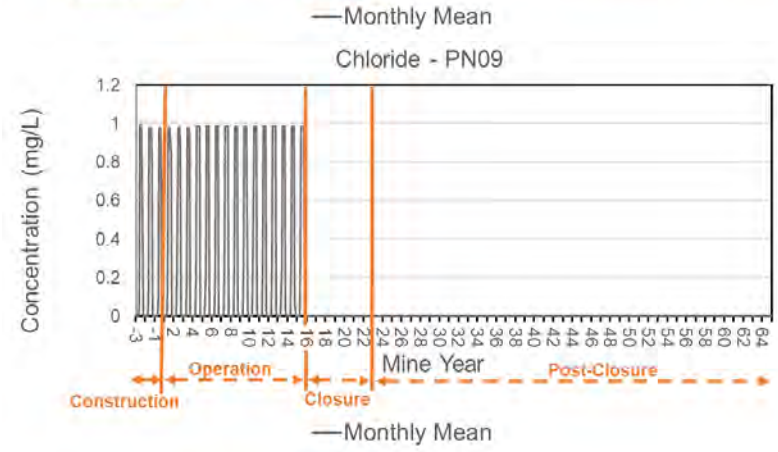

Aluminum - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

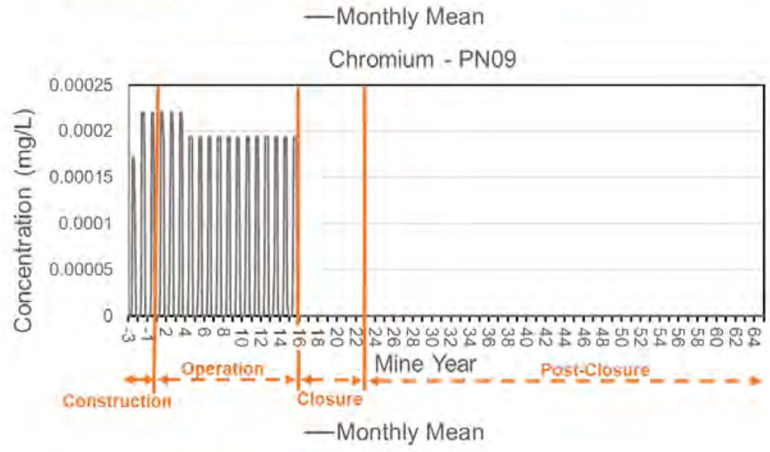

Ammonia - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

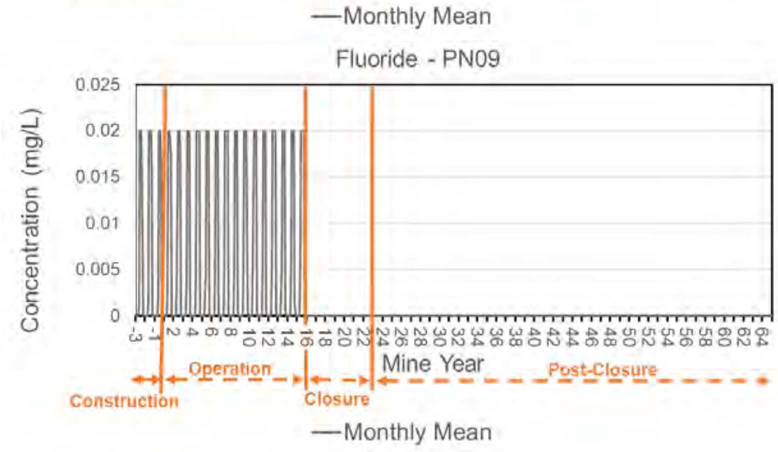

Boron - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

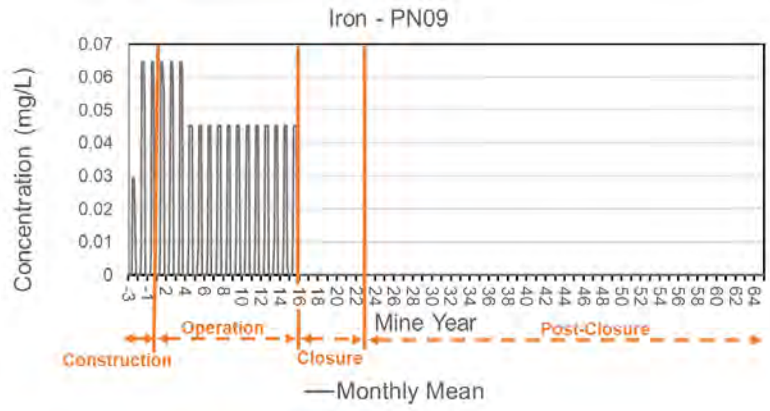

Cadmium - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

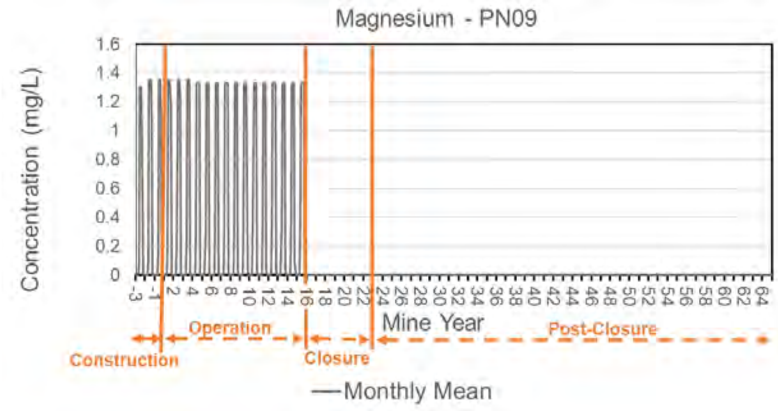

Calcium - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

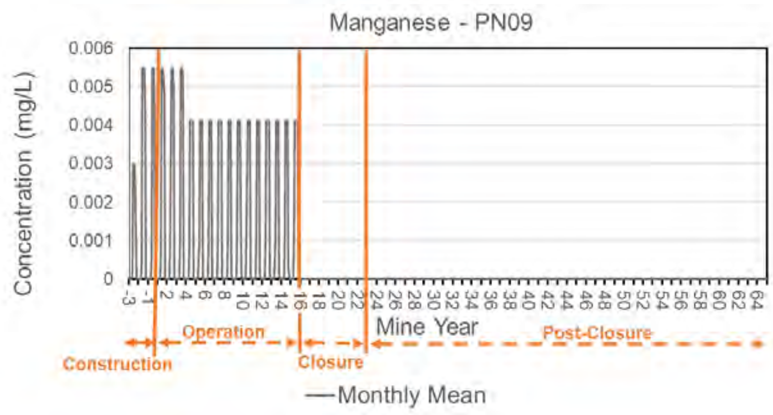

Chloride - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

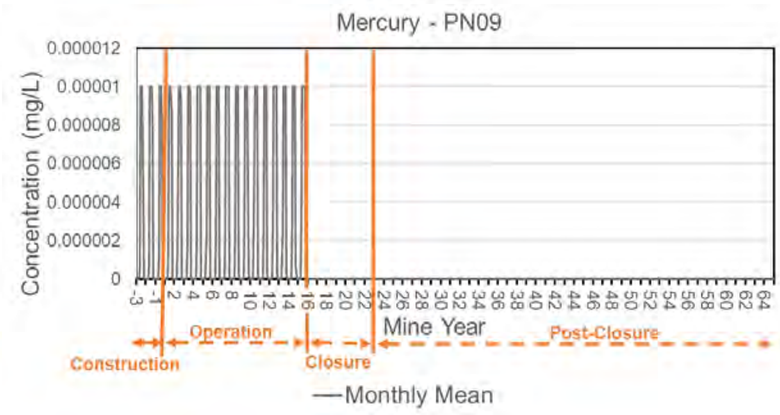

Chromium - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

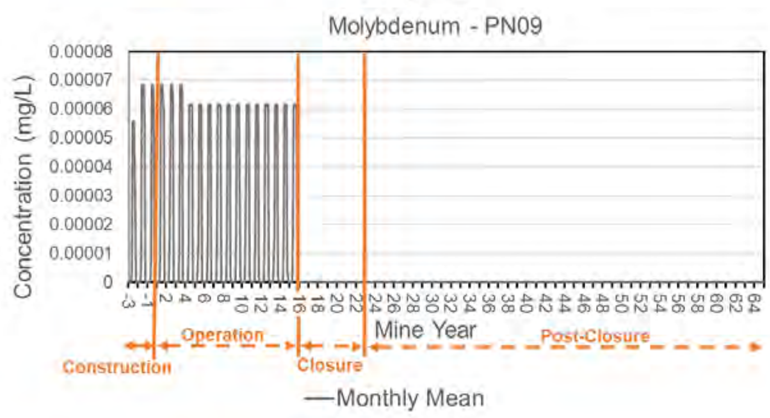

Fluoride - PN09
Concentration (mg/L)
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

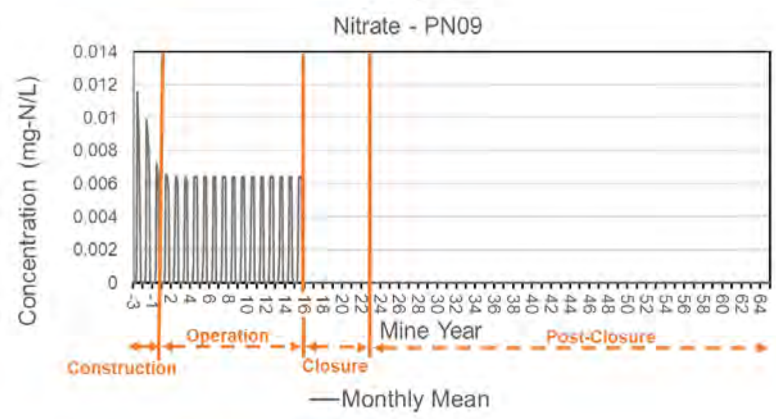

Iron - PN09
Concentration (mg/L)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

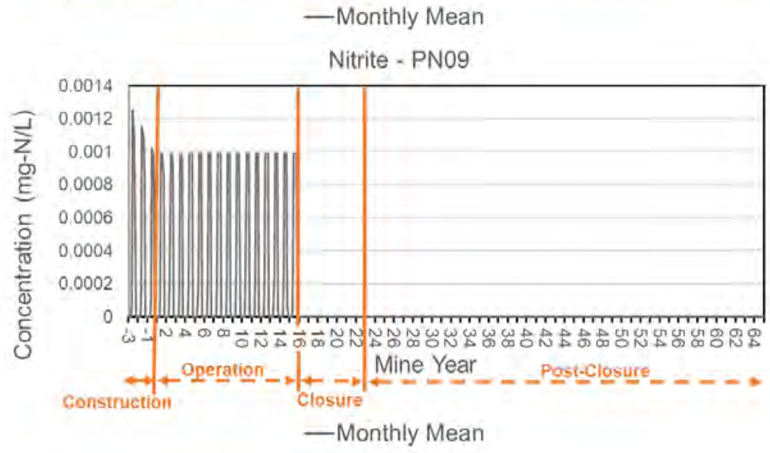

Magnesium - PN09
Concentration (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

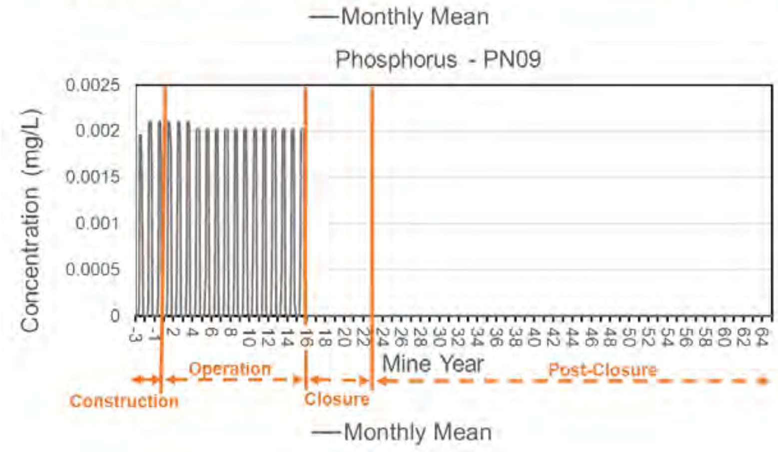

Manganese - PN09
Concentration (mg/L)
0.006
0.005
0.004
0.003
0.002
0.001
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

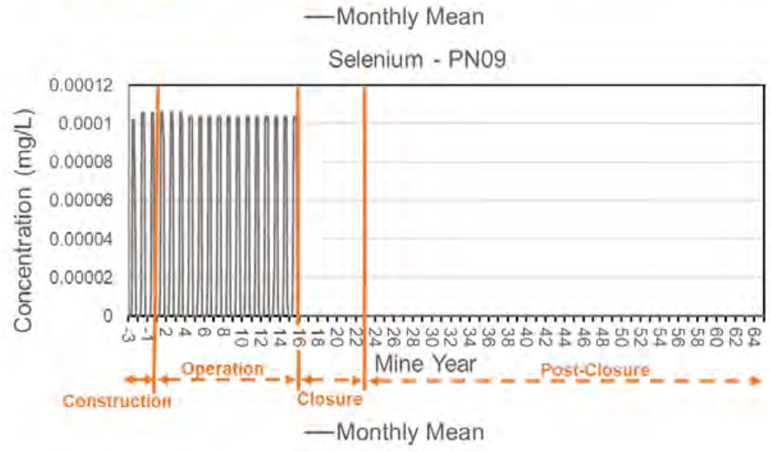

Mercury - PN09
Concentration (mg/L)
0.000012
0.00001
0.000008
0.000006
0.000004
0.000002
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Molybdenum - PN09
Concentration (mg/L)
0.00008
0.00007
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

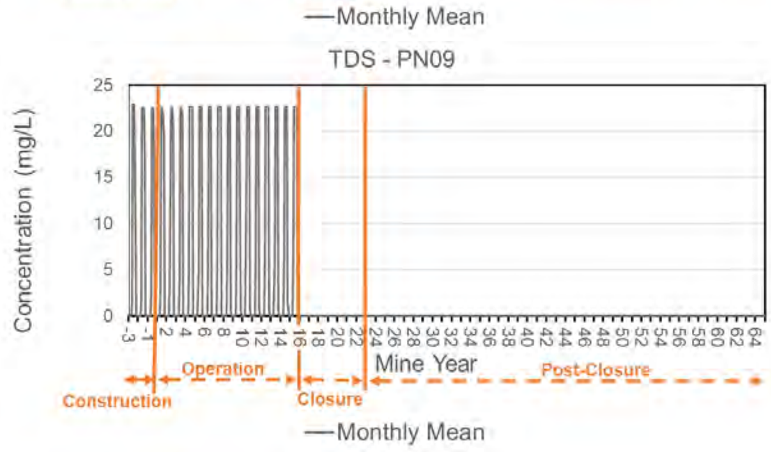

Nitrate - PN09
Concentration (mg-N/L)
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

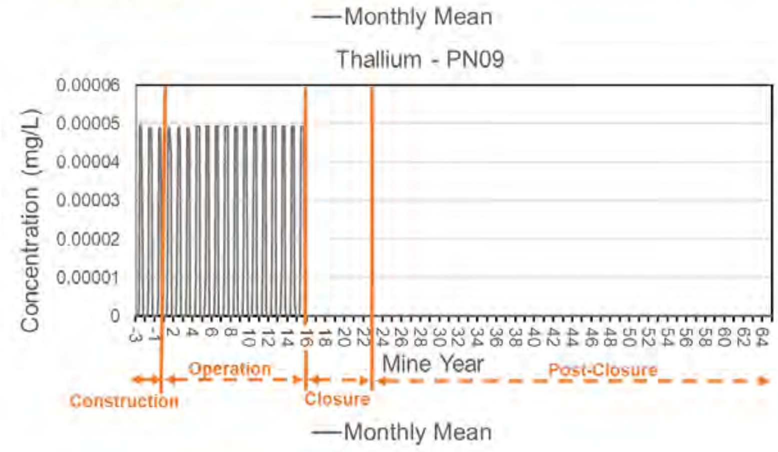

Nitrite - PN09
Concentration (mg-N/L)
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean

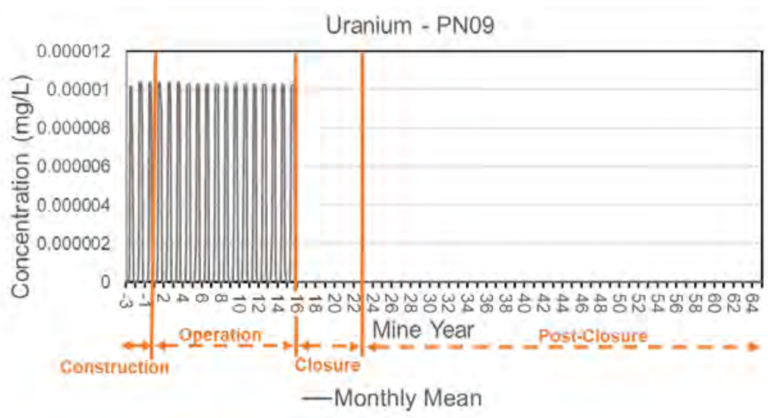

Phosphorus - PN09
Concentration (mg/L)
0.0025
0.002
0.0015
0.001
0.0005
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Selenium - PN09
Concentration (mg/L)
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Silver - PN09
Concentration (mg/L)
0.000012
0.00001
0.000008
0.000006
0.000004
0.000002
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


TDS - PN09
Concentration (mg/L)
25
20
15
10
5
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Thallium - PN09
Concentration (mg/L)
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0
Mine Year
Construction
Operation
Closure
Post-Closure
Monthly Mean


Uranium - PN09
Concentration (mg/L)
0.000012
0.00001
0.000008
0.000006
0.000004
0.000002
0
Mine Year
Construction
Operation
Closure
Post-Closure
—Monthly Mean

APPENDIX G

Predicted Maximum Monthly Average Concentrations per Mine Phase at Each Prediction Node for Average Hydrological Conditions

Table G-1: Predicted Maximum Monthly Average Concentrations per Mine Phase at Each Prediction Node for Average Hydrological Conditions

Constituent	Unit	PN04				PN05				PN06				PN08				PN09[(a)]	
		Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations
Aluminum	mg/L	0.06	0.069	0.086	0.074	0.015	0.016	0.074	0.025	0.013	0.013	0.013	0.013	0.021	0.021	0.051	0.051	0.053	0.053
Ammonia	mg-N/L	0.0062	0.0049	2.4	0.36	0.0054	0.005	1.3	0.001	0.0054	0.005	0.005	0.005	0.005	0.005	0.0043	0.0043	0.0081	0.005
Antimony	mg/L	0.000077	0.000082	0.0011	0.00037	0.000052	0.000053	0.00043	0.0002	0.000051	0.000051	0.000051	0.000051	0.000055	0.000055	0.00038	0.00038	0.000073	0.000073
Arsenic	mg/L	0.0014	0.0016	0.0063	0.015	0.0003	0.00031	0.0023	0.0011	0.00024	0.00023	0.00024	0.00024	0.00043	0.00043	0.028	0.028	0.0012	0.0012
Barium	mg/L	0.0052	0.0052	0.033	0.0079	0.0051	0.0051	0.09	0.034	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0059	0.0059	0.0052	0.0052
Beryllium	mg/L	0.0002	0.00019	0.00033	0.00022	0.0002	0.0002	0.00028	0.00023	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00018	0.00017	0.0002	0.0002
Bismuth	mg/L	0.0005	0.00048	0.004	0.0017	0.0005	0.0005	0.0043	0.0019	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00049	0.00049	0.0005	0.00049
Boron	mg/L	0.005	0.0048	0.43	0.17	0.005	0.005	0.28	0.1	0.005	0.005	0.005	0.005	0.005	0.005	0.28	0.14	0.005	0.0049
Cadmium	mg/L	0.0000099	0.0000097	0.000054	0.00002	0.000010	0.000010	0.000033	0.000018	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000021	0.000021	0.0000099	0.0000099
Calcium	mg/L	2.5	2.6	80	13	2.2	2.2	230	81	2.2	2.2	2.2	2.2	2.2	2.2	8.7	8.7	2.5	2.5
Chloride	mg/L	0.99	0.97	53	13	1.0	1.0	111	185	1.0	1.0	1.0	1.0	0.99	0.99	2.9	2.9	0.99	0.99
Chromium	mg/L	0.00023	0.00025	0.00059	0.00043	0.00016	0.00016	0.0003	0.00021	0.00015	0.00015	0.00015	0.00015	0.00017	0.00017	0.00081	0.00047	0.00022	0.00022
Cobalt	mg/L	0.00062	0.00072	0.0079	0.0026	0.00016	0.00017	0.0024	0.001	0.00014	0.00014	0.00014	0.00014	0.00022	0.00022	0.0026	0.0026	0.00055	0.00055
Copper	mg/L	0.0014	0.0015	0.0027	0.0022	0.0014	0.0014	0.0016	0.0015	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0027	0.0027	0.0014	0.0014
Cyanate	mg/L	0	0	0.79	0.0087	0	0	0.0054	0.000013	0	0	0	0	0	0	0	0	0	0
Fluoride	mg/L	0.02	0.02	0.039	0.024	0.02	0.02	0.026	0.022	0.02	0.02	0.02	0.02	0.02	0.02	0.024	0.024	0.02	0.02
Free Cyanide	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron	mg/L	0.073	0.084	0.22	0.1	0.019	0.02	0.11	0.055	0.016	0.016	0.016	0.016	0.025	0.025	0.081	0.082	0.065	0.065
Lead	mg/L	0.000052	0.000052	0.0024	0.00088	0.00005	0.00005	0.0015	0.00055	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00061	0.00029	0.000052	0.000052
Lithium	mg/L	0.005	0.0048	0.11	0.041	0.005	0.005	0.17	0.066	0.005	0.005	0.005	0.005	0.005	0.005	0.022	0.013	0.005	0.0049
Magnesium	mg/L	1.4	1.4	9.0	2.5	1.3	1.3	16	6.4	1.3	1.3	1.3	1.3	1.3	1.3	2.6	2.6	1.4	1.4
Manganese	mg/L	0.0061	0.0068	0.12	0.036	0.0022	0.0023	0.077	0.03	0.002	0.002	0.002	0.002	0.0027	0.0027	0.065	0.065	0.0055	0.0055
Mercury	mg/L	0.00001	0.00001	0.000012	0.0000098	0.00001	0.00001	0.000011	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	mg/L	0.000071	0.000075	0.0026	0.00074	0.000052	0.000052	0.0014	0.00053	0.000051	0.000051	0.000051	0.000051	0.000054	0.000054	0.00072	0.00072	0.000068	0.000068
Nickel	mg/L	0.0049	0.0052	0.027	0.011	0.0035	0.0035	0.0095	0.0059	0.0034	0.0034	0.0034	0.0034	0.0036	0.0036	0.011	0.011	0.0047	0.0047
Nitrate	mg-N/L	0.0087	0.0063	1.8	1.4	0.0071	0.0065	1.4	0.95	0.0071	0.0065	0.0065	0.0065	0.0073	0.0065	0.31	0.31	0.012	0.0066
Nitrite	mg-N/L	0.0011	0.00097	0.029	0.045	0.001	0.0010	0.0067	0.003	0.001	0.0010	0.0010	0.0010	0.001	0.0010	0.076	0.076	0.0013	0.00099
Orthophosphate	mg-P/L	0.00099	0.00097	0.015	0.0036	0.0010	0.0010	0.006	0.0028	0.0010	0.0010	0.0010	0.0010	0.00099	0.00099	0.00086	0.00086	0.00099	0.00099
Phosphate	mg-P/L	0	0	0.015	0.0027	0	0	0.0073	0.0025	0	0	0	0	0	0	0	0	0	0
Phosphorus	mg/L	0.0021	0.0022	0.0061	0.0095	0.0019	0.0019	0.0094	0.017	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.032	0.032	0.0021	0.0021
Potassium	mg/L	0.34	0.34	25	10	0.34	0.34	17	6.4	0.34	0.34	0.34	0.34	0.34	0.34	14	7.4	0.34	0.34
Selenium	mg/L	0.00011	0.00011	0.0005	0.00022	0.0001	0.0001	0.00029	0.00017	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00035	0.00035	0.00011	0.00011
Silicon	mg/L	0.42	0.45	11	3.3	0.29	0.29	3.5	1.5	0.28	0.28	0.28	0.28	0.31	0.31	5.5	5.0	0.4	0.4
Silver	mg/L	0.00001	0.00001	0.000036	0.000015	0.00001	0.00001	0.00003	0.000017	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000014	0.000014	0.00001	0.00001
Sodium	mg/L	0.66	0.65	121	32	0.66	0.66	155	54	0.66	0.66	0.66	0.66	0.66	0.66	0.81	3.6	0.66	0.65
Strontium	mg/L	0.0094	0.0091	1.4	0.23	0.0094	0.0094	4.7	1.7	0.0094	0.0094	0.0094	0.0094	0.0094	0.0094	0.089	0.049	0.0094	0.0093
Sulphate	mg/L	5.0	5.1	276	104	4.2	4.2	195	74	4.1	4.1	4.1	4.1	4.3	4.3	32	32	4.9	4.9
TDS	mg/L	23	22	224	31	23	23	464	330	23	23	23	23	23	23	20	20	23	23
Tellurium	mg/L	0.002	0.0019	0.0026	0.0019	0.002	0.002	0.0021	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Thallium	mg/L	0.00005	0.000048	0.00011	0.000065	0.00005	0.00005	0.00013	0.000079	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000086	0.000064	0.00005	0.000049
Thiocyanate	mg/L	0	0	0.3	0.0021	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thorium	mg/L	0	0	0.000081	0.000031	0	0	0.000045	0.000017	0	0	0	0	0	0	0.000035	0.000035	0	0
Tin	mg/L	0.000099	0.000097	0.0021	0.00086	0.00010	0.00010	0.0012	0.00049	0.00010	0.00010	0.00010	0.00010	0.000099	0.000099	0.0015	0.00077	0.000099	0.000099
Titanium	mg/L	0.011	0.011	0.017	0.012	0.01	0.01	0.014	0.012	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.013	0.011	0.011
TOC	mg/L	4.0	3.9	3.8	3.6	4.0	4.0	3.9	3.9	4.0	4.0	4.0	4.0	4.0	4.0	3.4	3.4	4.0	3.9
Total Cyanide	mg/L	0.0023	0.0022	0.0035	0.0017	0.0023	0.0023	0.0022	0.00047	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.002	0.002	0.0023	0.0023
TSS	mg/L	3.0	2.9	2.9	2.7	3.0	3.0	2.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.6	2.6	3.0	3.0
Uranium	mg/L	0.00001	0.00001	0.0053	0.0023	0.00001	0.00001	0.001	0.00036	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.0074	0.0037	0.00001	0.00001
Vanadium	mg/L	0.000076	0.000081	0.015	0.0061	0.000055	0.000055	0.011	0.0041	0.000054	0.000054	0.000054	0.000054	0.000058	0.000058	0.0071	0.0036	0.000073	0.000073
WAD Cyanide	mg/L	0	0	0.000027	0.0000082	0	0	0.000017	0.0000061	0	0	0	0	0	0	0	0	0	0
Zinc	mg/L	0.0033	0.0034	0.011	0.0047	0.003	0.003	0.0086	0.0051	0.003	0.003	0.003	0.003	0.0031	0.0031	0.0047	0.0047	0.0033	0.0033
Zirconium	mg/L	0.0004	0.00039	0.0014	0.00072	0.0004	0.0004	0.00084	0.00056	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0009	0.0009	0.0004	0.00039

(a) PN09 is not active after the Operations (i.e., at the start of Closure)

TDS = total dissolved solids; TOC = total organic carbon; TSS = total suspended solids; mg/L = milligrams per liter; mg-N/L = milligrams of nitrogen per liter; mg-P/L = milligrams phosphorus per liter; WAD= weak acid dissociable

APPENDIX H

Predicted Maximum Monthly Average Concentrations per Mine Phase at Each Prediction Node for Lower and Upper Bound Concentrations (5th and 95th Percentiles)

Table H-1: Predicted Maximum Monthly Average Concentrations per Mine Phase at Each Prediction Node for Lower Bound Concentrations (5th Percentile)

Constituent	Unit	PN04				PN05				PN06				PN08				PN09(a)	
		Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations
Aluminum	mg/L	0.06	0.069	0.085	0.072	0.015	0.016	0.074	0.024	0.013	0.013	0.013	0.013	0.021	0.021	0.051	0.051	0.053	0.053
Ammonia	mg-N/L	0.0061	0.0048	2.2	0.28	0.0053	0.005	0.68	0.0009	0.0053	0.005	0.005	0.005	0.005	0.005	0.0043	0.0043	0.0079	0.005
Antimony	mg/L	0.000077	0.000082	0.00053	0.0003	0.000052	0.000053	0.00029	0.00015	0.000051	0.000051	0.000051	0.000051	0.000055	0.000055	0.00038	0.00038	0.000073	0.000073
Arsenic	mg/L	0.0014	0.0016	0.0062	0.014	0.0003	0.00031	0.0018	0.00095	0.00024	0.00023	0.00024	0.00024	0.00043	0.00043	0.028	0.028	0.0012	0.0012
Barium	mg/L	0.0052	0.0052	0.018	0.0071	0.0051	0.0051	0.069	0.029	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0059	0.0059	0.0052	0.0052
Beryllium	mg/L	0.0002	0.00019	0.00023	0.0002	0.0002	0.0002	0.00024	0.00021	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00018	0.00017	0.0002	0.0002
Bismuth	mg/L	0.00049	0.00048	0.0022	0.0012	0.0005	0.0005	0.0021	0.0011	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00049	0.00049	0.0005	0.00049
Boron	mg/L	0.0049	0.0048	0.24	0.13	0.005	0.005	0.17	0.07	0.005	0.005	0.005	0.005	0.005	0.005	0.28	0.14	0.005	0.0049
Cadmium	mg/L	0.0000099	0.0000097	0.000027	0.000017	0.000010	0.000010	0.000026	0.000016	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000021	0.000021	0.0000099	0.0000099
Calcium	mg/L	2.5	2.6	43	10	2.2	2.2	174	67	2.2	2.2	2.2	2.2	2.2	2.2	8.7	8.7	2.5	2.5
Chloride	mg/L	0.99	0.97	50	11	1.0	1.0	111	153	1.0	1.0	1.0	1.0	0.99	0.99	2.9	2.9	0.99	0.99
Chromium	mg/L	0.00023	0.00025	0.00057	0.0004	0.00016	0.00016	0.00027	0.0002	0.00015	0.00015	0.00015	0.00015	0.00017	0.00017	0.00081	0.00047	0.00022	0.00022
Cobalt	mg/L	0.00062	0.00072	0.0037	0.0021	0.00016	0.00017	0.0015	0.00073	0.00014	0.00014	0.00014	0.00014	0.00022	0.00022	0.0026	0.0026	0.00055	0.00055
Copper	mg/L	0.0014	0.0015	0.0026	0.0021	0.0014	0.0014	0.0016	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0027	0.0027	0.0014	0.0014
Cyanate	mg/L	0	0	0.6	0.0038	0	0	0.0000093	0.00001	0	0	0	0	0	0	0	0	0	0
Fluoride	mg/L	0.02	0.02	0.024	0.022	0.02	0.02	0.023	0.021	0.02	0.02	0.02	0.02	0.02	0.02	0.024	0.024	0.02	0.02
Free Cyanide	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron	mg/L	0.073	0.084	0.17	0.098	0.019	0.02	0.091	0.05	0.016	0.016	0.016	0.016	0.025	0.025	0.081	0.082	0.065	0.065
Lead	mg/L	0.000052	0.000052	0.0016	0.00066	0.00005	0.00005	0.00093	0.00039	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00061	0.00029	0.000052	0.000052
Lithium	mg/L	0.0049	0.0048	0.064	0.029	0.005	0.005	0.12	0.047	0.005	0.005	0.005	0.005	0.005	0.005	0.022	0.013	0.005	0.0049
Magnesium	mg/L	1.4	1.4	4.7	2.1	1.3	1.3	12	5.4	1.3	1.3	1.3	1.3	1.3	1.3	2.6	2.6	1.4	1.4
Manganese	mg/L	0.0061	0.0068	0.055	0.029	0.0022	0.0023	0.055	0.022	0.002	0.002	0.002	0.002	0.0027	0.0027	0.065	0.065	0.0055	0.0055
Mercury	mg/L	0.00001	0.00001	0.000010	0.0000095	0.00001	0.00001	0.00001	0.00001	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.0000057	0.0000057	0.000005	0.000005
Molybdenum	mg/L	0.000071	0.000075	0.0013	0.00057	0.000052	0.000052	0.0010	0.0004	0.000051	0.000051	0.000051	0.000051	0.000054	0.000054	0.00072	0.00072	0.000068	0.000068
Nickel	mg/L	0.0049	0.0052	0.013	0.0089	0.0035	0.0035	0.0065	0.0048	0.0034	0.0034	0.0034	0.0034	0.0036	0.0036	0.011	0.011	0.0047	0.0047
Nitrate	mg-N/L	0.0085	0.0063	1.5	1.1	0.0071	0.0065	1.3	0.74	0.007	0.0065	0.0065	0.0065	0.0072	0.0065	0.31	0.31	0.011	0.0065
Nitrite	mg-N/L	0.0011	0.00097	0.028	0.04	0.001	0.0010	0.0053	0.0026	0.001	0.0010	0.0010	0.0010	0.001	0.00099	0.076	0.076	0.0012	0.00099
Orthophosphate	mg-P/L	0.00099	0.00097	0.013	0.003	0.0010	0.0010	0.0047	0.0024	0.0010	0.0010	0.0010	0.0010	0.00099	0.00099	0.00086	0.00086	0.00099	0.00099
Phosphate	mg-P/L	0	0	0.012	0.0022	0	0	0.0054	0.002	0	0	0	0	0	0	0	0	0	0
Phosphorus	mg/L	0.0021	0.0022	0.006	0.009	0.0019	0.0019	0.0094	0.015	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.032	0.032	0.0021	0.0021
Potassium	mg/L	0.34	0.34	14	8.1	0.34	0.34	11	4.5	0.34	0.34	0.34	0.34	0.34	0.34	14	7.4	0.34	0.34
Selenium	mg/L	0.00011	0.00011	0.00035	0.00021	0.0001	0.0001	0.00025	0.00016	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00035	0.00035	0.00011	0.00011
Silicon	mg/L	0.42	0.45	4.8	2.5	0.29	0.29	2.0	0.99	0.28	0.28	0.28	0.28	0.31	0.31	5.5	5.0	0.4	0.4
Silver	mg/L	0.00001	0.00001	0.000023	0.000014	0.00001	0.00001	0.000025	0.000015	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000014	0.000014	0.00001	0.00001
Sodium	mg/L	0.66	0.65	93	26	0.66	0.66	115	43	0.66	0.66	0.66	0.66	0.66	0.66	0.81	3.6	0.66	0.65
Strontium	mg/L	0.0093	0.0091	0.74	0.18	0.0094	0.0094	3.6	1.3	0.0094	0.0094	0.0094	0.0094	0.0094	0.0094	0.089	0.049	0.0094	0.0093
Sulphate	mg/L	5.0	5.1	200	80	4.2	4.2	122	49	4.1	4.1	4.1	4.1	4.3	4.3	32	32	4.9	4.9
TDS	mg/L	23	22	131	28	23	23	464	276	23	23	23	23	23	23	20	20	23	23
Tellurium	mg/L	0.002	0.0019	0.0019	0.0018	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Thallium	mg/L	0.000049	0.000048	0.000074	0.000059	0.00005	0.00005	0.00011	0.000071	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000086	0.000064	0.00005	0.000049
Thiocyanate	mg/L	0	0	0.18	0.00093	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thorium	mg/L	0	0	0.000045	0.000023	0	0	0.000024	0.0000092	0	0	0	0	0	0	0.000035	0.000035	0	0
Tin	mg/L	0.000099	0.000097	0.0012	0.00067	0.00010	0.00010	0.00071	0.00033	0.00010	0.00010	0.00010	0.00010	0.000099	0.000099	0.0015	0.00077	0.000099	0.000099
Titanium	mg/L	0.011	0.011	0.012	0.011	0.01	0.01	0.012	0.011	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.013	0.011	0.011
TOC	mg/L	4.0	3.9	3.5	3.5	4.0	4.0	3.9	3.9	4.0	4.0	4.0	4.0	4.0	4.0	3.4	3.4	4.0	3.9
Total Cyanide	mg/L	0.0023	0.0022	0.0027	0.0016	0.0023	0.0023	0.0022	0.00041	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.002	0.002	0.0023	0.0023
TSS	mg/L	3.0	2.9	2.6	2.6	3.0	3.0	2.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.6	2.6	3.0	3.0
Uranium	mg/L	0.00001	0.00001	0.0034	0.002	0.00001	0.00001	0.00077	0.0003	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.0074	0.0037	0.00001	0.00001
Vanadium	mg/L	0.000076	0.000081	0.0081	0.0044	0.000055	0.000055	0.0047	0.0019	0.000054	0.000054	0.000054	0.000054	0.000058	0.000058	0.007	0.0036	0.000073	0.000073
WAD Cyanide	mg/L	0	0	0.000023	0.0000067	0	0	0.000013	0.0000047	0	0	0	0	0	0	0	0	0	0
Zinc	mg/L	0.0033	0.0034	0.0059	0.0042	0.003	0.003	0.0071	0.0045	0.003	0.003	0.003	0.003	0.0031	0.0031	0.0047	0.0047	0.0033	0.0033
Zirconium	mg/L	0.0004	0.00039	0.00083	0.00062	0.0004	0.0004	0.00061	0.00047	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0009	0.0009	0.0004	0.00039

(a) PN09 is not active after the Operations (i.e., at the start of Closure)
TDS = total dissolved solids; TOC = total organic carbon; TSS = total suspended solids; mg/L = milligrams per liter; mg-N/L = milligrams of nitrogen per liter; mg-P/L = milligrams phosphorus per liter; WAD= weak acid dissociable

Table H-2: Predicted Maximum Monthly Average Concentrations per Mine Phase at Each Prediction Node for Upper Bound Concentrations (95th Percentile)

Constituent	Unit	PN04				PN05				PN06				PN08				PN09(a)	
		Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations	Closure	Post-Closure	Construction	Operations
Aluminum	mg/L	0.06	0.069	0.086	0.079	0.015	0.016	0.074	0.027	0.013	0.013	0.013	0.013	0.021	0.021	0.051	0.051	0.053	0.053
Ammonia	mg-N/L	0.0064	0.0049	2.7	0.46	0.0054	0.005	1.5	0.0011	0.0054	0.005	0.005	0.005	0.005	0.005	0.0043	0.0043	0.0085	0.0052
Antimony	mg/L	0.000077	0.000082	0.0022	0.00047	0.000052	0.000053	0.00061	0.00026	0.000051	0.000051	0.000051	0.000051	0.000055	0.000055	0.00038	0.00038	0.000073	0.000073
Arsenic	mg/L	0.0014	0.0016	0.0063	0.016	0.0003	0.00031	0.0026	0.0013	0.00024	0.00023	0.00024	0.00024	0.00043	0.00043	0.028	0.028	0.0012	0.0012
Barium	mg/L	0.0052	0.0052	0.075	0.0092	0.0051	0.0051	0.1	0.044	0.0051	0.0051	0.0051	0.0051	0.0051	0.0051	0.0059	0.0059	0.0052	0.0052
Beryllium	mg/L	0.0002	0.00019	0.00047	0.00024	0.0002	0.0002	0.00032	0.00024	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.00018	0.00017	0.0002	0.0002
Bismuth	mg/L	0.0005	0.00048	0.0091	0.0025	0.0005	0.0005	0.0069	0.0028	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00049	0.00049	0.0005	0.00049
Boron	mg/L	0.005	0.0048	0.74	0.21	0.005	0.005	0.39	0.15	0.005	0.005	0.005	0.005	0.005	0.005	0.28	0.14	0.005	0.0049
Cadmium	mg/L	0.0000099	0.0000097	0.000097	0.000024	0.000010	0.000010	0.00004	0.000021	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000021	0.000021	0.0000099	0.0000099
Calcium	mg/L	2.5	2.6	190	16	2.2	2.2	261	107	2.2	2.2	2.2	2.2	2.2	2.2	8.7	8.7	2.5	2.5
Chloride	mg/L	0.99	0.97	55	17	1.0	1.0	111	246	1.0	1.0	1.0	1.0	0.99	0.99	2.9	2.9	0.99	0.99
Chromium	mg/L	0.00023	0.00025	0.0006	0.00046	0.00016	0.00016	0.00032	0.00023	0.00015	0.00015	0.00015	0.00015	0.00017	0.00017	0.00081	0.00047	0.00022	0.00022
Cobalt	mg/L	0.00062	0.00072	0.015	0.0033	0.00016	0.00017	0.0037	0.0015	0.00014	0.00014	0.00014	0.00014	0.00022	0.00022	0.0026	0.0026	0.00055	0.00055
Copper	mg/L	0.0014	0.0015	0.0028	0.0024	0.0014	0.0014	0.0017	0.0015	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0027	0.0027	0.0014	0.0014
Cyanate	mg/L	0	0	1.2	0.021	0	0	0.18	0.000017	0	0	0	0	0	0	0	0	0	0
Fluoride	mg/L	0.02	0.02	0.065	0.026	0.02	0.02	0.03	0.024	0.02	0.02	0.02	0.02	0.02	0.02	0.024	0.024	0.02	0.02
Free Cyanide	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron	mg/L	0.073	0.084	0.23	0.11	0.019	0.02	0.12	0.065	0.016	0.016	0.016	0.016	0.025	0.025	0.081	0.082	0.065	0.065
Lead	mg/L	0.000052	0.000052	0.0037	0.0011	0.00005	0.00005	0.0019	0.00076	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00061	0.00029	0.000052	0.000052
Lithium	mg/L	0.005	0.0048	0.24	0.056	0.005	0.005	0.23	0.092	0.005	0.005	0.005	0.005	0.005	0.005	0.022	0.013	0.005	0.0049
Magnesium	mg/L	1.4	1.4	16	3.0	1.3	1.3	18	8.0	1.3	1.3	1.3	1.3	1.3	1.3	2.6	2.6	1.4	1.4
Manganese	mg/L	0.0061	0.0068	0.2	0.046	0.0022	0.0023	0.098	0.039	0.002	0.002	0.002	0.002	0.0027	0.0027	0.065	0.065	0.0055	0.0055
Mercury	mg/L	0.00001	0.00001	0.000017	0.00001	0.00001	0.00001	0.000011	0.00001	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.0000057	0.0000057	0.000005	0.000005
Molybdenum	mg/L	0.000071	0.000075	0.0046	0.00093	0.000052	0.000052	0.0018	0.0007	0.000051	0.000051	0.000051	0.000051	0.000054	0.000054	0.00072	0.00072	0.000068	0.000068
Nickel	mg/L	0.0049	0.0052	0.05	0.013	0.0035	0.0035	0.014	0.0072	0.0034	0.0034	0.0034	0.0034	0.0036	0.0036	0.011	0.011	0.0047	0.0047
Nitrate	mg-N/L	0.009	0.0064	2.3	1.6	0.0072	0.0065	1.6	1.2	0.0071	0.0065	0.0065	0.0065	0.0074	0.0065	0.31	0.31	0.012	0.0069
Nitrite	mg-N/L	0.0011	0.00097	0.029	0.053	0.001	0.0010	0.0075	0.0036	0.001	0.0010	0.0010	0.0010	0.001	0.0010	0.076	0.076	0.0013	0.001
Orthophosphate	mg-P/L	0.00099	0.00097	0.018	0.0044	0.0010	0.0010	0.0069	0.0033	0.0010	0.0010	0.0010	0.0010	0.00099	0.00099	0.00086	0.00086	0.00099	0.00099
Phosphate	mg-P/L	0	0	0.018	0.0036	0	0	0.0084	0.0033	0	0	0	0	0	0	0	0	0	0
Phosphorus	mg/L	0.0021	0.0022	0.0062	0.01	0.0019	0.0019	0.0094	0.023	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.032	0.032	0.0021	0.0021
Potassium	mg/L	0.34	0.34	42	13	0.34	0.34	24	9.0	0.34	0.34	0.34	0.34	0.34	0.34	14	7.4	0.34	0.34
Selenium	mg/L	0.00011	0.00011	0.00051	0.00025	0.0001	0.0001	0.00032	0.00019	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.00035	0.00035	0.00011	0.00011
Silicon	mg/L	0.42	0.45	20	4.3	0.29	0.29	5.5	2.2	0.28	0.28	0.28	0.28	0.31	0.31	5.5	5.0	0.4	0.4
Silver	mg/L	0.00001	0.00001	0.000057	0.000018	0.00001	0.00001	0.000034	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000014	0.000014	0.00001	0.00001
Sodium	mg/L	0.66	0.65	171	39	0.66	0.66	178	72	0.66	0.66	0.66	0.66	0.66	0.66	0.81	3.6	0.66	0.65
Strontium	mg/L	0.0094	0.0091	3.6	0.3	0.0094	0.0094	5.4	2.2	0.0094	0.0094	0.0094	0.0094	0.0094	0.0094	0.089	0.049	0.0094	0.0093
Sulphate	mg/L	5.0	5.1	401	132	4.2	4.2	268	102	4.1	4.1	4.1	4.1	4.3	4.3	32	32	4.9	4.9
TDS	mg/L	23	22	235	36	23	23	464	430	23	23	23	23	23	23	20	20	23	23
Tellurium	mg/L	0.002	0.0019	0.004	0.002	0.002	0.002	0.0023	0.0021	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Thallium	mg/L	0.00005	0.000048	0.00017	0.000071	0.00005	0.00005	0.00015	0.000088	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.000086	0.000064	0.00005	0.000049
Thiocyanate	mg/L	0	0	0.56	0.0059	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thorium	mg/L	0	0	0.00013	0.000039	0	0	0.00007	0.000025	0	0	0	0	0	0	0.000035	0.000035	0	0
Tin	mg/L	0.000099	0.000097	0.0037	0.0011	0.00010	0.00010	0.0017	0.00069	0.00010	0.00010	0.00010	0.00010	0.000099	0.000099	0.0015	0.00077	0.000099	0.000099
Titanium	mg/L	0.011	0.011	0.024	0.013	0.01	0.01	0.016	0.012	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.013	0.011	0.011
TOC	mg/L	4.0	3.9	4.9	3.8	4.0	4.0	3.9	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.4	3.4	4.0	3.9
Total Cyanide	mg/L	0.0023	0.0022	0.0051	0.0022	0.0023	0.0023	0.0022	0.00053	0.0023	0.0023	0.0023	0.0023	0.0023	0.0023	0.002	0.002	0.0023	0.0023
TSS	mg/L	3.0	2.9	3.7	2.9	3.0	3.0	2.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.6	2.6	3.0	3.0
Uranium	mg/L	0.00001	0.00001	0.0068	0.0028	0.00001	0.00001	0.0011	0.00047	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.0074	0.0037	0.00001	0.00001
Vanadium	mg/L	0.000076	0.000081	0.03	0.0084	0.000055	0.000055	0.018	0.0065	0.000054	0.000054	0.000054	0.000054	0.000058	0.000058	0.007	0.0036	0.000073	0.000073
WAD Cyanide	mg/L	0	0	0.000031	0.00001	0	0	0.000021	0.0000081	0	0	0	0	0	0	0	0	0	0
Zinc	mg/L	0.0033	0.0034	0.018	0.0053	0.003	0.003	0.01	0.0057	0.003	0.003	0.003	0.003	0.0031	0.0031	0.0047	0.0047	0.0033	0.0033
Zirconium	mg/L	0.0004	0.00039	0.0022	0.00083	0.0004	0.0004	0.0011	0.00066	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0009	0.0009	0.0004	0.00039

(a) PN09 is not active after the Operations (i.e., at the start of Closure)
TDS = total dissolved solids; TOC = total organic carbon; TSS = total suspended solids; mg/L = milligrams per liter; mg-N/L = milligrams of nitrogen per liter; mg-P/L = milligrams phosphorus per liter; WAD= weak acid dissociable

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