

5. Water Balance Model Results



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5. Water Balance Model Results

The water balance model predictions for key nodes and all mine phases are presented in this section. Results are provided for collection ponds, open mine pits, water treatment plant discharge volumes, and Active Closure pit lake flooding and water management.

5.1 Operations Phase

5.1.1 Collection Ponds

This section summarizes the water balance model results for the surface contact water collection ponds (Whale Tail WRSF Collection Pond, Whale Tail Attenuation Pond, IVR Attenuation Pond), and the underground mine contact water ponds (GSP-1 and IVR Pit).

5.1.1.1 Whale Tail Waste Rock Storage Facility Collection Pond

The Whale Tail WRSF Collection Pond is predicted to remain below the maximum operating level (154 m) for the duration of Operations and Active Closure (Figure 5-1). The effective water level fluctuates around elevation 153.5 masl once the Whale Tail WRSF Collection Pond Dike is breached and the pond is reconnected to Kangislulik Lake via gravity drainage. This pattern holds in all three precipitation scenarios considered for the remainder of the Operations phase (10th percentile, average and 90th percentile).

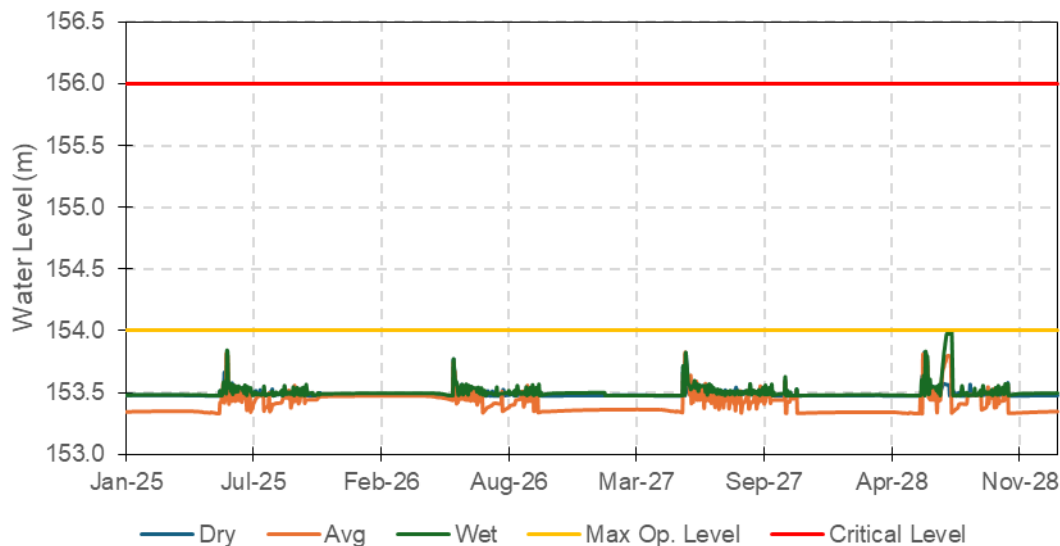


Figure 5-1: Predicted water levels and target operating levels in Whale Tail Waste Rock Storage Facility Collection Pond for the Operations phase under dry-, average and wet-year scenarios. Maximum operating level shown by orange line, and critical level shown by red line.

Early in mine Operations (2020) the contact water from the Whale Tail WRSF Collection Pond was pumped to the Whale Tail Attenuation Pond. A limited volume of the Whale Tail WRSF Collection Pond was pumped to the Whale Tail Attenuation Pond in 2021, with the majority routed to the IVR Attenuation Pond. From 2022 onwards, all Whale Tail WRSF Collection Pond contact water is routed to the IVR Attenuation Pond.

5.1.1.2 *Whale Tail Attenuation Pond*

The Whale Tail Attenuation Pond began operation in freshet of 2019 and operated as the primary Attenuation Pond until 2021. Due to this pond's location downgradient of the Whale Tail Dike and upgradient of Whale Tail Pit, it receives significant seepage volumes from the Whale Tail South Basin and is a source of groundwater seepage into Whale Tail Pit (see Section 2.2.1.1 for details). As such, to limit the overall volumes of diluted contact water that must be managed, the majority of site contact water that is actively managed (*i.e.*, pumped) was routed to the IVR Attenuation Pond in 2021, with all contact water sources except WT Pit pumped to the IVR Attenuation Pond thereafter. Thus, the water balance inputs to the Whale Tail Attenuation Pond from 2023 onwards consist of incident meteoric precipitation, WT Pit sump water, gravity drainage from the surrounding catchments, minimal pumped volumes from the WT WRSF Pond and ongoing seepage through the Whale Tail Dike. Over the Operations phase, seepage through the Whale Tail Dike is predicted to account for 50% of the inputs to the Whale Tail Attenuation Pond, and 42% are sourced from the WT Pit sump (Table 5-1 and Figure 5-3). The proportion of total pond inflows contributed by Whale Tail Dike Seepage increases to 53% under the dry-year scenario and reduces to 49% under the wet-year scenario.

The water levels in the Whale Tail Attenuation Pond are predicted to remain within the operational criteria for the duration of Operations (Figure 5-2) and begin to rise in July 2028 once Operational water management activities have ceased. This pattern holds in all three precipitation scenarios considered for the remainder of the Operations phase (10th percentile, average and 90th percentile).

Table 5-1:
Annual Inflows to the Whale Tail Attenuation Pond during the Operations phase
under the average year precipitation scenario.

Pumped From:	WT_WRCP	WT Pit	IVR Pit	Meteoric Inputs ¹	Gravity Drainage ²	WT Dike Seepage	Minor Sumps ³
Year	m ³						
2025	0	1,349,925	0	67,738	117,999	1,302,952	0
2026	0	1,226,317	0	73,521	129,676	1,303,626	0
2027	0	1,127,579	0	70,935	139,771	1,304,168	0
2028	0	579,703	0	66,389	127,937	1,066,041	0
Average	0	1,070,881	0	69,646	128,846	1,244,197	0

¹ Meteoric inputs include rainfall and snowmelt on the pond surface, and surrounding bank runoff

² Gravity drainage from surrounding catchments, including Camp, Warehouse Pad, Ore Stockpile #1 and #2, NPAG Stockpile and SANA Crusher Pad

³ Minor sumps are A47, A49, A53, Road 7, Mammoth DS, and Quarry 1

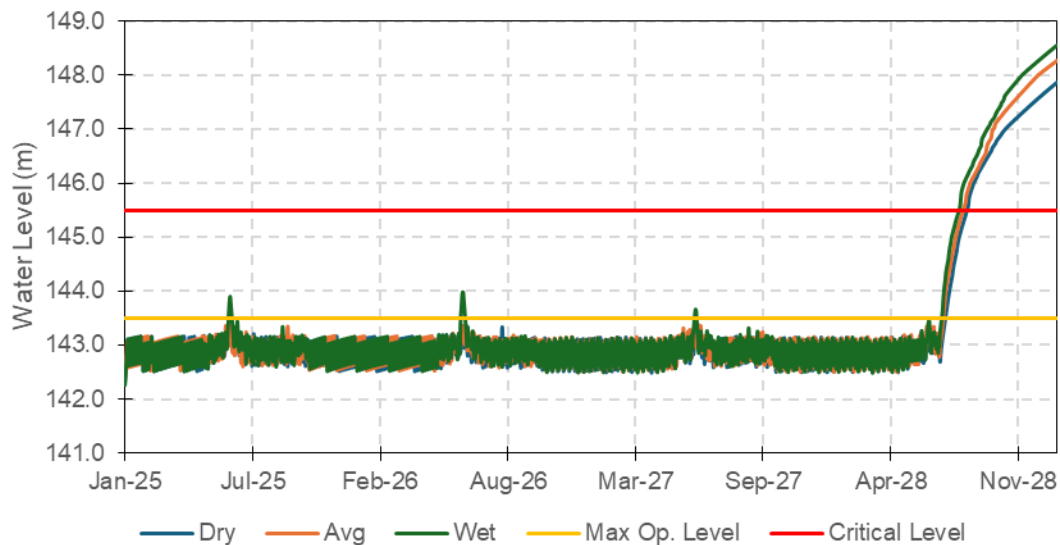


Figure 5-2: Predicted water levels and target operating levels in the Whale Tail Attenuation Pond for the Operations phase under dry-, average and wet-year scenarios. Maximum operating level shown by orange line, and critical level shown by red line.

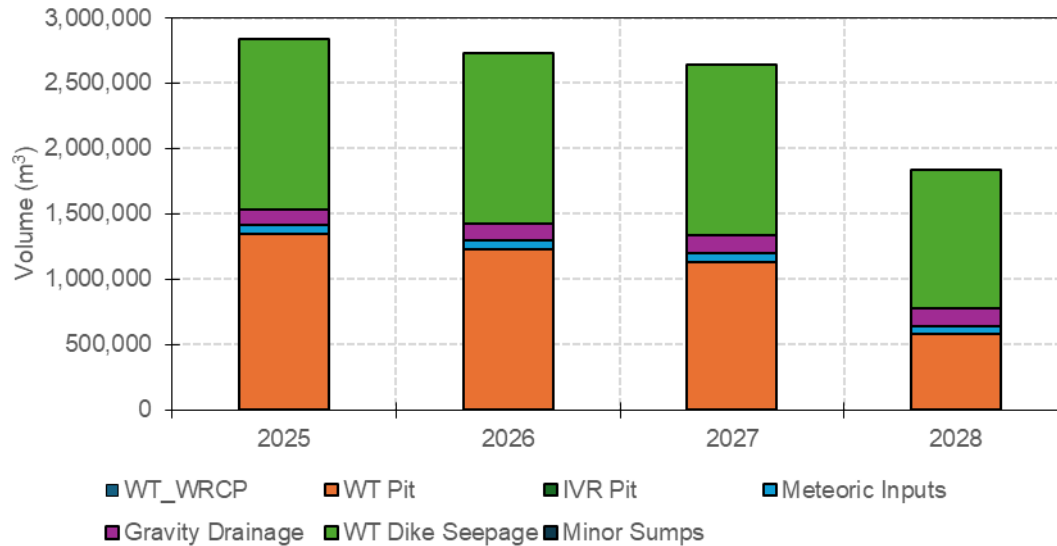


Figure 5-3: Annual inflow volumes to the Whale Tail Attenuation Pond during the Operations phase for the average year precipitation scenario.

5.1.1.3 IVR Attenuation Pond

The IVR Attenuation Pond began operating for freshet of 2021 and is currently the primary contact water Attenuation Pond at the Whale Tail Mine. It receives gravity drainage from the IVR WRSF, and pumped flows from the Whale Tail WRSF Collection Pond, Whale Tail Pit, IVR Pit, minor sumps and the Whale Tail Attenuation Pond. Water levels in the IVR Attenuation Pond are predicted to remain below the maximum operating water level in all remaining years of Operations (Figure 5-4). This pattern holds in all three precipitation scenarios considered for the remainder of the Operations phase (10th percentile, average and 90th percentile).

For the remaining years of Operations, the various mine contact water management sumps and the Whale Tail Attenuation Pond are the primary inputs to the IVR Attenuation Pond, comprising 18% and 66% of the total inflows, respectively (Table 5-2 and Figure 5-5).

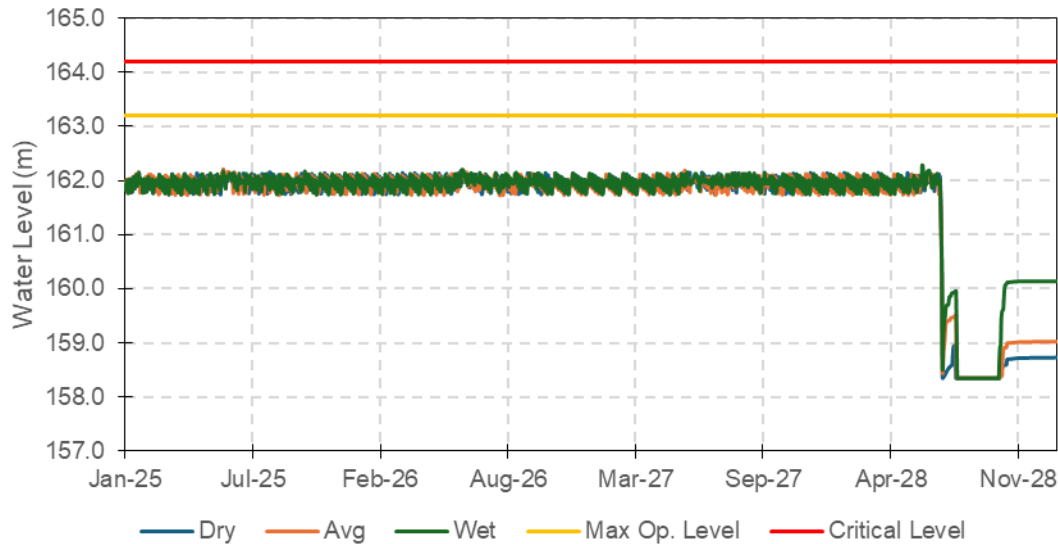


Figure 5-4: Predicted water levels and target operating levels in the IVR Attenuation Pond for the Operations phase under dry-, average and wet-year scenarios. Maximum operating level shown by orange line, and critical level shown by red line.

**Table 5-2:
 Annual Inflows to the IVR Attenuation Pond during the Operations Phase under
 the average year precipitation scenario.**

Pumped From:	WT_WRCP	IVR WRSF	WT Attenuation Pond	WT Pit	IVR Pit	STP	Meteoric Inputs ¹	Gravity Drainage ¹	Minor Sumps ²
Year	m ³								
2025	138,000	17,909	2,193,408	14,593	165,228	47,450	133,979	29,983	577,536
2026	154,560	13,518	2,101,248	16,170	46,460	47,450	147,133	31,376	577,536
2027	215,280	48,474	2,009,088	16,170	46,185	47,450	140,739	35,048	577,536
2028	99,360	29,749	1,032,192	9,867	28,647	25,124	138,337	29,119	287,977
Average	151,800	27,413	1,833,984	14,200	71,630	41,869	140,047	31,382	505,147

Notes:

¹ Meteoric inputs include rainfall and snowmelt on the pond surface, and surrounding bank runoff

² Gravity drainage from surrounding catchments, including Ore Stockpile #3 and Pad K extension

³ Minor sumps are A47, A49, Road 7, and Mammoth DS

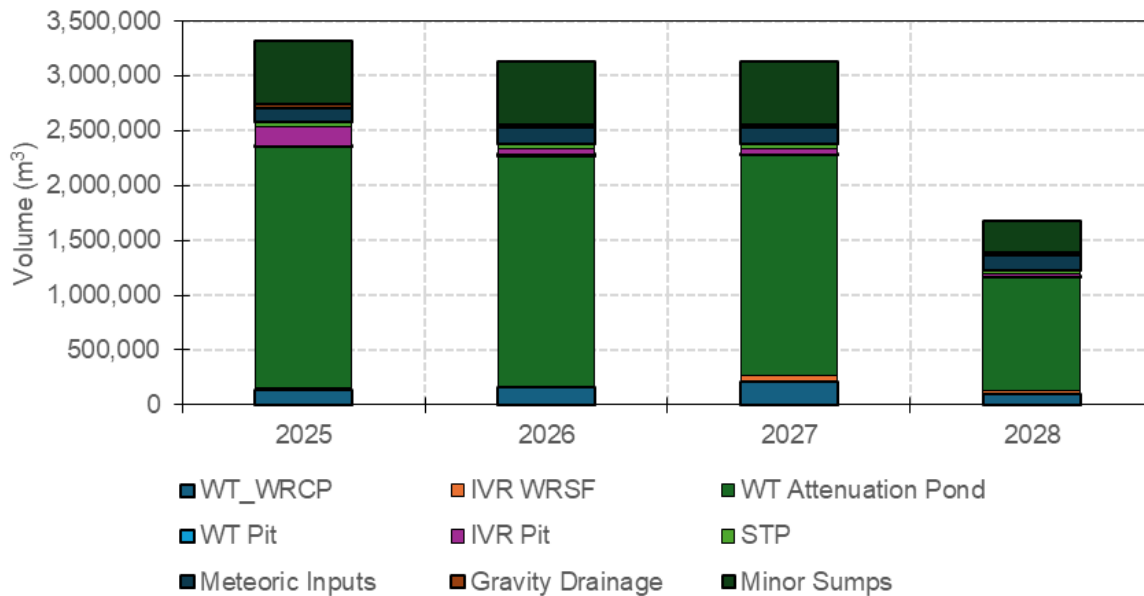


Figure 5-5: Annual inflow volumes to the IVR Attenuation Pond during the Operations phase under the average year precipitation scenario.

5.1.1.4 GSP-1 and IVR Pit East Lobe

GSP-1 is currently the primary groundwater storage pond at the Whale Tail Mine. The pond currently operates as a closed loop system with all collected water (including incident precipitation and snowmelt) directed back underground for use as drilling brine. A positive water balance is not predicted to occur for this pond until mid-June 2026, when groundwater inflows to the underground mine are predicted to significantly increase. This pattern holds in all three precipitation scenarios considered for the remainder of the Operations phase (10th percentile, average and 90th percentile). Following this, the additional water collected in this pond will be pumped to the IVR Pit East Lobe (see Section 3.6.5) for storage to maintain GSP-1 well below the maximum operating water level. A total of 96,757 m³ (average year) and 125,581 m³ beginning in October 2025 (wet-year) is predicted to be pumped from GSP-1 to the East Lobe of the IVR Pit over the remainder of the Operations phase (Table 5-3).

The IVR Pit is located entirely within permafrost and has a limited upgradient catchment beginning in June 2026 leading to a simple water balance. Surface runoff from the surrounding catchment areas dominated the pit water balance earlier in Operations, switching to pit wall runoff dominating as the open pit comprises more of the total pit catchment.

**Table 5-3:
 Annual Inflows to the IVR Pit during the Operations Phase**

Year	West Lobe Pit Wall Runoff	West Lobe Gravity Drainage ¹	Precipitation on West Lobe Pit Lake	GSP-1 to IVR Pit East Lobe	East Lobe Pit Wall Runoff	East Lobe Gravity Drainage ¹	Precipitation on East Lobe Pit Lake
	m ³						
2024	32,593	4,708	277	0	21,742	3,017	1,048
2025	37,266	6,441	274	0	21,207	4,128	1,618
2026	33,124	4,546	257	22,011	18,525	2,914	2,214
2027	52,954	8,871	431	51,071	26,421	5,686	10,337
2028	39,666	34,483	12,027	22,348	10,710	4,018	5,088
Average	39,121	11,810	2,653	19,086	19,721	3,953	4,061

Notes:

¹ Gravity drainage from all surrounding disturbed and non-contact catchments.

At the end of the Operations phase in June 2028, 115,300 m³ of underground mine water is stored in GSP-1, and 752,643 m³ in the IVR Pit lake, with approximately 89% of this stored water of underground provenance (via groundwater inflows to the underground mine [13%], and inflows through the Whale Tail Pit Crown Pillar [76%]). The East Lobe IVR Pit wall runoff and surrounding catchment runoff contributes 9% of the total (Table 5-3).

Under the dry- and wet-year scenarios, the volume of underground mine water stored in the East Lobe of IVR Pit is 637,671 m³ and 819,499 m³, respectively.

These volumes are pumped into the underground void in July 2028, at the onset of Active Closure. Once this has been completed, GSP-1 will be backfilled with NPAG/NML waste rock, and the remainder of the underground mine will be filled with water pumped from the IVR Attenuation Pond and Whale Tail South Basin.

5.1.2 Whale Tail Pit Water Balance

The Whale Tail Pit annual water balance for the Operations phase is presented in Table 5-4. During Operations, groundwater seepage inflows through the south wall from the Whale Tail South Basin (and the Whale Tail Attenuation Pond, to a lesser degree; Lorax 2024b) dominate the total pit inflows, ranging from approximately 80% to 90%, dropping to approximately 70% of total inflows in 2027 and 2028 (Table 5-4). Passive surface runoff from the surrounding catchments and incident precipitation/snowmelt on the pit walls and floor contribute the remainder of the inflows (Table 5-4). As this seepage inflow dominates the Whale Tail Pit water balance, these proportions show minimal variability between the three precipitation scenarios.

Table 5-4:
Annual Inflows to the Whale Tail Pit during the Operations phase for the average year precipitation scenario.

Year	Pit Wall ¹	Gravity Drainage ²	Precipitation on Pit Lake	Groundwater Inflow	Whale Tail Pit to Crown Pillar	Groundwater Inflow
	m ³					% of Total Flows
2025	101,883	53,975	263	1,208,150	0	89%
2026	112,477	56,959	304	1,204,500	132,085	80%
2027	112,477	60,580	304	1,251,950	281,895	73%
2028	82,782	56,152	1,588	624,260	144,926	69%
Average	102,405	56,916	615	1,072,215	139,726	78%

Notes:

¹ Pit wall runoff and pit lake meteoric inputs are a combination of pit wall runoff and inputs for both the main lobe and Pushback

² Gravity drainage represents all catchments surrounding the pit that drain by gravity to the pit

5.1.3 Water Treatment and Effluent Discharge Volumes

This section summarizes the relative proportion of O-WTP influent derived from the two Attenuation Ponds, and the predicted treated effluent discharges to Kangislulik Lake and Whale Tail South Basin during the remainder of the Operations period, for the three precipitation scenarios considered.

The IVR Attenuation Pond is the source of 96% of total influent to the O-WTP for the remainder of the Operations phase under the average and wet-year scenarios, and 95% of total inflows under the dry-year scenario. More limited inputs from the Whale Tail Attenuation Pond are expected as the IVR Attenuation Pond will be the primary repository for pumped contact water flows, except for the WT Pit sump, which continues to be pumped to the Whale Tail Attenuation Pond (Table 5-5).

The relative proportion of total annual treated effluent discharge is weighted towards the open water season discharges to Kangislulik Lake (52% of the total discharges), with the remaining 48% of treated effluent discharged to the Whale Tail South Basin under the average year precipitation scenario (Table 5-5). Under the dry-year and wet-year scenarios, this split shifts to 53%/47%.

For the Operations period overlapping with the 2018 FEIS (2025 only), the predicted treated effluent discharges to Whale Tail South Basin are approximately 2% higher under the LOM mine plan relative to the 2018 FEIS predictions for all precipitation scenarios (Table 5-6).

Table 5-5:
Annual Effluent Discharge Volumes and Proportions of Total Discharge for the Operations Phase under the average year precipitation scenario.

Year	O-WTP Influent Source (m ³)		Water Treatment Plant Discharge To: (m ³)	
	WT AP to WTP	IVR AP to WTP	To WT S. Basin	To Kangislulik Lake
2025	138,600	3,120,000	1,605,000	1,653,600
2026	131,040	2,964,000	1,472,640	1,622,400
2027	126,000	2,932,800	1,405,200	1,653,600
2028	80,640	1,591,200	860,640	811,200
Total	476,280	10,608,000	5,343,480	5,740,800
% Total	4%	96%	48%	52%

Table 5-6:
Annual Effluent Discharge Volumes for LOM (all scenarios) and 2018 FEIS Predictions (2025).

Year	Current Model		2018 FEIS
	Water Treatment Plant Discharge (m ³) To:		
	Whale Tail South Basin	Kangislulik Lake	Whale Tail South Basin
2025	1,605,000	1,653,600	1,572,541

On an annual basis, the total volumes reporting to the O-WTP vary relatively more for the IVR Attenuation Pond than for the Whale Tail Attenuation Pond (Figure 5-6), which is in turn reflected in the total treated effluent discharged to Whale Tail South Basin and Kangislulik Lake (Figure 5-7).

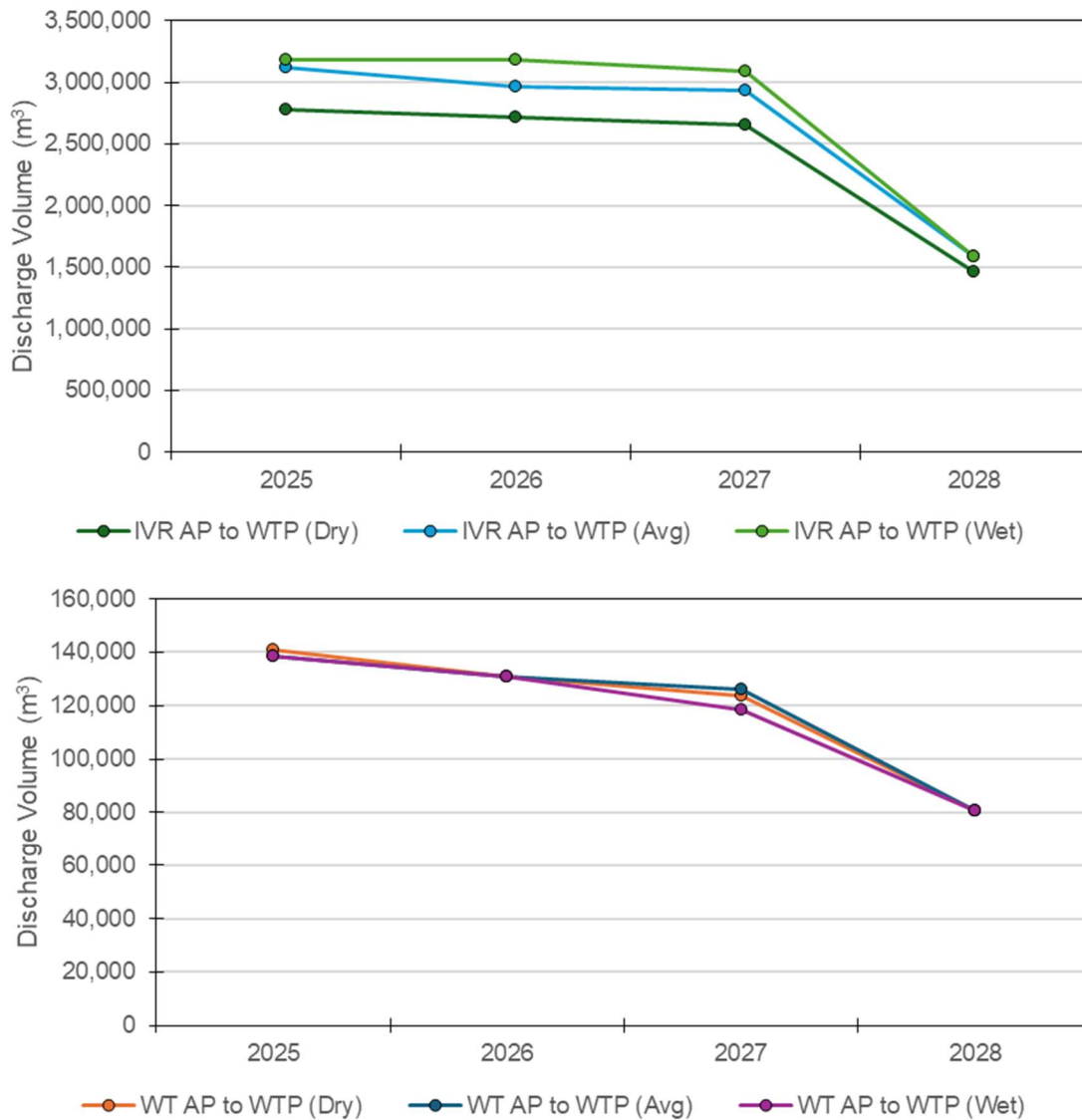


Figure 5-6: Annual inflow volumes to the Operational Water Treatment Plant from the IVR Attenuation Pond (top) and the Whale Tail Attenuation Pond (bottom) for the three precipitation scenarios.

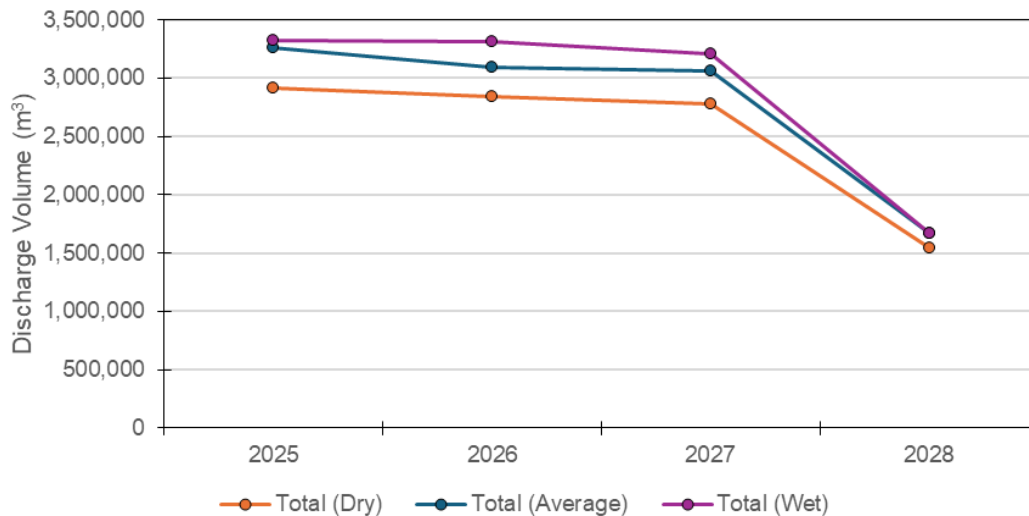


Figure 5-7: Total annual treated effluent discharge volumes for the three precipitation scenarios.

5.2 Active Closure Phase

During the first six years of Active Closure (including Q3 and Q4 2028) while the O-WTP is still active, the IVR Attenuation Pond remains in use as a collection pond for water routed to the O-WTP. During this period, the primary contact water inputs to this pond are the collected pit wall runoff from the Whale Tail and IVR Pits (see Section 3.9), water from the Whale Tail WRSF Collection Pond, treated effluent from the STP, and runoff/interflow from the IVR WRSF.

The underground mine voids (1.67 Mm³) are actively filled in July 2028 by pumping water from GSP-1, IVR Pit, and the IVR Attenuation Pond, with the range of underground and Whale Tail South Basin inputs shown in Table 5-7 for the three precipitation scenarios considered. The open pits are filled from July 2028 to July 2045 first by passive runoff and then by pumping from the Whale Tail South Basin, Whale Tail WRSF Collection Pond, and the O-WTP effluent in the first six years of Active Closure.

**Table 5-7:
Total Volumes Pumped Underground at EOM (July 2028).**

Pumped To:	Underground	
Pumped From:	IVR Pit	WT S. Basin
Climate Scenario	m ³	
Dry Year	996,000	685,200
Average Year	1,080,000	616,680
Wet Year	1,176,000	548,160

The sequence of mine void flooding is as follows, and as summarized in Table 5-9, Figure 5-9, and Table 5-10 for the average year precipitation scenario:

- Underground mine active flooding occurs during July 2028.
 - The primary source of water is groundwater stored in IVR Pit (752,600 m³), water from the Whale Tail S. Basin (616,700 m³), remaining contact water in the IVR Attenuation Pond (207,400 m³), and finally the remaining volume stored in GSP-1 (120,000 m³).
- IVR Pit active flooding begins in July 2028 and is filled to the spill point elevation of 123 masl by October 2030 (Figure 5-8).
 - Water pumped from the Whale Tail South Basin is the primary source (11.7 Mm³), followed by treated effluent discharge from the O-WTP (1.46 Mm³), and lastly by water pumped from the Whale Tail WRSF Collection Pond (369,800 m³). Note that after 2032, the O-WTP discharge directed to the IVR Pit is combined with the other overflow from IVR Pit into the WT Pit. Surrounding catchment runoff (685,000 m³) and pit wall runoff (65,000 m³) contribute to the remainder of pit inflows over this period.
- Whale Tail Pit active flooding begins in June 2031, and is filled to the spill point elevation of 123 masl by July 2039;
 - Water pumped from the Whale Tail South Basin is the primary source (28.3 Mm³), followed by water pumped from the Whale Tail WRSF Collection Pond (1.89 Mm³), and lastly, groundwater inflows to the pit (3.04 Mm³). These groundwater inflows during Active Closure are based on Lorax (2024b) and assume that permafrost develops on the South Wall late in Operations, preventing groundwater ingress. This permafrost is predicted to melt as the pit fills, leading to increasing groundwater inflows until the Whale Tail pit is full to the spill elevation (Figure 5-8). The remainder of the pit inflows are contributed from the surrounding catchment runoff (1.55 Mm³), uncaptured pit wall runoff (383,600 m³), overflow from the IVR Pit Lake (2.85 Mm³) and the Whale Tail Attenuation Pond (3.71 Mm³).
- Once the Whale Tail Pit and IVR Pit lakes join above the 123 m sill elevation, the Whale Tail /IVR Complex is formed. This occurs in August 2039;
 - Water pumped from the Whale Tail South Basin is the primary source (17.5 Mm³), followed by water pumped from the Whale Tail WRSF Collection Pond (1.25 Mm³). Surrounding catchment runoff (1.34 Mm³), uncaptured pit

wall runoff (108,000 m³), and overflow from the IVR Pit Lake (1.18 Mm³) contribute to the remainder of pit inflows.

- Active flooding of the Whale Tail North Basin continues until July 2045 when the final water level of 153.5 masl is reached (Figure 5-9).
 - Water pumped from the Whale Tail South Basin is the primary source (2.92 Mm³), followed by water pumped from the Whale Tail WRSF Collection Pond (226,000 m³). Surrounding catchment runoff (1.24 Mm³), uncaptured pit wall runoff (25,000 m³), and overflow from the IVR Pit (416,000 m³) contribute the remainder of pit inflows.

The water level will drop in Whale Tail South Basin as a result of pumping during Active Closure (Figure 5-9). This will result in the Lake A18 complex becoming disconnected from Whale Tail South basin in September 2028 when water levels are predicted to drop below 154 masl. This will allow Lake A18 Sill to be built in early 2029 and commissioned for freshet 2029. The fully flooded Post-Closure mine pits are depicted in Figure 3-31.

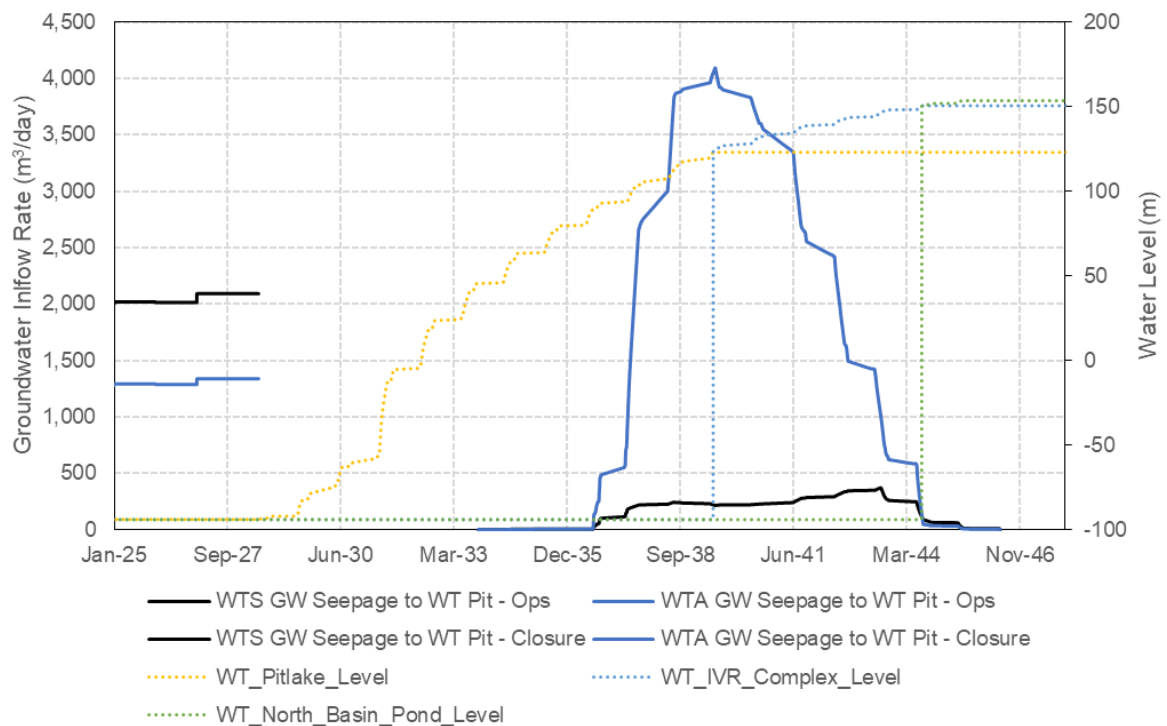


Figure 5-8: Seepage from Whale Tail Attenuation Pond and Whale Tail South Basin into Whale Tail Pit, as a function of Whale Tail Pit water level.

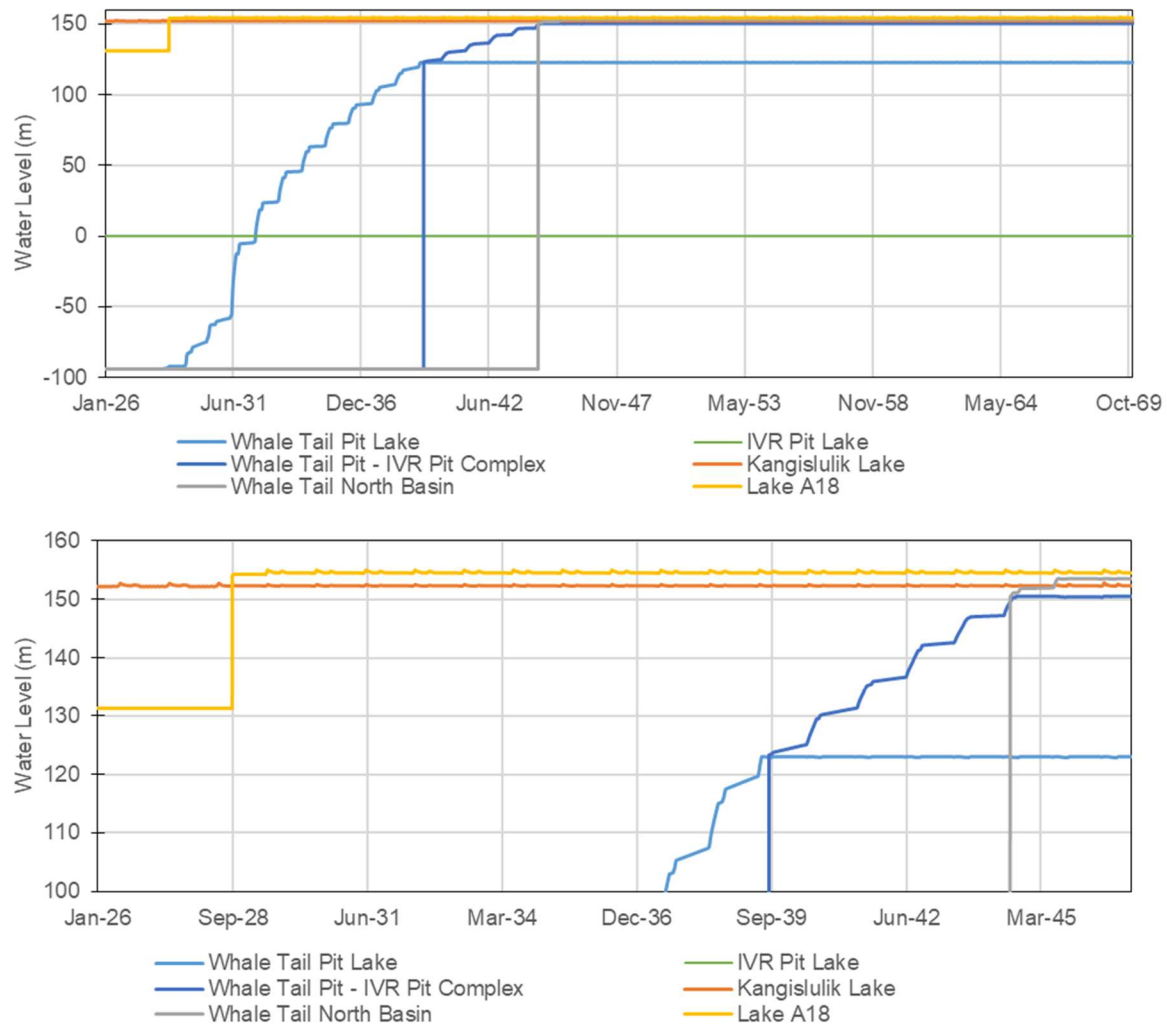


Figure 5-9: Closure lake water levels for the full range during the flooding period (top panel) and focused on the final lake elevations (bottom panel).

A total of 1.46 Mm³ of water will require treatment over a 6-year period (2028-2033) – discharged to IVR Pit and Whale Tail Pit. Captured runoff from the WT Pit and IVR Pit walls comprises 22% of the total volume treated during the early Active Closure phase (Table 5-8).

Table 5-8:
Sources of Water Routed to Active Treatment During Active Closure Phase

Year	Total Catchment Runoff	IVR WRSF	Captured WT Pit Wall	Captured IVR Pit Wall	STP	IVRAP to WTP
2028	198,418	29,749	26,388	11,779	25,124	98,467
2029	175,278	29,232	66,941	24,426	2,208	272,913
2030	175,860	25,005	65,282	17,638	2,208	264,626
2031	198,471	8,688	59,082	14,793	2,208	235,974
2032	233,215	17,886	52,526	14,987	2,208	272,027
2033	256,181	58,291	47,275	14,992	2,208	313,736
Total	1,237,423	168,851	317,494	98,615	36,164	1,457,743

Note: Sum of inputs greater than volume routed to O-WTP due to evaporative losses from pond surface.

The total volume pumped over the 18-year closure period is 3.74 Mm³ from the Whale Tail WRSF Collection Pond, 1.46 Mm³ from the O-WTP (discharged to the IVR Pit), and 61.1 Mm³ from the Whale Tail South Basin (Table 5-9). A total of 15.1 Mm³ is required to fill the IVR Pit, including the additional surface runoff from surrounding catchments and meteoric inputs to the pit shell (Table 5-9). The Whale Tail Pit requires a total of 24.9 Mm³ to fill to the sill elevation with the IVR Pit (123 masl), which includes surface runoff from surrounding catchments, groundwater inflows, and meteoric inputs to the pit shell (Table 5-4). The Whale Tail North Basin requires an additional 31.3 Mm³ to fill from the 123 m sill elevation to the final closure elevation of 153.5 m. The fully flooded Post-Closure mine pits are depicted in (Figure 3-31).

In addition to the actively pumped volumes, water also reports to the open pits via surrounding catchment runoff, pit wall runoff, meteoric (rainfall and snowmelt) inputs to the flooded pit surfaces, and overflow from adjacent flooded reservoirs (*e.g.*, Whale Tail Attenuation Pond; Table 5-10).

In total, during Active Closure 65.7 Mm³ is pumped into the open pits, 3.95 Mm³ enters Whale Tail pit via groundwater inflows, and 13.8 Mm³ flows into the open pits via passive drainage and meteoric inputs (Table 5-9). Therefore, the total volume required to fill the WT and IVR Pit complexes, including the Whale Tail North Basin to the closure elevation (153.5m), is 83.45 Mm³.

Table 5-9:
Active Closure Mine Void Flooding Sequence and Pumped Water Sources

Pumped To:	Underground		IVR Pit			WT Pit		WT/IVR Pit Complex		WT N. Basin	
Pumped From:	IVR Pit ¹	WT S. Basin	WT WRCP	O-WTP ²	WT S. Basin	WT WRCP	WT S. Basin	WT WRCP	WT S. Basin	WT WRCP	WT S. Basin
Year	m ³										
2028	1,080,000	616,680	27,600	98,467	4,590,840	0	0	0	0	0	0
2029	0	0	176,640	272,913	3,821,891	0	0	0	0	0	0
2030	0	0	165,600	264,626	3,271,749	5,520	0	0	0	0	0
2031	0	0	0	235,974	0	154,560	3,337,711	0	0	0	0
2032	0	0	0	272,027	0	138,000	3,333,960	0	0	0	0
2033	0	0	0	313,736	0	259,440	3,406,900	0	0	0	0
2034	0	0	0	0	0	231,840	3,466,316	0	0	0	0
2035	0	0	0	0	0	242,880	3,585,232	0	0	0	0
2036	0	0	0	0	0	226,320	3,358,025	0	0	0	0
2037	0	0	0	0	0	276,000	3,422,171	0	0	0	0
2038	0	0	0	0	0	242,880	3,365,121	0	0	0	0
2039	0	0	0	0	0	115,920	1,072,440	132,480	2,257,031	0	0
2040	0	0	0	0	0	0	0	220,800	3,334,136	0	0
2041	0	0	0	0	0	0	0	215,280	3,382,163	0	0
2042	0	0	0	0	0	0	0	242,880	3,315,853	0	0
2043	0	0	0	0	0	0	0	303,600	3,489,765	0	0
2044	0	0	0	0	0	0	0	138,000	1,747,680	93,840	1,650,152
2045	0	0	0	0	0	0	0	0	0	132,480	1,271,040
2046	0	0	0	0	0	0	0	0	0	0	0
Total	1,080,000	616,680	369,840	1,457,743	11,684,481	1,893,360	28,347,875	1,253,040	17,526,627	226,320	2,921,192

Notes:

¹ Total volume comprised of underground mine water stored in GSP-1 and IVR Pit East Lobe and contact water from IVR Attenuation Pond.

² Represents the conjoined Whale Tail and IVR Pit complex above the 123 m sill elevation.

Table 5-10:
Active Closure Mine Void Inflows from Pit Wall and Natural Catchment Runoff, and Adjacent Reservoir Inflows

Year	IVR Pit		WT Pit				
	Catchment Runoff	Uncaptured Pit Wall Runoff	Catchment Runoff	GW Inflow	Uncaptured Pit Wall Runoff	IVR Pit Overflow	WT Attenuation Pond Overflow
2028	106,304	42,336	57,740	624,260	73,126	0	0
2029	281,836	13,152	51,528	0	36,045	0	176,857
2030	296,824	9,497	54,882	0	35,152	18,286	444,924
2031	303,151	7,965	79,019	0	31,813	469,348	467,203
2032	297,432	8,070	124,084	0	28,283	491,208	516,777
2033	305,122	8,073	152,688	247	25,456	475,095	525,092
2034	311,516	23,059	167,762	2,365	66,035	240,412	670,626
2035	321,764	23,059	183,973	3,849	60,080	244,052	732,565
2036	306,358	22,762	188,557	233,094	52,784	231,229	589,022
2037	308,504	23,060	205,055	884,650	46,710	234,857	212,465
2038	315,131	22,771	222,423	1,438,277	38,772	238,159	0
2039	305,121	22,334	228,647	766,056	33,687	223,181	0
2040	320,195	17,697	243,862	0	27,409	220,827	0
2041	325,576	14,216	254,570	0	21,289	228,189	0
2042	327,389	11,484	258,184	0	19,160	233,714	0
2043	331,510	8,883	267,064	0	14,572	221,088	0
2044	336,101	6,823	273,391	0	11,286	211,394	0
2045	342,453	2,114	285,037	0	4,818	204,888	0
2046	352,143	1,861	291,017	0	3,866	205,451	0
Total	5,794,430	289,216	3,589,482	3,952,800	630,344	4,391,378	4,335,531

6. Water Quality Model Results



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6. *Water Quality Model Results*

Water quality model results for mine site water, treated effluent from the O-WTP, and receiving lakes during Operations, Active Closure, and Post-Closure are presented in this section. Model predictions shown in figures represent daily results, while tables in this section represent monthly mean values. All constituents are presented as dissolved concentrations similar to the 2018 Final Environmental Impact Statement (FEIS) model (Golder, 2018b and 2019e).

Effluent predictions at the end of pipe of the O-WTP are screened against the NWB Water License/MDMER effluent limits during Operations. Water quality predictions in the receiving environment and downstream lakes are compared against the following criteria throughout all mine phases:

- Long-term water quality guidelines for the protection of aquatic life established by the Canadian Council of Ministers of the Environment (CCME); and,
- Site-specific water quality objective (SSWQO) of 0.025 mg/L for arsenic

The full water quality model results screened against relevant guidelines are provided in Appendix C. Overall, the results show that all parameters are predicted to remain below their respective guidelines in receiving lakes. Time series predictions for arsenic are presented in the following sections and compared against previous model results, the 2023 Annual Report Model and FEIS predictions. Complete time series results for all parameters can be found in Appendix C.

6.1 *Operations*

During Operations, all surface contact water generated from mine facilities is collected and routed through a series of sumps and attenuation ponds and treated by the O-WTP prior to discharge to the receiving environment. Arsenic predictions in open pit sumps (Whale Tail Pit and IVR Pit), attenuation ponds (Whale Tail Attenuation Pond, IVR Attenuation Pond), O-WTP treated effluent, and receiving lakes are presented in the following subsections.

6.1.1 *Whale Tail Pit and IVR Pit*

IVR Pit receives pit wall runoff and natural runoff from the surrounding catchment. Beginning in 2026, the IVR Pit East Lobe will start receiving underground mine water and will no longer be dewatered to attenuation ponds or discharged to the receiving environment. Starting in June 2026, the only IVR Pit water managed through attenuation ponds will originate from the IVR West Lobe. This change in water management will

reduce the overall As loading from IVR Pit reporting to the attenuation ponds but will have little influence on pit sump concentrations in the west lobe.

Arsenic concentrations in the Whale Tail Pit vary seasonally due to groundwater seepage through the south wall (Figure 6-1). This provides a source of dilution in winter months generating the strong seasonal signature observed in sump water, and variability in summer months as meteoric events dictated by the climate time series control the timing that pit wall runoff enters mine sumps.

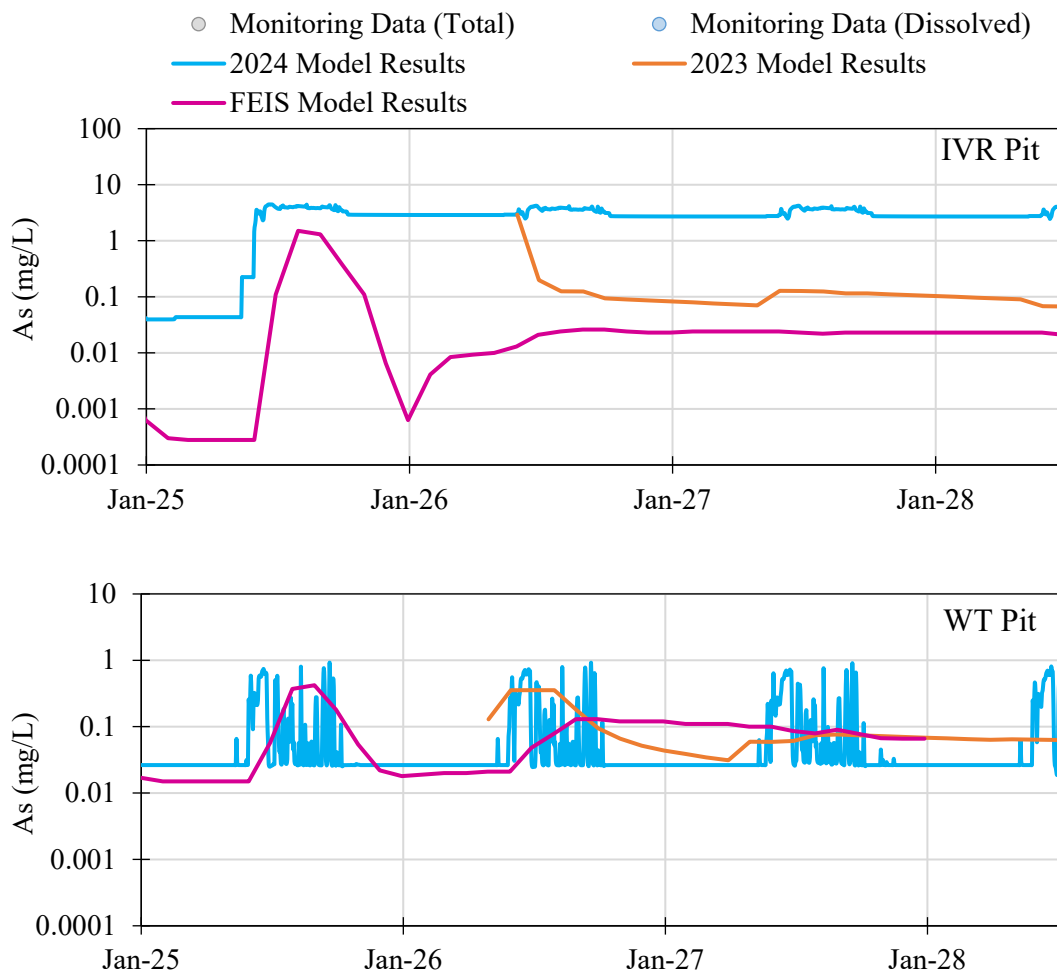


Figure 6-1: Arsenic concentrations for IVR Pit (top) and Whale Tail Pit (bottom) predicted in the 2024 Annual Report Model, 2023 Annual Report Model and FEIS for the remainder of operations.

6.1.2 Attenuation Ponds and O-WTP Effluent Discharge

Surface contact water generated from mine facilities during Operations is collected in the Whale Tail and IVR attenuation ponds and routed to the O-WTP for treatment. Pumped flows from the IVR Pit and Whale Tail Pit are the main source of arsenic in the attenuation ponds.

The WT Attenuation Pond receives contact water from Whale Tail Dike Seepage and Whale Tail Pit. The arsenic concentrations show a strong seasonal signature similar to the Whale Tail Pit. The IVR Attenuation Pond receives contact water from the IVR Pit, Whale Tail Pushback, Whale Tail WRSF, and IVR WRSF as well as some flows from the Whale Tail Attenuation Pond, which results in higher predicted concentrations in the IVR Attenuation Pond relative to the Whale Tail Attenuation Pond (Figure 6-2).

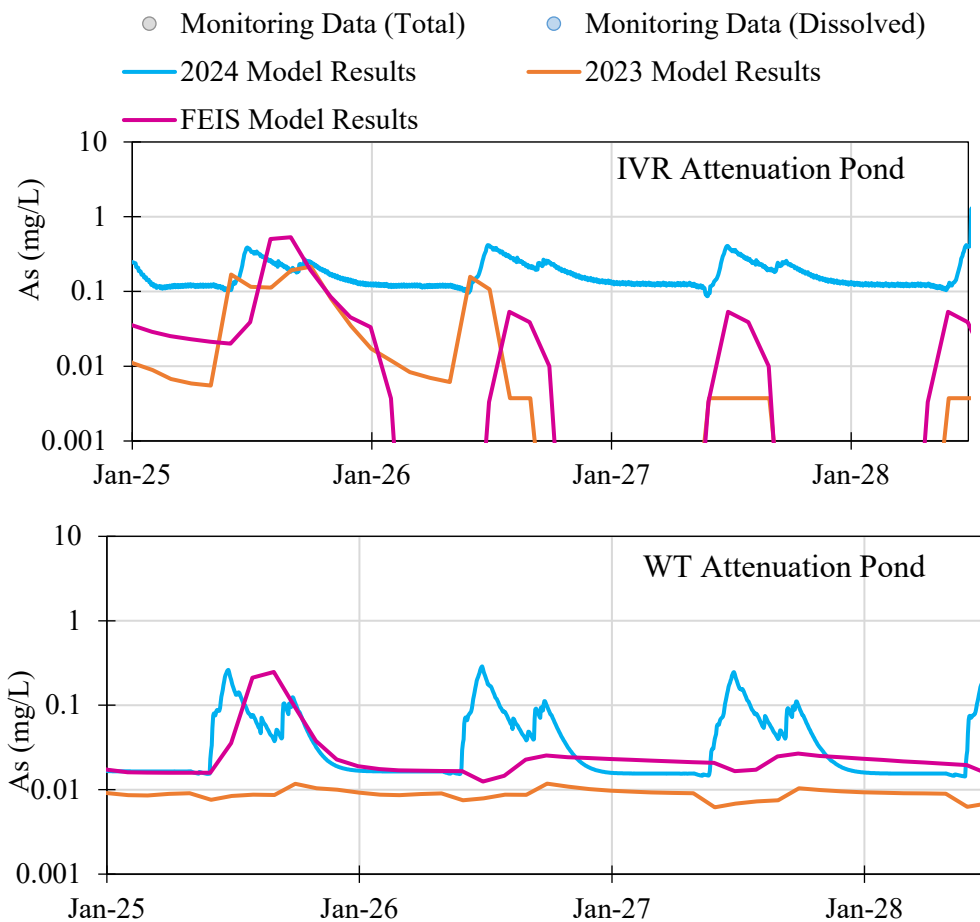


Figure 6-2: Arsenic concentrations for IVR Attenuation Pond (top) and Whale Tail Attenuation pond (bottom) predicted in the 2024 Annual Report Model, 2023 Annual Report Model and FEIS for the remainder of operations.

Water from the attenuation ponds will be treated at the O-WTP before being discharged to Whale Tail South Basin or Kangislulik Lake (Section 2.3.1). Effluent discharged from the O-WTP is predicted to meet the NWB Water License/MDMER effluent limits for all parameters (Table 6-1).

Table 6-1:
Maximum End-Of-Pipe Predictions during the remainder of Operations (Jan.2025-Jun.2028)

Constituents	Units	End of Pipe Discharge to Whale Tail South Basin	End of Pipe Discharge to Kangislulik Lake	NWB Water License/MDMER (End-of-Pipe)
Ammonia-N	mg-N/L	0.97	2.27	16
Nitrate-N	mg-N/L	1.3	3.8	-
Chloride	mg/L	34	37	-
Fluoride	mg/L	0.15	0.18	-
Sulphate	mg/L	67	152	-
Aluminum	mg/L	0.012	0.037	0.5
Arsenic	mg/L	0.017	0.052	0.1
Cadmium	mg/L	0.000020	0.000044	0.002
Chromium	mg/L	0.00042	0.00043	0.02
Copper	mg/L	0.0017	0.0032	0.1
Iron	mg/L	0.23	0.21	1
Mercury	mg/L	0.0000083	0.000014	0.004
Manganese	mg/L	0.24	0.54	-
Nickel	mg/L	0.023	0.075	0.25
Phosphorus	mg/L	0.011	0.0106	0.3
Lead	mg/L	0.00016	0.00017	0.05
Selenium	mg/L	0.00060	0.00086	-
Zinc	mg/L	0.0039	0.0042	0.1

6.1.3 Receiving Environment and Downstream Lakes

Treated effluent is pumped from the O-WTP to the Whale Tail South Basin during winter months (typically October to June) and to Kangislulik Lake during summer months (typically May to September), with some overlap during the seasonal transition.

Arsenic concentrations are predicted to be elevated in Kangislulik Lake relative to Whale Tail South Basin, since it receives O-WTP treated effluent during the open water season

(Figure 6-3) when attenuation pond arsenic concentrations are relatively high due to pit wall runoff, in addition to being downstream of Whale Tail South Basin.

Maximum concentrations predicted in Kangislulik Lake and Whale Tail South Basin for the remainder of operations are screened against SSWQO/CCME guidelines in Table 6-2. Model results indicate that all parameters will remain below receiving environment guidelines.

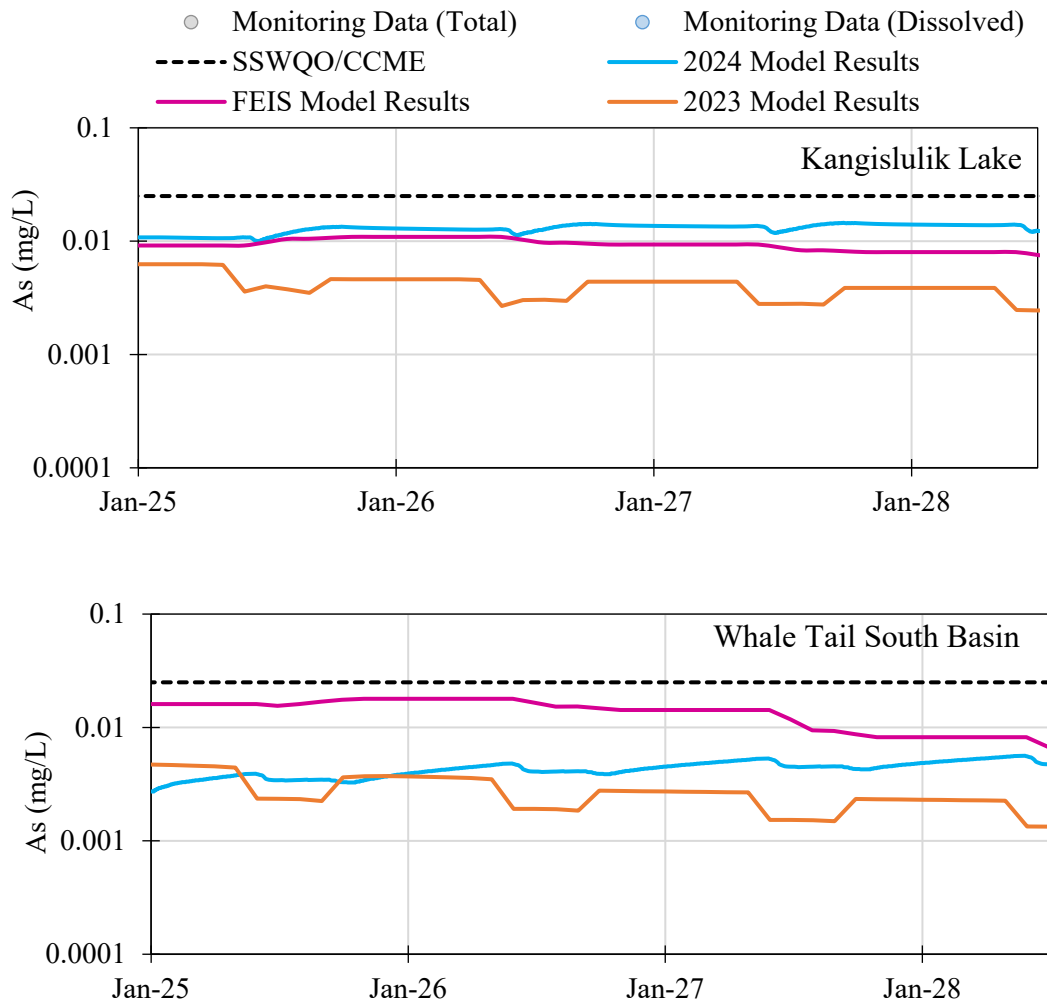


Figure 6-3: Operations arsenic concentrations for Kangislulik Lake (top) and Whale Tail South Basin (bottom) predicted in the 2024 Annual Report Model, 2023 Annual Report Model and FEIS.

**Table 6-2:
 Maximum Monthly Predictions in the Receiving Environment and Downstream
 Lakes during remainder of Operations (Jan. 2025-Jun. 2028)**

Constituents	Units	Kangislulik	Whale Tail	CCME/
		Lake	South Basin	SSWQ
Total Ammonia ¹	mg-N/L	0.35	0.07	0.58
Nitrate	mg-N/L	2.1	0.78	2.93
Chloride	mg/L	41	24	120
Fluoride	mg/L	0.10	0.078	0.12
Sulphate	mg/L	46	19	-
Aluminum	mg/L	0.015	0.011	0.1
Arsenic	mg/L	0.014	0.0056	0.025
Cadmium	mg/L	0.000013	0.0000063	variable
Chromium ²	mg/L	0.00080	0.00046	0.001-0.0089
Copper	mg/L	0.0014	0.00095	variable
Iron	mg/L	0.18	0.12	0.3
Mercury	mg/L	0.0000070	0.0000046	0.000026
Manganese	mg/L	0.16	0.10	variable
Nickel	mg/L	0.018	0.0059	variable
Phosphorus	mg/L	0.0076	0.0081	0.01
Lead	mg/L	0.00013	0.000072	variable
Selenium	mg/L	0.00033	0.00018	0.001
Zinc	mg/L	0.0049	0.0028	variable

Note:

CCME = Canadian Environmental Quality Guidelines, Canadian Council of Ministers of the Environment

SSWQO = Site Specific Water Quality Objective

Variable guidelines are dependent on predicted hardness, pH, temperature, and DOC

1. The CCME guideline for total ammonia conservatively assumes pH of 8 and temperature of 15°C.

2. The CCME guidelines for Cr include both Cr(VI) 0.001 mg/L and Cr(III) 0.0089 mg/L. Given that Cr is expected to be present primarily as Cr (III) in mine water, model predictions are compared against the CCME Cr(III) guideline for initial screening.

6.1.4 Dry- and Wet-Year Sensitivities

The influence of drier or wetter than average climate conditions on WBWQM predictions was tested by modelling repeated dry-years (10th percentile historical precipitation; 277 mm) and repeating wet-years (90th percentile historical precipitation; 449 mm) for the remainder of operations (2025-2028). Water quality results for arsenic in Kangislulik Lake and Whale Tail South Basin are shown in Figure 6-4 and maximum concentrations for all parameters are screened against SSWQO/CCME guidelines in Table 6-3.

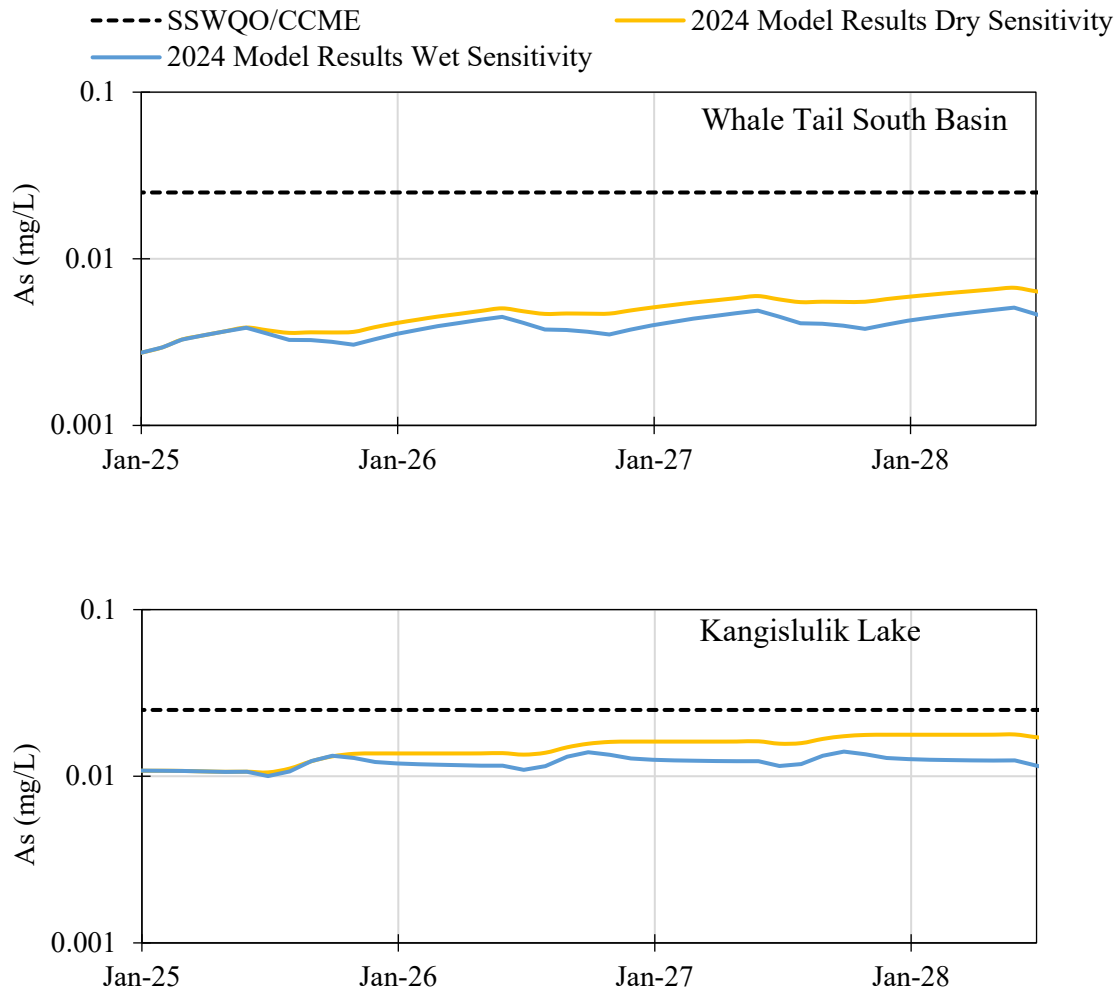


Figure 6-4: Operations arsenic concentrations for Whale Tail South Basin (top) and Kangislulik Lake (bottom) for the Dry Year and Wet Year sensitivity screened against SSWQO guidelines.

The wet year sensitivity analysis results in increased volumes of mine water being discharged to the environment and greater runoff from natural catchments into receiving lakes. Overall, the higher mine site discharge is offset by increased flows in receiving lakes, leading to a minimal change in concentrations compared to base case conditions. In contrast, the dry-year sensitivity analysis results in reduced flow rates, leading to higher concentrations of most parameters. For example, arsenic concentrations increase by 25% in Whale Tail South Basin and 29% in Kangislulik Lake, respectively.

Table 6-3:
Maximum Monthly Predictions in the Receiving Environment and Downstream
Lakes during remainder of Operations for dry and wet year sensitivities
(Jan. 2025-Jun. 2028)

Constituents	Units	WTS Lake Dry	Kang Lake Dry	WTS Lake Wet	Kang Lake Wet	CCME/ SSWQO
Total Ammonia ¹	mg-N/L	0.07	0.37	0.08	0.37	0.58
Nitrate	mg-N/L	0.8	2.1	0.8	2.1	2.93
Chloride	mg/L	27	41	24	41	120
Fluoride	mg/L	0.09	0.11	0.07	0.10	0.12
Sulphate	mg/L	23	56	17	44	-
Aluminum	mg/L	0.011	0.016	0.011	0.015	0.1
Arsenic	mg/L	0.007	0.018	0.005	0.014	0.025
Cadmium	mg/L	0.000007	0.000016	0.000006	0.000013	variable
Chromium ²	mg/L	0.00046	0.00080	0.00046	0.00080	0.001-0.0089
Copper	mg/L	0.0011	0.0016	0.0009	0.0014	variable
Iron	mg/L	0.13	0.18	0.11	0.18	0.3
Mercury	mg/L	0.0000052	0.0000079	0.0000046	0.0000070	0.000026
Manganese	mg/L	0.11	0.21	0.10	0.15	variable
Nickel	mg/L	0.007	0.020	0.006	0.018	variable
Phosphorus	mg/L	0.0090	0.0081	0.0078	0.0072	0.01
Lead	mg/L	0.00009	0.00013	0.00007	0.00013	variable
Selenium	mg/L	0.00021	0.00042	0.00016	0.00031	0.001
Zinc	mg/L	0.0029	0.0049	0.0028	0.0049	variable

Note:

CCME = Canadian Environmental Quality Guidelines, Canadian Council of Ministers of the Environment

SSWQO = Site Specific Water Quality Objective

Variable guidelines are dependent on predicted hardness, pH, temperature, and DOC

1. The CCME guideline for total ammonia conservatively assumes pH of 8 and temperature of 15°C.

2. The CCME guidelines for Cr include both Cr(VI) 0.001 mg/L and Cr(III) 0.0089 mg/L. Given that Cr is expected to be present primarily as Cr (III) in mine water, model predictions are compared against the CCME Cr(III) guideline for initial screening.

6.2 Active Closure and Post-Closure

Active flooding of the underground mine voids and pit lakes spans the period from July 2028 through July 2045 (Active Closure). Active flooding begins with IVR Pit in July 2028 which is filled to the spill point elevation of 123 masl by October 2030. Whale Tail Pit active flooding begins in June 2031 and is filled to the spill point elevation of 123 masl by July 2039. Once the Whale Tail Pit and IVR Pit lakes join above the 123 m sill elevation, the Whale Tail /IVR Complex is formed. This occurs in August 2039; active flooding of the Whale Tail North Basin continues until July 2045 when the final water level of 153.5 masl is reached.

6.2.1 Pit Lakes

Active flooding of mine pits begins with IVR Pit in 2028, leading to a rapid improvement in water quality (Figure 6-5 and Figure 6-6). After IVR Pit flooding is completed in 2031, arsenic concentrations begin to increase again due to exposure to the remaining IVR Pit walls. Whale Tail Pit flooding begins in 2031, resulting in a rapid improvement of water quality similar to what was initially observed at IVR Pit. The reduction in arsenic concentrations during the first 6 years of Active Closure is further enhanced by continued operation of the O-WTP, which treats treat mine contact water including, 65% of pit wall runoff, with treated water discharged to the IVR Pit.

In 2039, water levels will exceed the 123 m sill elevation and IVR Pit and Whale Tail Pit will merge to form the Whale Tail-IVR Complex. The Whale Tail-IVR Complex begins to overflow into the Whale Tail Attenuation Pond in July 2044, forming the Whale Tail North Basin. The Whale Tail North Basin continues flooding until July 2045 when the Kangislulik Dike is breached; note that breaching will only take place once water quality within the Whale Tail North Basin meets CCME water quality guidelines, baseline concentrations, or SSWQOs.

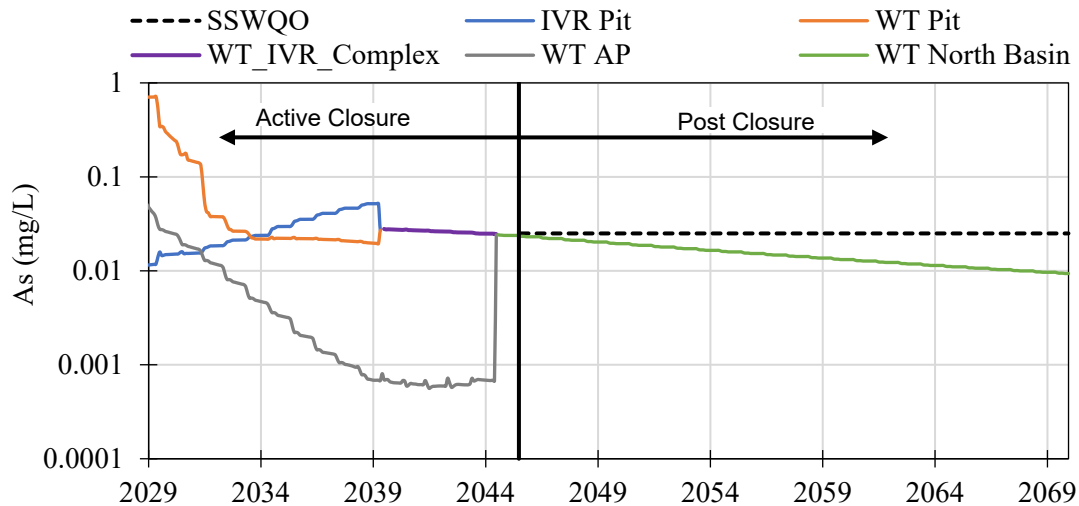


Figure 6-5: Active Closure and Post Closure arsenic concentrations for IVR Pit, WT Pit, WT_IVR Complex, and WT North Basin for the 2024 Annual Report Model.

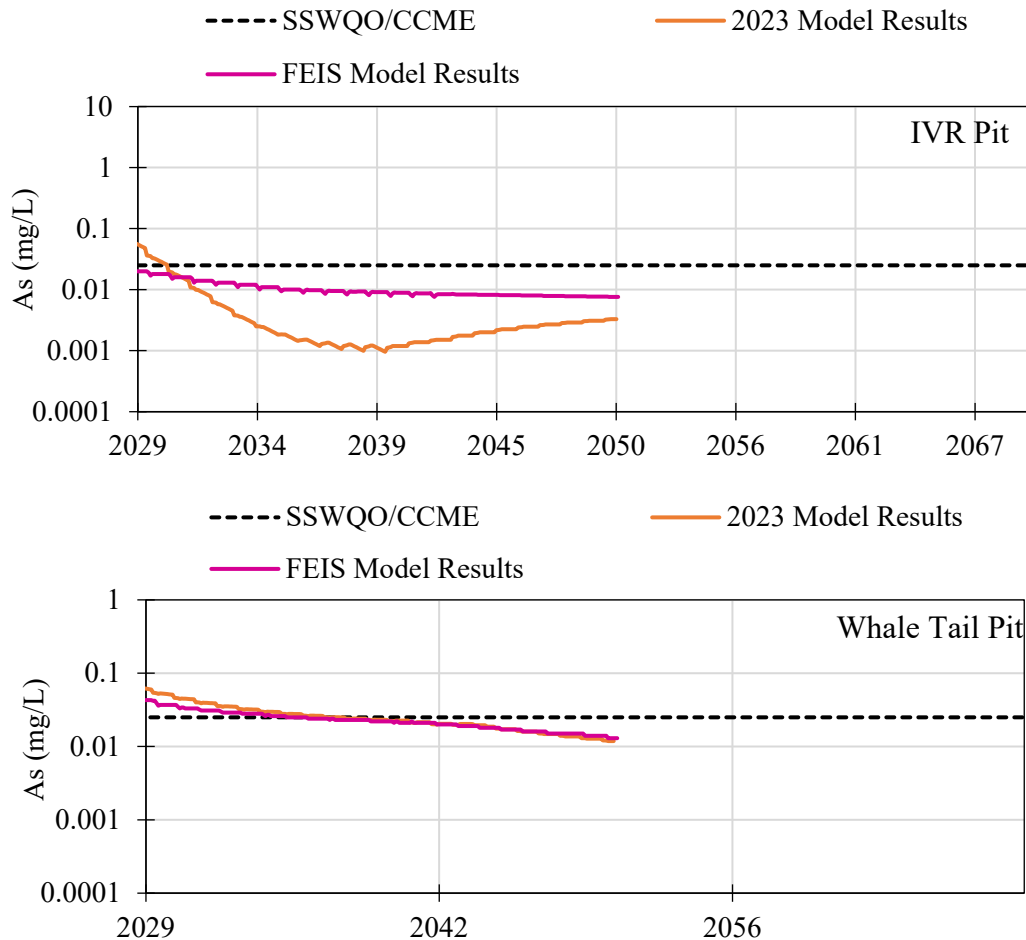


Figure 6-6: Active Closure and Post Closure arsenic concentrations for IVR Pit (top) and Whale Tail Pit (bottom) predicted in the 2023 Annual Report Model and FEIS. The Post Closure phase begins in 2045 in the 2023 Annual Report Model, and 2042 in the FEIS model.

Arsenic concentrations are expected to decline throughout this flooding period, with concentrations declining below SSWQO guidelines by the end of Active Closure. Concentrations are expected to continue declining during Post-Closure (modelled out to 2069). Maximum concentrations for the mine pit complex (Whale Tail North Basin) are screened against SSWQO and CCME guidelines in Table 6-4. All parameters are predicted to meet receiving environment water quality criteria.

6.2.2 Receiving Environment and Downstream Lakes

At the end of operations, water quality in receiving lakes is expected to initially improve due to the cessation of mine effluent discharge (Figure 6-7). This improving trend will continue throughout Active Closure, until the Kangislulik Dike is breached in July 2045 (breaching will only take place once water quality within Whale Tail North Basin meets

CCME water quality guidelines, baseline conditions or SSWQOs). At this point, Whale Tail North Basin water will begin to flow into Kangislulik Lake, resulting in a temporary increase in concentrations. After the Lakes are reconnected, arsenic concentrations are expected to decrease as non-contact flows from surrounding catchments report to the lakes.

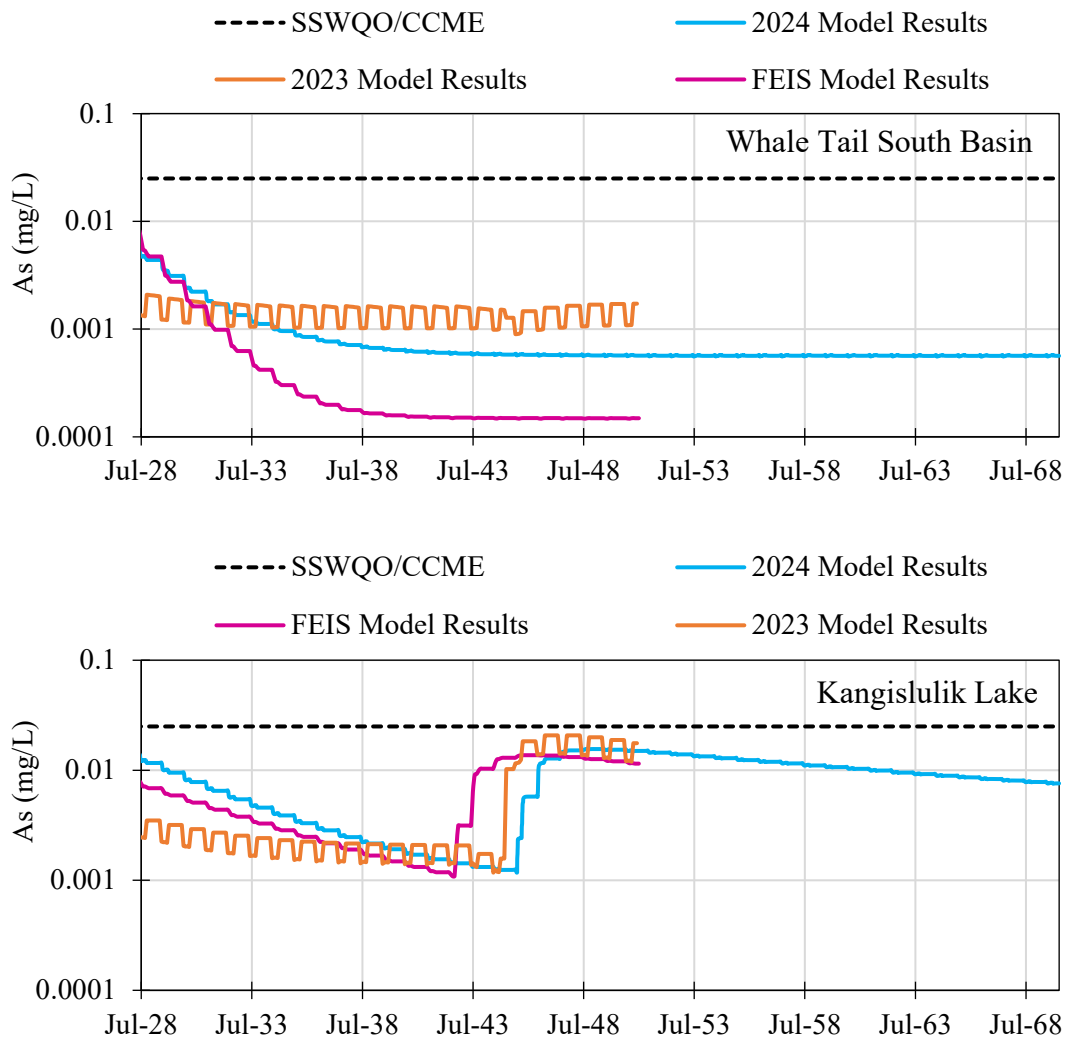


Figure 6-7: Closure arsenic concentrations for Whale Tail South Basin (top) and Kangislulik Lake (bottom) predicted in the 2024 Annual Report Model, 2023 Annual Report Model and FEIS.

Maximum concentrations for the Kangislulik Lake and Whale Tail South Basin are screened against SSWQO and CCME guidelines in Table 6-4. All parameters are predicted to meet receiving environment water quality criteria.

Table 6-4:
Maximum Monthly Predictions in the Receiving Environment and Downstream Lakes during Post Closure (July 2045 onwards)

Parameter	Maximum Monthly Concentration during Post-Closure Jul.2045-Dec.2069 (mg/L)			CCME or SSWQO
	WTS Lake	Kangislulik Lake	WT North Basin	
Total Ammonia (as N)	0.0028	0.0017	0.0010	0.58
Nitrate (as N)	0.10	0.55	0.20	2.93
Chloride	12	29	14	120
Fluoride	0.043	0.067	0.062	0.12
Sulphate	4.5	18	21	variable
Aluminum	0.0071	0.0149	0.014	0.1
Arsenic	0.00058	0.016	0.023	0.025
Cadmium	0.0000027	0.0000061	0.0000073	variable
Chromium	0.00021	0.00020	0.00022	0.001
Copper	0.00051	0.00099	0.0010	variable
Iron	0.048	0.049	0.054	0.3
Mercury	0.0000026	0.0000045	0.0000043	0.000026
Manganese	0.026	0.051	0.041	variable
Nickel	0.0014	0.0070	0.010	variable
Phosphorus	0.0049	0.0050	0.0050	0.01
Lead	0.000038	0.000042	0.00004	0.001
Selenium	0.000027	0.00015	0.00012	0.001
Zinc	0.0016	0.0019	0.0019	variable

Note:

CCME = Canadian Environmental Quality Guidelines, Canadian Council of Ministers of the Environment

SSWQO = Site Specific Water Quality Objective

Variable guidelines are dependent on predicted hardness, pH, temperature, and DOC

1. The CCME guideline for total ammonia conservatively assumes pH of 8 and temperature of 15°C.

2. The CCME guidelines for Cr include both Cr(VI) 0.001 mg/L and Cr(III) 0.0089 mg/L. Given that Cr is expected to be present primarily as Cr (III) in mine water, model predictions are compared against the CCME Cr(III) guideline for initial screening.

6.3 Comparison of Model Forecasts

Previous model forecasts are not directly comparable to the current model, as they were completed before the LOM mine plan extended operations until July 2028. Most variations between model iterations for the remaining operational period are due to changes in the mine plan and updates to water management strategies.

For example, the 2023 Annual Report assumed that mine site water would be routed directly to the IVR Attenuation Pond, bypassing the WT Attenuation Pond. This resulted in a lower estimate of Whale Tail Attenuation Pond concentrations in 2025 compared to the FEIS and 2024 Annual Report models (Table 6-2). Beginning in 2026, both the FEIS and 2023 Annual Report models assume that closure activities will commence, leading to a gradual improvement in pit sump and attenuation pond water quality.

In the receiving environment, the FEIS model assumed that treated effluent would be discharged into Kangislulik Lake until May 2021 and into the Whale Tail South Basin from June 2021 through the end of operations. However, in reality, mine water is discharged into Whale Tail South Basin only during winter months (typically October to June), with most mine water being discharged into Kangislulik Lake during the open-water season (typically May to September). As a result, the FEIS model overpredicts concentrations in the Whale Tail South Basin. Notably, all three models should be considered conservative, as they have historically overestimated arsenic concentrations in both the Whale Tail South Basin and Kangislulik Basin (Figure 6-3).

Both the 2023 Annual Report model and the FEIS forecasts predict a decline in arsenic concentrations after 2026, as they were completed before the mine life extension to June 2028. In contrast, the current model projects a modest increase in arsenic concentrations from 2026 to 2028 due to the extended period of mine water discharge.

During the Active Closure phase, model comparison is further confounded by differences in pit flooding times. The FEIS model projected an active closure period of 2026 to 2042, and the 2023 Annual Report Model projected an active closure period of 2026 to 2045. These models provided results for IVR Pit and Whale Tail Pit during the flooding phase, while the current model provides resolution on sequential basin flooding during the active closure phase. In general, all models show a similar trend of declining concentrations during the pit flooding phase, with water quality projections being below CCME/SSWQO limits by the beginning of Post Closure (Figure 6-6 and Figure 6-7).

7. Summary



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7. Summary

A water balance and water quality model was constructed to predict the movement of water and water quality for the Whale Tail mine plan during Operations, Active Closure and Post Closure. The model operates on a daily time-step and is driven by a climate forcing series consisting of a repeating average year climate, for a 50-year period from 2020 to 2069, with predictions presented for 2025 onwards. Two sensitivities are run whereby the remainder of the Operations phase is represented by repeating dry- and wet-year climate scenarios. The mine plan is replicated on an annual basis, with sub-catchment areas and mine facility footprints reflective of the Whale Tail mine schedule and mine site layout.

All mine site components, including open pits, underground operations, WRSFs, ore pads and underground WRSFs are assigned runoff and interflow signatures, as well as geochemical source terms. All water management infrastructure is incorporated into the model, along with the lake water and load balances for the Whale Tail South Basin and Kangislulik Lake.

Mine site flows and source loadings were parameterized via a calibration exercise that utilized measured data from mine operations in 2020 to 2022. These calibrated parameter sets were then carried forward for use in the predictive model, which was validated using monitoring data from 2023 and 2024.

- The water levels in the Whale Tail Attenuation Pond and IVR Attenuation Pond are predicted to remain within the operational criteria for the duration of Operations.
- Model results indicate that under the LOM mine plan, the existing mine water management infrastructure can handle the additional contact water generated by the pit pushbacks.

At EOM, GSP-1 is predicted to contain 115,300 m³ of groundwater and 752,643 m³ is stored in IVR Pit as of June 30, 2028, under the average year scenario. Approximately 89% of this stored water is of underground provenance. The East Lobe IVR Pit wall runoff and surrounding catchment runoff contributes 9% of the total. Under the dry- and wet-year scenarios, the volume of underground mine water stored in the East Lobe of IVR Pit is 637,671 m³ and 819,499 m³, respectively. These volumes are pumped into the underground void in July 2028, at the onset of Active Closure.

- During the Active Closure phase, the sequence of active flooding of mine voids is as follows:
 - Active flooding of the underground mine voids occurs in July 2028;

- IVR Pit active flooding begins in August 2028, and is filled to the spill point elevation of 123 masl by October 2030 (Dry-year = July 2031; Wet-year = September 2030);
- Whale Tail Pit active flooding begins in June 2031, and is filled to the spill point elevation of 123 masl by July 2039 (Dry-year = September 2039; Wet-year = June 2039);
- Once the flooded Whale Tail and IVR Pits join above the 123 m sill elevation, the Whale Tail/IVR Complex is formed. This occurs in July 2044 (Dry-year = October 2044; Wet-year = June 2044); and,
- Active flooding of the Whale Tail North Basin continues until July 2045 (Dry-year = September 2045; Wet-year = June 2045) when the final water level of 153.5 masl is reached.
- Water is pumped from the Whale Tail WRSF Collection Pond and the Whale Tail South Basin during this active flooding campaign. The maximum pumped volume from the Whale Tail South Basin to the mine voids is 2,855 m³/hour in 2028 (4.6 Mm³/year), and 2.1 to 4.1 Mm³/year for the remainder of the Active Closure phase.

During the operational years of 2024 through 2028, treated effluent discharged from the O-WTP is predicted to meet NWB water licence limits for all parameters. The O-WTP will be operated for the first six years of Active Closure and will treat mine contact water including 65% of pit wall runoff, with treated effluent discharged to the IVR Pit. Once effluent discharge ceases in Active Closure, concentrations are expected to decrease and remain below guidelines in the receiving environment and downstream lakes. All parameters are expected to meet their respective guidelines throughout closure.

8. *Closure*



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8. Closure

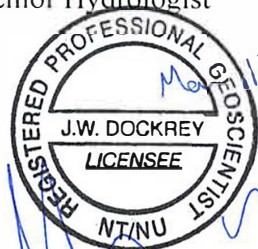
We trust that this report meets your requirements at this time. Please contact us should you have any questions or concerns or require additional information in support of this work.

Yours sincerely,

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Date	<u>March 13, 2025</u>
PERMIT NUMBER: P 1487	
NT/NU Association of Professional Engineers and Geoscientists	

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