Fairbanks Gold Mining Inc.

Fort Knox Pit Lake Evaluation 2024 Update

Fort Knox Mine

Fairbanks, Alaska

February 25, 2025

Fort Knox Pit Lake Evaluation – 2024 Update

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Acronyms and Abbreviations

2019 Update	Fort Knox Pit Lake Evaluation 2019 Update
2021 Update	Fort Knox Pit Lake Evaluation 2021 Update
2023 Update	Fort Knox Pit Lake Evaluation 2023 Update
2024 Update	Fort Knox Pit Lake Evaluation 2024 Update
°C	degree Celsius
ADEC	Alaska Department of Environmental Conservation
amsl	above mean sea level
BCHL	Barnes Creek heap leach
FGMI	Fairbanks Gold Mining, Inc
gpm	gallon per minute
gpm/ft^2	gallon per minute per square foot
Knight Piésold	Knight Piésold Consulting
memorandum	Fort Knox Pit Lake Evaluation – 2023 Update
mg/L	milligram per liter
MWMP	Meteoric Water Mobility Procedure
NADP	National Atmospheric Deposition Program
RO	reverse osmosis
Site	Fort Knox Mine, located near Fairbanks, Alaska
s.u.	standard unit
SWS	Schlumberger Water Services
TDS	total dissolved solids
TSF	tailings storage facility
USACE	U.S. Army Corps of Engineers
WAD	weak-acid dissociable

Executive Summary

This Fort Knox Pit Lake Evaluation – 2024 Update (memorandum) presents an update to the closure pit lake evaluation, which was completed in support of reclamation and closure planning for the Fort Knox Mine, located near Fairbanks, Alaska (Site). The objectives of this pit lake evaluation were to update flow, volume, and chemistry data for evaluating post-closure pit filling rates, pit water quality, and the potential for stratification. The pit lake evaluation was completed using GoldSim, which was linked to PHREEQC for geochemical speciation modeling. This memorandum builds on the 2023 evaluation (Arcadis 2024) with an updated reclamation and closure plan and flow, volume, and chemistry data.

This 2024 update to the pit lake evaluation is based on relevant mining and reclamation milestones presented in the Fort Knox Mine Reclamation and Closure Plan (FGMI 2024), which includes the following assumptions:

- Continued mining in the western portion of the pit (Gilmore expansion area) through mid-year 2028 and filling of the eastern pit with runoff and precipitation (pit dewatering will continue to limit groundwater discharge to the eastern and western pits during this time).
- Milling of Fort Knox and satellite ores (including Manh Choh) with tailings deposition in the eastern pit through mid-year 2028, at which point the mill is scheduled to be shut down.
- Discrete transfers and long-term flows from the tailings storage facility (TSF) decant ponds, heap leach facility, and the groundwater interception system directed to the pit starting in 2028.

Model predictions included in this memorandum are as follows:

- The pit lake will fill to the contact with alluvium (1,421 feet above mean sea level) in 2089, at which point pit lake water will begin to flow into to Fish Creek alluvium.
- Pit lake chemistry will be alkaline with significant buffering capacity throughout pit filling. Most constituents will remain at concentrations less than the water quality standards for the model simulation period.
- Concentrations of nitrate, ammonia, weak acid-dissociable (WAD)-cyanide, antimony, selenium, sulfate, and total dissolved solids will be greater than water quality standards during early pit filling; however, these constituent concentrations are predicted to decrease to less than the standards before the pit lake reaches the contact with alluvium.
- Arsenic and copper concentrations are predicted to be greater than water quality standards when the pit lake reaches the contact with alluvium (2089). These constituents are largely attributable to their presence in tailings slurry water (particularly during Manh Choh processing), and this may require active management in the future to ensure water quality standards are not exceeded.
- Model results are not strongly sensitive to changes in the precipitation inputs (+/- 20 percent), highly conservative assumptions for groundwater inflow chemistry, or uncertainties with potential continued leaching from tailings deposited in the pit. Under some conservative sensitivity scenarios, antimony is also predicted to be close to or above the water quality standard when the pit level reaches the alluvium.
- The potential exists that the pit lake will become permanently stratified; the driving factor is the pit lake geometry.

The pit lake evaluation will continue to be updated as reclamation concepts are modified and as additional site data become available. Given the prediction that arsenic, copper, and potentially antimony concentrations will be close to or above the water quality standard when the pit lake level reaches the alluvium, active water management/treatment strategies, which may include either operational changes within the mill circuit or water treatment of the tailings slurry or pit water, may become necessary if continued data collection and model refinement suggest these constituents will be above the water quality standard when the pit fills.

1 Introduction

This Fort Knox Pit Lake Evaluation – 2024 Update (memorandum) presents an update to the closure pit lake evaluation, which was completed in support of reclamation and closure planning for the Fort Knox Mine, located near Fairbanks, Alaska (Site). This memorandum was updated from the previous pit lake evaluation (Arcadis 2024). The Site is owned and operated by Fairbanks Gold Mining, Inc. (FGMI), a subsidiary of Kinross Gold Corporation. This pit lake evaluation has been revised with reclamation and closure concepts presented in the Fort Knox Mine Reclamation and Closure Plan recently updated and submitted as draft in December 2024 (FGMI 2024). As part of this evaluation, the existing closure water balance and chemistry model was refined, and the inputs were updated with operational data estimates through closure, post-closure flow/volume forecasts, and updated Site water chemistry data. In 2023, the pit lake model was updated to include planned tailings deposition in the eastern pit from 2024 through 2028; this evaluation has been updated based on actual tailings deposition that occurred in 2024, as well as updated plans for 2025 through 2028. This memorandum includes updated pit lake model results as well as an evaluation of the potential for stratification of the pit lake during the post-closure period, which may affect discharge water quality in the future.

The objectives of this update are to:

- Present updated water flow/volume data for input to the pit lake water balance
- Present updated input water chemistry data
- Develop estimates of post-closure pit lake water quality compared to Alaska reference standards
- Evaluate the potential for stratification in the post-closure pit lake
- Determine the effectiveness of the current reclamation approach from a water quality perspective and identify potential needs for additional water management strategies as necessary.

2 Project Background

The Site is located approximately 15 miles northeast of Fairbanks, Alaska in T2N, R2E and T2N, R3E, Fairbanks Meridian near the headwaters of the Fish Creek drainage. The land is owned by the State of Alaska, the Alaska Mental Health Trust, and private parties. Water Management Consultants, Inc. (WMC [2006]) describes the Site climate, topography, hydrology, hydrogeology, and geology; therefore, this information is not replicated in this memorandum.

The Fort Knox Mine Reclamation and Closure Plan (FGMI 2024) was submitted as draft to the Alaska Department of Natural Resources in December 2024. This updated Reclamation and Closure Plan, albeit in draft form, is assumed herein to supersede the Reclamation and Closure Plan submitted in January 2020 (FGMI 2020) and the Fort Knox Reclamation and Closure Plan Amendment 1 (FGMI 2021), which were used as the basis for the previous pit lake model update (Arcadis 2024). This section describes the elements of Site operations and the Fort Knox Mine Reclamation and Closure Plan that are relevant to the pit lake evaluation.

2.1 Pit Expansion (through 2028)

Mining will continue in the Gilmore expansion area (western portion of the pit) through mid-year 2028. A ridge of unmined material between the completed eastern pit bottom and the western pit in the Gilmore expansion area will remain at the completion of mining. Ore from the Gilmore expansion area will be processed at the mill or placed in the Barnes Creek heap leach (BCHL) facility for leaching. Mining will be completed mid-year 2028. The final pit configuration is shown on Figure 1.

Pit dewatering will continue through mid-2028 to provide slope stability and to facilitate continued mining in the Gilmore expansion area. Although pit dewatering is anticipated to limit groundwater inflow to both the eastern and western portions of the pit, direct precipitation, pit wall runoff water, and tailings slurry water will accumulate in the eastern pit lake prior to 2028.

As it receives precipitation, runoff, tailings slurry inflows, and transfers from the TSF decant ponds, the eastern pit lake will continue to fill up to the elevation of the ridge separating the western pit bottom of the Gilmore expansion area, at which point the pit lake will overflow into the western pit area, eventually combining to create one pit lake. As described in Section 6, the pit lake is expected to overflow into the western pit area starting in 2028 and combine into one pit lake in 2029.

2.2 Milling With Tailings Deposition in the Pit (2024 through 2028) and TSF Seepage

Generally, milling at the Site is planned to include ores from three sources: Fort Knox Mine, Gil Mine, and Manh Choh Mine. In 2024, tailings from all three sources were placed via slurry pumping into the eastern pit. Mill tailings from the Gil Mine were deposited in the pit between April and August 2024, but the current mine plan primarily includes Manh Choh tailings placement in the pit from September 2024 through mid-2028. Some Fort Knox tailings will also be transferred to the pit during winter months to prevent line freezing in between quarterly Manh Choh campaigns. During this time, mill process water will be drawn from the TSF North Decant Pond/Barge Pond. Beginning in June 2025, water will be pumped from the pit lake into the TSF ponds for storage and reuse in the milling circuit.

At the end of milling operations, the remaining water in the TSF decant ponds will be transferred to the pit; FGMI estimates that approximately 2,300 acre-feet of water will be transferred at this time. Following mill shut down in 2028, planned reclamation of the north TSF decant pond will begin and a surface water diversion will be constructed. After the pond transfers, runoff to all areas of the TSF will be diverted, allowing for dry closure of the TSF.

Consistent with the Fort Knox Mine Reclamation and Closure Plan (FGMI 2024), a 35-year timeframe (through mid-2063) is assumed for collection and pumpback of TSF toe seepage. Based on recent groundwater modeling and recent observations, flows from the groundwater interception system are expected to decrease from 700 gallons per minute (gpm) in 2028 to 0 gpm by mid-2048 (discussed further in Section 4.6). Beginning in mid-2028, downgradient groundwater pumpback flows will be conveyed into the pit instead of the TSF decant ponds.

2.3 Active Heap Leaching (through 2031)

Heap leaching at the WCHL and BCHL facilities will continue through approximately 2031. After the end of economic leaching, an initial draindown from the heap leach pads will be pumped to the pit lake for 2 to 3 months. After the initial transfer, residual draindown from the heap leach facilities will gravity-flow to the pit throughout the post-closure period.

2.4 Closure (2032 and Beyond)

After the end of mining and active transfers to the pit lake, the pit lake will continue to fill with water from natural discharges including pit-area groundwater inflow, direct precipitation to the pit lake, pit wall runoff, and runoff from disturbed/undisturbed areas above the pit rim that have not been diverted. The pit lake is expected to fill throughout several decades up to the contact between bedrock and Fish Creek alluvium (1,421 feet above mean sea level [amsl]), at which point the pit lake water will begin to flow into the downgradient alluvial groundwater. It is anticipated that once the pit lake level reaches the alluvium, the pit lake will continue to rise to flow into the "Fish Creek aquifer" (i.e., the waste rock overlying tailings on the northeast end of the pit). From there, lake water will flow into the alluvium at the pit boundary and beneath saturated waste rock. There is a possibility that the Fish Creek Aquifer will fill to the point at which water expresses to surface at the former North Pond (at which point the water would flow into engineered drainage channels associated with the former pond), but this possibility is currently being explored with the Fort Knox groundwater flow model. Ultimately, water that flows from the pit into Fish Creek alluvium or over the TSF through engineered drainage channels will discharge to Fish Creek via the wetlands.

3 Closure Water Balance Modeling – Updated Input Data

The existing site-wide closure water balance model was initially developed in 2011 using GoldSim modeling software (www.goldsim.com) to incorporate operational flows from facilities outside the pit area (Schlumberger Water Services [SWS] 2011). The pit lake portion of the site-wide model was based on the original pit lake modeling from 2006 (WMC 2006). The model was updated using GoldSim Version 14.0 R3 based on the current mine plan and closure strategy, described above. Updated Site information, including current and forecasted water flows and water volume data are described below. Water chemistry data were also updated and are described in Section 4. Table 1 provides a summary of updates made between the 2023 model update and this current 2024 update.

3.1 Closure Pit Geometry

The final pit configuration, shown on Figure 1, is based on the Phase 10 mine plan expansion. Stage-volume and stage-surface area curves for the ultimate pit configuration are shown on Figure 2. As noted in Section 2.4, the contact between bedrock and overlying alluvium occurs at 1,421 feet amsl. Based on additional groundwater modeling (Section 3.3.4), once the pit lake stage reaches 1,421 feet amsl, pit lake water will begin to flow into alluvial groundwater toward the TSF. At this point, the pit volume and surface area will be 180,500 acre-feet and

392 acres, respectively (Figure 2). This spill point elevation was selected to represent a conservative estimate at which discharge may occur to the environment via the Fish Creek alluvium; however, it is anticipated that the pit level will continue to rise after contacting the alluvium and will saturate a portion of the Fish Creek aquifer waste rock associated with the Fish Creek East Waste Rock Dump (Figure 3).

3.2 In-Pit Backfill

Previous model updates (e.g., HydroGeologica 2019) accounted for approximately 18 million tons of waste rock that would have been placed within the lower elevations of the eastern pit bottom. However, in-pit waste rock disposal is no longer part of the mine plan and was not included in this pit lake evaluation.

3.3 Pit Water Balance Inflows and Outflows

The closure water balance model tracks the magnitude and timing of flows into and out of the pit during the recovery period. The flows are outlined below, presented in Table 2, and shown on Figure 4:

- Inflows:
  1) Direct precipitation
  2) Undisturbed catchment area runoff
  3) Disturbed catchment area runoff
  4) Waste pile runoff
  5) Pit wall runoff
  6) Groundwater inflow
  7) TSF decant pond transfers
  8) Interception system pumping (TSF seepage and downgradient groundwater)
  9) Draindown and runoff/infiltration from heap leach facilities
  10) Tailings slurry inflows
- Outflows:
  1) Evaporation
  2) Groundwater outflow to alluvium and the Fish Creek aquifer
  3) Pit water pumping (tailings slurry water recycle) during milling

These individual flow components are described further in the following subsections.

3.3.1 Precipitation and Evaporation

The model uses average monthly precipitation based on the Fort Knox Mine operational water balance model (Knight Piésold Consulting [Knight Piésold] 2023; with precipitation data updates through 2024). The average monthly precipitation values are based on a 110 year record combining data from the Fairbanks University Experiment Station and the Fort Knox Station. For January 1915 to September 1990, the Fairbanks University data were scaled to conditions at Fort Knox based on scaling factors developed from the Fairbanks University Experiment Station data and the Fort Knox Station data obtained between 1990 and 2024. For the period from

October 1990 to December 2024, the Fort Knox Station data were used directly. The pit lake model adjusts the monthly precipitation to account for snow; precipitation from November through April is assumed to occur as snow, while half of the precipitation in May and October is assumed to occur as snow. While variable, snowpack melting is assumed to occur from mid-May through mid-July and accounts for an estimated sublimation of 45 percent of the snowpack (HydroGeologica 2019).

The model uses site-specific monthly pan evaporation rates based on the Fort Knox Water Balance Standard Operating Procedure (HydroGeologica 2019). Pan evaporation scaling factors, generally consistent with the fourth quarter 2014 calibrated operational water balance (HydroGeologica 2019), were used for open water (0.75), the leach pads (0.25), undisturbed areas (0.3), and disturbed areas (0.3). Evaporation losses from the pit lake were calculated as the product of the monthly pan evaporation rate (Table 3), the open water scaling factor (0.75), and the pit lake surface area, which changes as a function of pit lake volume/stage (Figure 2). Average monthly precipitation and pan evaporation at the Site are presented in Table 3, below.

Table 3. Average Precipitation and Evaporation

Month	Average Precipitation (Inches)	Average Pan Evaporation (inches)
January	0.7	0.0
February	0.6	0.0
March	0.7	0.0
April	0.4	0.0
May	1.2	1.5
June	2.3	4.5
July	3.2	4.3
August	3.4	2.8
September	2.2	0.8
October	1.0	0.25
November	0.9	0.0
December	0.7	0.0
Total	17.3	14.2

3.3.2 Runoff

Undisturbed areas, disturbed areas, and waste rock dumps within the pit catchment will provide runoff to the pit. Figure 3 shows the areas that may provide runoff within the pit catchment and Table 4 presents runoff areas and parameters. Runoff was calculated as the product of precipitation (Section 3.3.1), the catchment area, and a runoff coefficient. Runoff coefficients were calculated as a function of precipitation, evaporation, and groundwater infiltration as follows:

$$runoff\ coefficient = \left(\frac{precipitation - evaporation}{precipitation}\right) * (1 - infiltration)$$

Average monthly precipitation and evaporation at the Site are presented in Table 2. Infiltration was set as 34 percent of precipitation (6 inches per year), consistent with the groundwater flow model used to model groundwater inflow into the pit (Section 3.3.4).

The undisturbed catchment area is 23 acres. The disturbed catchment area, consisting of haul roads, buildings, yards, and other reworked areas, total 313 acres. In the 2024 pit lake model, the waste pile area within the pit drainage basin was updated from 445 acres to 385 acres to reflect the expansion of the BCHL westward onto the Barnes Creek Waste Rock Dump (Figure 3). In the model, it is assumed that waste pile areas contribute less runoff than undisturbed areas. Specifically, the model assumes that flat and sloped waste pile areas (193 acres each) yield 10 and 55 percent of the runoff per unit area relative to undisturbed areas, respectively; this was accounted for in the model by scaling the waste pile areas down by these percentages when calculating runoff. As a result of Site operations, some runoff from this area is captured and rerouted before entering the pit. Between 2024 and 2028, the fraction of runoff that enters the pit will range from 60 to 85 percent; after 2028, the fraction is 100 percent.

As originally described in the Fort Knox Reclamation and Closure Plan Amendment 1 (FGMI 2021), the Victoria Creek waste rock dump was constructed south of the open pit. This waste rock dump was constructed in a separate surface water catchment area from the pit and therefore it is not anticipated to impact the pit lake water balance. As such, construction of the Victoria Creek waste rock dump does not affect this 2024 model update.

While the BCHL facility is within the pit catchment and the WCHL facility will ultimately drain to the pit, runoff from these features is discussed in Section 3.3.7.

3.3.3 Pit Wall Runoff

Pit wall runoff was calculated based on the precipitation rate onto the pit footprint area, minus the pit lake area. A pit wall runoff coefficient of 35 percent (i.e., 35 percent of precipitation reaches the lake) was applied to account for infiltration and evaporation. However, this pit wall runoff term is only applied in the pit lake model between 2024 and mid-2028, when there is assumed to be no groundwater inflow into the pit. Starting in July 2028, the pit wall runoff term is set to zero because the recharge rate applied to the pit wall areas in the groundwater model already accounts for any runoff that occurs.

3.3.4 Groundwater Inflow

Starting with the 2021 model update (Arcadis 2022a), groundwater inflow into the pit is modeled using a calibrated numerical three-dimensional groundwater flow model developed using MODFLOW-USG code, a publicly available groundwater flow simulation program developed by the U.S. Geological Survey (Panday et al 2015).

First, the groundwater flow model was run using the same surface water inflow parameters used in the GoldSim pit lake model. The groundwater flow model was used to calculate groundwater inflow and outflow rates as a function of time, along with pit lake stage as a function of time. These groundwater model outputs were then combined to develop groundwater inflow vs. lake stage and groundwater outflow vs. lake stage relationships (shown in Figure 5), which were then fed back into the pit lake model to calculate groundwater inflow and outflow in GoldSim as a function of pit lake stage. The original groundwater model for the Site has been described in the Sitewide Groundwater Model Report (Arcadis 2022b).

3.3.5 Tailings Storage Facility Decant Pond Transfers

Between now and 2028, inflows to the TSF include mill process water, direct precipitation, surface runoff, consolidation water, seepage/groundwater from the interception system, and RO system brines. Outflows include evaporation, seepage, entrainment, makeup to the heap leach facilities, and discharge via the RO system. Rather than modeling these flows explicitly, the current pit lake model includes estimated decant pond volumes at closure based on Site operational decision making. TSF decant pond water has been actively managed by FGMI through RO treatment and offsite discharge, with the goal of reducing water inventory prior to closure. Consistent with the current mine plan, the TSF decant ponds will be used to store process water for milling operations. Process water will be pumped from the pit into the TSF decant ponds beginning in June 2025. FGMI estimates that at the end of milling operations (mid-2028), there will be approximately 2,300 acre-feet of water in the North TSF pond and Barge Pond that will be transferred to the pit starting in July 2028. The transfer of this water is assumed to occur over one year (from July 2028 through June 2029). There will not be a separate south TSF pond transfer because the south TSF pond area has been filled with tailings, with runoff water gravity draining to the North Pond.

3.3.6 Interception System Pumping

The interception system collects a mixture of seepage from the TSF and downgradient groundwater. Currently, this water is treated via RO and discharged offsite or recirculated back to the decant ponds; however, starting in 2028, this water will be pumped to the pit. The volume and rate of pumping to the pit during the closure and post-closure periods were calculated as the sum of TSF seepage and groundwater collection.

The groundwater interception system currently collects groundwater at a rate of approximately 700 gpm. Additional groundwater modeling has demonstrated that through time, the groundwater pumping rate can be decreased while remaining in compliance with downgradient groundwater quality standards. Consistent with that modeling, the groundwater interception system pumping rate is assumed to be 700 gpm from July 2028 through June 2038, 200 gpm from July 2038 through June 2048, and 0 gpm thereafter.

Following the transfer of decant pond water to the pit in 2029, it is anticipated that the porewater within the tailings will drain out and the TSF seepage rate will decrease through time from the current rate of approximately 2,000 gpm. The temporal draindown rates were approximated using Darcy’s law, applied to vertical porewater flow. The TSF was divided into coarse and fine tailings components, and drainable volumes and seepage rates were calculated according to the parameters presented in Table 5, below.

Table 5. TSF Seepage Estimate Summary

Parameter	Coarse Tailings	Fine Tailings
Average TSF thickness	247 feet	247 feet
Area	20 percent (150 acres)	80 percent (601 acres)
Drainable porosity	12 percent	10 percent
Drainable volume	4,450 acre-feet	14,540 acre-feet
Hydraulic conductivity	9.9×10^{-6} cm/sec	6.6×10^{-7} cm/sec
Vertical hydraulic gradient	1	1
Seepage rate	951 gpm	255 gpm

Note:
cm/sec = centimeter per second

Based on the parameters above, the TSF seepage rate was approximated as 1,206 gpm (951 + 255 gpm, including drainage from coarse and fine tailings) from 2028 through May 2031 and 205 gpm thereafter (representing residual drainage from fine tailings). Ultimately, TSF draindown will likely be a smooth curve instead of a step-function; however, this estimate is sufficient for the purposes of the pit lake model. Consistent with the Fort Knox Mine Reclamation and Closure Plan (FGMI 2024), it is assumed that TSF seepage will be intercepted for a 35-year timeframe (through 2063); after 2063, it assumed any residual draindown will not result in water quality exceedances in downgradient groundwater.

3.3.7 Barnes Creek and Walter Creek Heap Leach Facilities

Once processing of the leach solution is no longer economical, solution stored in the in-heap ponds and draindown from the leach pads will be pumped to the pit. It is assumed that active heap leaching will continue through the end of 2031, and active transfer of leach solution and draindown will occur in 2032. Based on typical operating volumes, the WCHL pond and the BCHL pond are assumed to have 135 and 169 acre-feet, respectively, that will need to be transferred to the pit.

Process solution draindown rates were not modified from the 2023 model update (Arcadis 2024). A summary of the development of these rates is provided below.

The process solution draindown rates are based on the WCHL draindown analyses developed in 2013 (Knight Piésold 2013), which were developed for the WCHL facility assuming an average pad thickness of 280 feet and a solution application rate of 16,000 gpm. These modeling results were extrapolated to the current configuration (accounting for both WCHL and BCHL) by scaling the draindown rates based on the current combined solution application rate, as follows:

- The application rate assumed for the WCHL draindown modeling was 16,000 gpm (Knight Piésold 2013).
- The current application rates were calculated from recent leach solution flow rates and active heap leaching areas

1) BCHL facility: 0.0053 gallon per minute per square foot (gpm/ft^2) over 36.9 acres = 8,500 gpm
2) WCHL facility: 0.0025 gpm/ft^2 over 145 acres = 15,800 gpm
3) Combined current leach solution application rate of 24,300 gpm.

The scaling factor was calculated as the ratio of the current leach solution application rate (24,300 gpm) to the rate corresponding to the draindown modeling (16,000 gpm); the resulting scaling factor is 1.52. The majority of the process water will drain in the first few months, and residual process water will gravity-drain and be routed to the pit through the post-closure period; this flow rate is estimated to decrease through time to approximately 4 gpm. Initial draindown, occurring in the first year (2032), will total approximately 1,230 acre-feet. Residual draindown from 2033 through pit filling will total approximately 330 acre-feet.

In addition to pond and draindown water, runoff and infiltration of direct precipitation and snowmelt through the pads will also be collected and gravity fed to the pit throughout the closure and post-closure periods at an estimated average annual rate of approximately 466 gpm. This flow rate is estimated based on direct precipitation/snowmelt minus evaporation (with a 25 percent pan evaporation scaling factor) on the pad footprints, also accounting for snow accumulation and sublimation as described in Section 3.3.1. The estimation is based on a 435-acre area for WCHL and accounts for the planned expansion of BCHL from 297 acres to 357 acres (FGMI 2024). From 2032 through pit filling, runoff and infiltration will total approximately 43,800 acre-feet. Long-term flow rates from net precipitation are presented in Table 6, below.

Table 6. Precipitation Flow Through the Heap Leach Pads

Month	Precipitation Through the Pads (gpm)
January	0
February	0
March	0
April	0
May	356
June	1290
July	1445
August	1295
September	997
October	210
November	0
December	0
Average	466

3.3.8 Mill Tailings

Starting in April 2024 and planned to continue through mid-2028, a portion of the tailings produced in the mill is being deposited into the pit. The priority over this timeframe is for placement of Manh Choh tailings in the pit. Mill tailings are pumped as a slurry from the mill into the pit, resulting in accumulation of decant water and formation of a pit lake. Starting in June 2025, water will be pumped from the pit lake to the TSF for storage and reuse in the mill process circuit. These additional inflows (water and solids) and outflows were accounted for in the model as follows:

- Actual recorded processed ore tonnages from April through December 2024 were used in the model (Table 7, below). Based on testing results provided by FGMI, it was assumed that 70 percent of the Fort Knox ore mass, 73 percent of the combined Gil/Fort Knox ore mass, and effectively 100% of the Manh Choh ore mass would remain after processing and would be transferred to the pit as tailings. Using these estimates, the tailings mass deposited in the pit in 2024 was calculated to be approximately 3.6 million tons.
- For 2025 through mid-2028, the following assumptions were applied:
    1) The total amount of tailings to be deposited in the pit was assumed to be 18 million tons, as described in the Reclamation and Closure Plan (FGMI 2024). The remaining 14.5 million tons of capacity following tailings deposition in 2024 was split uniformly throughout the 2025 to mid-2028 timeframe.
    2) A portion of the in-pit tailings will include Fort Knox tailings sent to the pit three months out of the year (winter months when Manh Choh ore is not being processed) at an assumed crusher feed rate of 961 kilotons ore per year to prevent slurry lines from freezing (Table 7).
    3) The remainder of the tailings capacity in the pit is assumed to be reserved for Manh Choh tailings, which was modeled as a crusher feed rate of 3,600 kilotons per year of Manh Choh ore in 2025, 2026, and 2027, and an additional 1,000 kilotons in the first half of 2028 (Table 7). Although these ore feed rates exceed the current Manh Choh mine plan, these higher numbers were used as a conservative basis to meet the in-pit stored tailings quantity as stated in the Reclamation and Closure Plan.
- Water volume added to the pit as part of the tailings slurry was calculated based on measured (for 2024) and planned slurry percent solids. In 2024, the measured average slurry solids content was 30%. From 2025 through 2028, the planned slurry solids content varies between 30 and 35% (annual weighted average of 33.3%) for Fort Knox tailings and between 40 and 45% (annual weighted average of 43.5%) for Manh Choh tailings.
- Process water for milling and slurry transport to the pit will be pumped from the pit starting in June 2025. Since a significant decant pond will have formed over settled tailings in the eastern pit by this time, it was assumed that a slight excess (108%) of the water that flows into the pit with the tailings slurry would be pumped out of the pit for storage in the TSF and reuse in processing. At this recycle rate, the maximum water flow rate from the pit is maintained below the anticipated maximum pumping rate of 3,000 gpm.
- It was assumed that at the end of milling there would be 100 acre-feet of process water within the mill that would be transferred to the pit in July 2028.
- The model accounts for the volume occupied within the open pit by tailings solids and tailings pore space. The model currently assumes a settled tailings porosity of 40 percent. Upon discharge to the pit, the tailings slurry water fully mixes with the lake water, then as the tailings settle, some of the mixed lake water is entrained within tailings pore space. Different options for simulating chemical mixing between tailings pore water and pit lake water through time are described further in Section 4.8.

Table 7. Crusher Feed to Mill (kilotons)

Year	Fort Knox	Gil	Manh Choh	Total
2024	3,274	1,037	568	4,879
2025	961	0	3,600	4,561
2026	961	0	3,600	4,561
2027	961	0	3,600	4,561
2028	961	0	1,000	1,961

4 Closure Water Quality Modeling – Updated Input Data

The closure water balance model includes water chemistry data, which are linked to the individual flow components to calculate chemical mass loading and concentrations through time in the pit lake. The water chemistry input data were updated in the model with recent Site data and information described in this section and presented in Tables 8a and 8b. When calculating averages for water quality data, if all analytical results for a constituent were less than the analytical reporting limit, the concentration for that constituent was set to zero in the water chemistry model. If only some analytical results were less than analytical reporting limit, the average concentration for that location was calculated by substituting all nondetect values with half the reporting limit for the analysis. Derivation of representative water quality data is described below.

Water quality input data (Tables 8a and 8b) and model-calculated solute concentrations (described further below) are compared to Alaska reference standards. The Alaska reference standards were developed based on water quality standards cited in Alaska Department of Environmental Conservation (ADEC) 18 Alaska Administrative Code 70 (amended as of April 13, 2022) and by selecting the lowest of drinking water, aquatic, irrigation, and human health standards for inorganic constituents listed in the Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances (ADEC 2022). Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The hardness correction for these values assumes the hardness of the most likely receiving water after the pit fills and discharges to surface water, either through Fish Creek alluvium flow or flow over the TSF. The long-term average (1999 to the present) calcium and magnesium concentrations at the Upper Wetlands monitoring point were used to calculate a hardness of 130 milligrams per liter (mg/L) as calcium carbonate ($CaCO_3$) for the baseline scenario. Similarly, the ammonia standard was calculated based on the average long-term pH and water temperature of the Upper Wetlands (7.30 standard units [s.u.] and 7.1 degrees Celsius [°C], respectively, for the baseline scenario).

4.1 Direct Precipitation

No updates were made to direct precipitation input chemistry from the 2021 or 2023 pit lake evaluations.

Consistent with the 2019 Update (HydroGeologica 2019), precipitation chemistry was calculated based on the average concentration in samples collected between 2015 and 2017 at station AK01 Poker Creek, Fairbanks North Star Borough, AK as part of the National Atmospheric Deposition Program (NADP [2019]).

4.2 Undisturbed Catchment Area Runoff

No updates were made to undisturbed catchment area runoff input chemistry from the 2021 or 2023 pit lake evaluations.

Background surface water quality data for upper Barnes Creek were used to represent the undisturbed catchment runoff. These data were used in previous pit lake model updates and were based on average data from Upper Barnes Creek (MWH 2004).

4.3 Waste Pile, Pit Wall, and Disturbed Catchment Runoff

No updates were made to waste pile, pit wall, and disturbed catchment runoff input chemistry from the 2021 or 2023 pit lake evaluations; however, as noted in Section 3.3.3, there was a change made to how pit wall runoff is handled in the GoldSim model.

The water quality of waste pile, pit wall, and disturbed catchment runoff was estimated from waste rock testing using the Meteoric Water Mobility Procedure (MWMP). Specifically, MWMP data from annual waste rock samples collected from the Site between 2007 and 2017 were used to estimate the water quality. MWMP results suggest that manganese concentrations may exceed Alaska reference standards (Table 6).

For the 2024 model, pit wall runoff starting in July 2028 is effectively accounted for with the groundwater inflow term. As such, the chemistry of pit wall runoff water is implicitly assigned groundwater inflow chemistry (see Section 4.4 below) rather than disturbed catchment runoff chemistry. This deviation is very minor, given the strong similarity between the estimated groundwater chemistry and disturbed catchment runoff chemistry (Table 8a). Regardless, the effect of pit wall runoff water quality is explored further with the groundwater maximum concentrations sensitivity analysis discussed in Section 8.1.

4.4 Groundwater Inflow

No updates were made to groundwater inflow chemistry from the 2021 or 2023 pit lake evaluations.

Consistent with the 2019 Update (HydroGeologica 2019), water quality data were used from dewatering well samples collected between 2016 and 2018. Specifically, geometric means were calculated for each well location and each pit dewatering sector. Then, calculated water chemistry data for each sector were weighted based on the sector dewatering pumping rates measured in 2018 (Piteau 2018). The flow-weighted average data are presented in Table 8a. The flow-weighted average arsenic concentration (0.016 mg/L) used in the model to represent groundwater inflow to the pit is slightly greater than the reference standard (0.010 mg/L), and the estimated groundwater antimony level (0.006 mg/L) is at the reference standard. These input pit groundwater chemistry data (Table 8a) were consistent with water quality data from samples of mixed pit groundwater directed to the RO system (RO feed). For comparison, these data along with the averaged groundwater chemistry data by pit sector are provided in in Appendix A.

Because groundwater flow is anticipated to be the largest single input to the pit lake during filling (Figure 4) and there is variability in constituent concentrations within pit dewatering wells (Appendix A), a conservative scenario was evaluated (described further in Section 7) using the maximum concentrations of constituents of concern from each of the pit dewatering sectors.

4.5 Tailings Storage Facility Decant Pond Transfers

Water chemistry of the TSF decant pond transfers was assumed to be equivalent to current TSF chemistry (specifically, assigning the 2024 average of Barge Pond water quality), as presented in Table 8b. Recent sample results for the TSF decant ponds contained elevated concentrations of antimony, arsenic, copper, weak acid-dissociable (WAD) cyanide, nitrate, sulfate, and total dissolved solids (TDS) compared to the Alaska reference standards (Table 8b).

4.6 Interception System Pumping

The interception system collects a mixture of seepage from the TSF which collects in the TSF sump and downgradient groundwater pumped from interceptor wells. At present, these water streams are combined and either pumped back up to the TSF decant ponds or sent to RO2 for treatment and discharge. The future water quality of this combined seepage/groundwater interception stream is therefore assumed equal to RO2 feed chemistry. The average of the past two years of data (2023 through 2024) was used to derive the values provided in Table 8a. Concentrations of antimony, WAD-cyanide, nitrate, and TDS were estimated to be greater than the Alaska reference standards.

4.7 Barnes Creek and Walter Creek Heap Leach Facilities

No updates were made to groundwater inflow chemistry from the 2023 pit lake evaluation.

The water chemistry of the process water portion of heap leach transferred to the pit lake was estimated for the modeling based on water quality analyses of pregnant leach solution from 2017 through October 2023. This water chemistry shows that concentrations of pH, aluminum, ammonia, antimony, arsenic, cadmium, copper, WAD-cyanide, iron, mercury, nickel, nitrate, nitrite, selenium, silver, zinc, and TDS are elevated compared with Alaska reference standards (Table 8b). The actual heap process water will likely have lower metals and nitrogen compound concentrations as it enters the pit because the water will first run through the carbon in column plant prior to discharge. As a conservative assumption, this water chemistry estimate is applied to the process water throughout the post-closure period.

Chemistry of the natural infiltration through the pads was represented in the model based on final, rinsed leachate data from column leach-rinse tests performed on spent heap leach material (McClelland 2010; Table 8b). Concentrations of aluminum, arsenic, and WAD-cyanide, as well as pH, were elevated in the leachate compared to Alaska reference standards.

4.8 Mill Tailings

As noted in Section 3.3.8, mill tailings will be conveyed to the pit as a slurry from 2024 through 2028. In 2024, three ore sources were processed with tailings deposition in the pit (Fort Knox, Gil, and Manh Choh); moving forward (2025 through 2028), only Fort Knox and Manh Choh ores will be placed in the pit. Ore is to be processed at the annual rates presented in Table 7. Due to the ore characteristics and subsequent processing needs, the ore will be processed in batches:

- Manh Choh ore will be processed by itself.
- In 2024, Gil ore was processed in a 1:1 ratio with Fort Knox ore.
- In 2025 through 2028, Fort Knox ore will be processed by itself.

Tailings slurry addition to the pit lake adds chemical mass to the pit lake via the water contained in the slurry mixture as the solids are deposited in the bottom of the pit. The model also includes the option of additional, subsequent leaching from tailings after the tailings are placed into the pit lake by assigning additional “leach cycles” on the model dashboard. Additional leaching from the tailings may occur, for example, if the tailings are placed into a large dilute volume when added to the pit and/or are allowed to mix substantially. However, for the purposes of this model, since the tailings are being placed into the pit early on in the pit filling period with low initial water volumes, mixing with pit water is anticipated to be minimal. Accordingly, it is assumed that subsequent leaching of the ore following placement in the pit will also be minimal, and therefore the subsequent leach cycles were set to zero in the base-case simulation. However, the potential effects of additional tailings leaching are investigated along with the effects of tailings pore water burial/isolation in a sensitivity analysis described in Section 8.X below.

As noted above, there are in effect three different processing conditions based on the feed ore with different annual processing rates (Table 7). Therefore, the model accounts for tailings addition to the pit lake as three separate streams with different rates: Fort Knox, Fort Knox/Gil, and Manh Choh. While feed source changes may occur on the order of weeks or months, the model uses the planned annual processing rates, which is sufficient for understanding long-term pit filling and water quality changes.

For each mill tailings stream, chemistry was defined for the slurry water filtrate based on direct sampling of filtrate water or scaling from tailings leachate results (Meteoric Water Mobility Procedure [MWMP] data) as follows (Table 8b):

- Tailings slurry filtrate – represents the water quality of the water contained in the slurry mixture that is conveyed into the pit lake.
    1) Fort Knox: Tailings filtrate median (2015 – 2021) reported in the Gil Mine Geochemistry Report (Kinross 2021). No change was made to this water quality assumption from the 2023 model update.
    2) Manh Choh: In 2024, Manh Choh tailings were placed in the pit, providing the first opportunity to measure field-scale tailings slurry chemistry. The model uses the measured tailings filtrate chemistry collected in September 2024.
    3) Fort Knox/Gil: Direct Fort Knox/Gil tailings slurry filtrate samples were not available; thus, the chemistry was developed from the other sources using professional judgment. For aluminum, antimony, arsenic, manganese, and molybdenum, concentrations were scaled from the Fort Knox/Gil tailings MWMP results (referenced below) based on the ratios observed between MWMP results and tailings slurry filtrate for the Fort Knox and Manh Choh ores. For all other analytes (including major ions and analytes with non-detect values by MWMP), concentrations were assumed equal to Fort Knox Tailings slurry filtrate.
- Tailings solids leachate – represents additional chemical mass that is released from the tailings solids due to leaching in the pit lake. The potential for leaching was determined through MWMP tests. As noted above, the current base-case simulation assumes no additional leaching following tailings deposition in the pit lake, but additional leaching is investigated in a sensitivity scenario. MWMP data sources for each tailings stream include the following:

1) Fort Knox: Tailings MWMP median (2015 – 2021) reported in the Gil Mine Geochemistry Report (Kinross 2021)
2) Manh Choh: Detoxified tailings MWMP (2022 Updated Bulk Leach), reported in Manh Choh Geochemical Characterization Report (SRK 2022)
3) Fort Knox/Gil: Gil Year 2 + Fort Knox MWMP results, reported in Gil Mine Geochemistry Report (SRK 2022).

As noted in Section 3.3.8, the model accounts for the volume occupied within the eastern pit by tailings solids and tailings pore space. The model currently assumes a settled tailings porosity of 40 percent. Upon discharge to the pit, the tailings slurry water fully mixes with the lake water, but then as the tailings settle, some of the mixed lake water is entrained within tailings pore space at the current lake water chemistry at each time step. For sensitivity analysis purposes, there are two options for handling the entrained tailings pore water in the model:

1) **Maintain full exchange between lake water and pore water**. Under this option, tailings pore water is assumed to be in full diffusive contact with lake water, resulting in mass transfer of dissolved solutes between the tailings pore water and lake water. This is accomplished in the model by keeping the tailings pore water within the lake water reservoir, with full mixing assumed (i.e., instantaneous mixing, without advective or diffusive mass transfer limitations).
2) **Isolate the tailings pore water from the lake water**. Under this option, the entrained pore water buried with tailings is assigned the current lake water chemistry at each time step at the time of burial. This tailings pore water is effectively taken out of communication with pit lake water, such that the chemistry of the pore water does not evolve as pit lake chemistry evolves over time (and, for example, tailings pore water solutes do not diffuse into the lake as the lake constituents become more dilute over time with freshwater inputs).

Option 1 was chosen for the base-case model run to provide the more conservative scenario, since this option results in slightly higher solute concentrations in the lake water over the long term.

It was assumed that at the end of milling (end of 2028), there would be leftover process water associated with the mill that will need to be transferred to the pit. It was assumed 100 acre-feet will be transferred on completion of milling in July 2028. The chemistry of this water was set to a 50/50 ratio of the Fort Knox tailings slurry filtrate and the Manh Choh tailings slurry filtrate.

5 Pit Lake Water Quality Geochemical Modeling Methods

No updates were made to the pit lake geochemical modeling methods from the 2021 or 2023 pit lake evaluations; however, the geochemical model was modified to allow the precipitation of copper hydroxide and copper carbonate if saturation is reached, given the observed increased copper concentrations in the pit resulting from Manh Choh tailings slurry filtrate. A summary of geochemical modeling methods is provided below.

The closure pit lake model, developed in GoldSim, was linked with the geochemical equilibrium model, PHREEQC (Parkhurst and Appelo 2013) to simulate geochemical reactions and provide a more realistic estimate of pit lake water chemistry throughout the modeling period. The modeling approach conceptualizes the pit lake as a completely mixed solution that results from instantaneous mixing of inflowing waters with specific chemical loadings. Solute mass rinsed from reactive Site materials was represented based on the geochemical source term data described above.

PHREEQC was used for geochemical speciation, mixing, and reaction modeling conducted for this assessment. This code is publicly available through the U.S. Geological Survey, has been rigorously tested, and has been used in numerous geochemical predictions. PHREEQC is an industry standard tool used to conduct geochemical calculations to predict the chemistry of natural or impacted waters in the environment. This software uses thermodynamic equilibrium speciation calculations to determine the concentration of mixed solutions as they evolve after allowing for mineral precipitation and trace element sorption under imposed gas and redox conditions. The resulting model output contains the aqueous concentrations of simulated elements, the speciation of the aqueous solutes, the solubility of relevant minerals, and the effects of sorption based on number of available sites and competition for weak and strong sorption sites to sorbing minerals. The PHREEQC model used the MINTEQv4 thermodynamic database supplied with the v2.15.02 version of PHREEQC (released March 31, 2013). This database is widely used for geochemical modeling and was selected for this study because it includes the full range of elements present at the Site, as well as key sorption reactions for iron oxyhydroxides (e.g., ferrihydrite). Sorption reactions can be an important process for removing a range of dissolved solutes from solution. Details of the geochemical modelling approach are presented below:

- The mixed pit lake chemistry was equilibrated with a carbon dioxide slightly oversaturated compared to atmospheric conditions (log pCO_2, -3.2), based on observations at mine sites (Eary 1999), and with atmospheric oxygen content (log pO_2, -0.67).
- This solution was equilibrated with specific mineral phases that, if oversaturated, were allowed to precipitate from the solution. The specific minerals (calcite, gypsum, ferrihydrite, and gibbsite) were selected based on literature review of mine waters by Eary (1999), while copper hydroxide ($CuOH_2$) and copper carbonate ($CuCO_3$) were added in the 2024 update due to elevated copper observed in Manh Choh tailings slurry water.
- Adsorption of species (antimony, arsenic, cadmium, copper, lead, nickel, calcium, phosphate, zinc, and sulfate) onto ferrihydrite was simulated according to Dzombak and Morel (1990). The mass of available ferrihydrite was limited to that precipitated by the solution under modeled conditions. For antimony, the MINTEQv4 thermodynamic database was modified slightly by removing the SbO_3^- species in favor of the fully hydrated $Sb(OH)_6^-$ species to be more consistent with the Dzombak and Morel sorption model.
- Non-equilibrium manganese oxidation and precipitation was modeled in GoldSim as a first-order process. It is assumed that dissolved manganese present in Site water is present in the reduced Mn(II) form. Over time, Mn(II) is expected to oxidize in the pit to form Mn (III/IV) oxyhydroxides. The kinetics of abiotic manganese oxidation and loss from the system was estimated using a first-order rate constant, per Morgan (2005), resulting in a half-life of 1.9 years.
- Non-equilibrium WAD-cyanide degradation was modeled in GoldSim as a first-order process. In previous submittals, degradation of WAD-cyanide in the pit lake and in heap leach porewater was approximated by applying of a half-life of 80 days for the first 2.5 years and 1,241 days after 2.5 years (Schafer and Associates 1990). Starting in the 2023 update, the slower (more conservative) half-life of 1,241 days (3.4 years) was used. The cyanide half-life is applied once cyanide is no longer being added to the leach circuit (beginning of 2031).

6 Pit Lake Water Balance Results

The pit lake water balance was modeled in GoldSim based on the flow terms described in Section 3.3 using a 5-day time step from January 2024 through January 2124. The modeled inflows and outflows are presented in Table 2 and shown on Figure 4.

The eastern pit has begun filling in 2024 with the placement of tailings slurry. Emplacement of 18 million tons of tailings is estimated to fill the eastern pit with settled tailings to an elevation of approximately 720 feet (Figure 6). The level of the pit lake (primarily constituting tailings decant water following settling of the slurry) will also rise from 2024 through 2028; assuming an excess pit water recycle (pumping of 108 percent of water inflow starting in June 2025), the lake is not predicted to spill into the western pit until 2028. At that point, the western pit area will begin to fill as the eastern pit overflows and the groundwater dewatering wells are shut off. The western pit is predicted to fill to meet the eastern lake, combining into one pit lake in 2029 (Figure 6).

The pit lake will then continue to fill to the estimated alluvium spillover point (1,421 feet amsl) in September 2089, approximately 65 years after the start of pit lake filling in 2024 (Figure 7); at this stage, the pit lake water volume will be approximately 180,500 acre-feet and the surface area will be 392 acres (Figure 2). The three most significant pit lake inflows (up to the alluvium contact point) will be groundwater inflow (62,100 acre-feet), leach pad flows (45,700 acre-feet), and interception system pumping (33,400 acre-feet). Once the pit lake stage reaches 1,421 feet amsl, pit lake water will begin to flow into Fish Creek alluvium downgradient of the pit toward the current TSF area; as noted above, the pit lake level is anticipated to keep rising, possibly up to the point at which water spills into the former North Decant Pond engineered drainage channels (approximately 1,542 ft amsl). Before contacting the alluvium, the pit lake will act as a hydraulic sink with continued inward hydraulic gradients that maintain groundwater flow toward the pit lake. Ultimately, pit water may flow out of the lake through the alluvium beneath the TSF as well as over alluvium and TSF through drainage channels on the reclaimed TSF, but in both cases the water will ultimately discharge to Fish Creek through the wetlands.

7 Pit Lake Water Quality Results

Model results for pit lake water quality are presented in this section for the baseline scenario and a potential water treatment scenario. Additional pit lake water quality sensitivity analysis scenarios associated with variability in groundwater inflow concentrations, constituent release from buried tailings, and precipitation are presented in Section 8.

Pit lake water chemistry was modeled using a five-day time step from January 2024 through January 2124. Predicted pit lake water quality is presented in Table 9 for select timepoints corresponding with distinct intervals of water management operations or pit lake development events, and concentration vs. time results for arsenic, copper, antimony, and nitrate are shown in Figure 8. Light blue curves show the “unreacted” concentrations (the concentrations governed by loading, mixing, and dilution without geochemical reaction), while the dark blue curves show the concentrations that include geochemical reactions modeled using PHREEQC. Pit lake water quality is summarized below. Overall, when the pit lake begins to flow into alluvium in 2089, with the exception of arsenic and copper, constituent concentrations are less than Alaska water quality standards.

- General chemistry
  1) The pH of the pit lake water is predicted to be circumneutral to slightly alkaline throughout filling (8.11 s.u. in 2089), typical of an alkaline water in equilibrium with atmospheric carbon dioxide.
  2) Alkalinity is variable during early pit filling and then begins to consistently decrease after 2048 toward levels consistent with inflowing groundwater (80 mg/L calcium carbonate). In 2089, pit lake alkalinity is predicted to be 91 mg/L as calcium carbonate. This level of alkalinity throughout filling indicates consistent buffering capacity in the pit lake.
  3) Sulfate and TDS concentrations in the pit lake generally decrease through time from approximately 409 and 952 mg/L, respectively, following the end of milling and tailings deposition in 2028, to approximately 105 and 279 mg/L in 2089, respectively. The decrease in sulfate and TDS concentrations is reflective of dilution of high-sulfate and high-TDS pit lake inputs (tailings slurry water, TSF decant ponds, and leach pad draindown [Tables 8a and 8b]) by groundwater, surface runoff, and precipitation.
- Nitrogen compounds:
  1) Ammonia and nitrate concentrations may exceed the water quality standard during early pit lake filling during mill tailings addition. The maximum nitrate concentration in the pit lake is predicted to be over 40 mg/L in 2028. Nitrate concentrations then decrease to less than the standard after 2080 and will be close to 9 mg/L in 2080 (Table 9, Figure 8). The maximum ammonia concentration in the pit lake is predicted to be approximately over 8.5 mg/L in 2028. Ammonia concentrations then decrease to less than the standard in 2041 and will be approximately 0.7 mg/L in 2089 (Table 9).
  2) WAD-cyanide concentrations are predicted to be at their highest (close to 11 mg/L) in the pit lake following tailings slurry addition. They will initially remain high until addition of tailings slurry to the pit is ceased in 2028, and then concentrations will decrease through time as the result of degradation and dilution, with a slight increase coinciding with draindown of the heap leach facilities. WAD-cyanide is predicted to decrease to less than the water quality standard in 2060 and less than the typical reporting limit (0.001 mg/L) before 2089 (Table 9).
- Metals and metalloids:
  1) With the exception of arsenic, antimony, copper, and selenium, all metals and metalloids are predicted to be less than water quality standards throughout pit filling.
  2) Arsenic concentrations in the pit lake (Figure 8) will increase during early pit filling following tailings slurry addition, heap leach pad draindown, transfer from the TSF decant pond, and pumpback of TSF seepage, which contain arsenic at concentrations greater than the standard (Tables 8a and 8b). Arsenic concentrations decrease over time due to dilution from precipitation, runoff, and groundwater inflows, although the groundwater inflow may still exhibit arsenic concentrations above the water quality standard. In the previous pit lake model (Arcadis 2024), arsenic was predicted to decrease to below the water quality standard before the pit level reached the alluvium, due to adsorption to iron introduced into the pit with groundwater interception below the TSF. However, with updated chemistry for this flow stream, the iron concentration in the pit will not be sufficient to fully attenuate the arsenic, and it is currently predicted to be 0.02 mg/L (above the water quality standard) in 2089.
  3) Copper concentrations in the pit lake will increase during early pit filling with tailings slurry inflows. Based on operations and data collected in 2024, elevated copper concentrations are particularly anticipated when processing Manh Choh ore due to elevated copper concentrations in the ore, as well as greater cyanide demand in the mill (which in turn requires a greater level of copper-catalyzed cyanide

destruction). Copper concentrations in the Manh Choh slurry filtrate were up to nearly 30 mg/L in 2024 (Table 8b). The primary control on copper concentrations in the pit (following copper oxidation and decreasing complexation by cyanide) includes precipitation as copper hydroxide, which at the predominant pit pH near 8.1 yields an equilibrium copper concentration of 0.13 mg/L (at least one order of magnitude higher than the hardness-based water quality standard; Figure 8).

4) Antimony concentrations in the pit lake (Figure 8) will increase during early pit filling following tailings slurry inflows, transfers from the TSF decant ponds, and pumpback of TSF seepage, which contain antimony at concentrations greater than the standard (Tables 8a and 8b). Unlike copper, elevated antimony concentrations are predicted to be more associated with Fort Knox ore than with Manh Choh ore. Over time, antimony concentrations are predicted to decrease as tailings slurry and TSF inflows are diluted with other pit inputs. At the time of pit spillover into alluvium in 2089, the predicted antimony concentration (0.0058 mg/L) is below the water quality standard (0.006 mg/L).
5) Selenium concentrations in the pit lake will increase during early pit filling during tailings slurry inflows, which contain selenium at concentrations greater than the standard (Table 8b). Selenium concentrations decrease over time due to dilution. Selenium concentrations peak at approximately 0.037 mg/L in 2028 and decrease below the standard in 2047. At the time of pit spillover into alluvium in 2089, the predicted selenium concentration is 0.0026 mg/L (Table 9).

Overall, the baseline model scenario indicates that copper and arsenic will exceed water quality standards when the pit lake reaches the alluvium in 2089. Although antimony and nitrate are close to water quality standards in 2089, the base-case scenario currently predicts these constituents will be within the limits.

Arcadis understands that based on FGMI's waste management permit, a water treatment plan may be required if model predictions suggest that any analytes will be above water quality standards at the time of contact with alluvium. The current model results suggest that water management may be required during or following tailings deposition in the pit to ensure that long-term arsenic and copper concentrations come below the water quality standards in the future. The concentrations of these constituents may be managed in numerous ways, from operational refinements and/or water treatment within the mill prior to discharge to the pit, to options involving treatment of pit water within the pit itself. Particularly for copper, which was conservatively assumed at the maximum measured concentration for Manh Choh slurry water, mill management and optimization is currently being explored to decrease loading to the pit.

Assuming copper and arsenic may require treatment, a scenario was evaluated with the pit lake model to estimate treatment reagent requirements to achieve long-term water quality objectives. In this scenario, an iron-based approach was used to simultaneously remove copper and arsenic from pit water. The simulation assumes a worst-case scenario in which copper and arsenic loads remain constant through tailings deposition to 2028 with no water treatment. The treatment approach involved dosing of the combined TSF interception water stream (TSF seepage and groundwater interceptor wells) with ferrous sulfate, starting in July 2028. This water is then sent to the pit, where the ferrous iron oxidizes, precipitates as an oxyhydroxide, and removes copper and arsenic via adsorption. The required ferrous sulfate concentration was iteratively adjusted in the model to achieve arsenic and copper concentrations below water quality standards.

Water treatment simulation results are shown in Figure 9 (light blue curves are concentrations before reaction, dark blue curves provide simulated concentrations after reactions with iron). Key observations include the following:

- Treatment of both copper and arsenic required a ferrous sulfate dosing at 150 mg/L iron in the TSF interception system water for a period of at least 12 years (2028 through 2040). This quantity of iron was only just sufficient to reduce copper concentrations to below the hardness-based water quality standard, but the model predicts that copper concentrations remain below the standard for the remainder of the model run. Although this scenario results in additional mass load of sulfate to the pit during treatment, this sulfate load is balanced by dilution, and the maximum sulfate concentration in the pit does not exceed the maximum value just above 400 mg/L observed in 2028 (Table 9).
- The tested quantity of iron was far more than sufficient to remove the arsenic present in the pit lake. Arsenic concentrations quickly come down from a maximum near 0.3 mg/L to below the 0.01 mg/L water quality standard within the first few months of dosing, suggesting that if the treatment only needed to target arsenic and not copper, the treatment demand would be substantially less.

As noted above, this treatment scenario represents a worst-case involving in-pit treatment of excessively high arsenic and copper concentrations following little to no active management during tailings deposition. Additional water management should be considered during milling to minimize long-term treatment requirements within the pit.

8 Model Sensitivity Analyses

Variables identified as having some degree of uncertainty and potentially affecting the model predictions include the highly variable chemistry of groundwater entering the pit, long-term interactions of pit lake water with tailings deposited in the eastern pit, and potentially variable long-term precipitation. These variables were evaluated in the model with sensitivity analyses presented below.

8.1 Groundwater Maximum Concentrations

Groundwater flow is anticipated to be the largest single input to the pit lake during filling (Figure 4 and Table 2) and, through time, pit lake chemistry is predicted to approach that of groundwater. However, there is considerable variability in constituent concentrations observed in pit dewatering wells, which were used to derive representative groundwater inflow chemistry (Table 8a). This variability was controlled by flow-weighting the chemistry from each of the dewatering sectors, as described in Section 4.4. However, a conservative model scenario was also evaluated in which groundwater was assumed to have the maximum metal/metalloid concentrations from each pit dewatering sector (Appendix A). In addition, it was noted that pit wall runoff after 2028 was effectively accounted for in the model through the groundwater inflow term. Therefore, this sensitivity analysis also included the potential for additional loading from pit walls as groundwater and wall runoff enter the pit. For metals that exhibited concentrations in disturbed catchment runoff water (represented by waste rock MWMP results) higher than the maximum groundwater concentration, the waste rock MWMP result was used instead. This was the case for aluminum, barium, cadmium, copper, phosphorus, and potassium, for which the undisturbed catchment runoff value was used (Table 8a); for all other constituents, the maximum metal/metalloid concentration in Appendix A was used. pH and alkalinity were held constant (consistent with the flow-weighted average [Table 8a]) and no other changes were made to the model. The selected groundwater chemistry for this dataset exceeds water quality standards for antimony, arsenic, and lead.

Water quality results for this model scenario are presented in Table 10. Similar to the baseline model scenario, when the pit lake reaches the contact with alluvium (2089), arsenic and copper are exceeding the water quality standard, while antimony also exceeds the water quality standard in 2089 in the sensitivity scenario. Specific observations include the following:

- Whereas the predicted arsenic concentration is slightly higher in the sensitivity analysis scenario at alluvial contact (0.023 mg/L vs. 0.020 mg/L in the baseline scenario), the copper concentration is the same (0.13 mg/L) because the aqueous concentration is controlled by copper hydroxide solubility.
- Like the baseline scenario, ammonia, WAD-cyanide, nitrate, selenium, sulfate, and TDS exceed water quality standards for discrete periods of time during early pit filling. However, each constituent decreases to less than their respective water quality standards by 2089 (Table 10).
- Like the baseline scenario, antimony concentrations in the pit lake increase during early pit filling following tailings slurry inflows, transfers from the TSF decant ponds, and pumpback of TSF seepage, which contain antimony at concentrations greater than the standard (Table 8b). Antimony concentrations then slowly decrease over time. However, because the groundwater inflow term in this scenario contains antimony concentrations greater than the water quality standard (Appendix A), antimony exceeds the water quality standard when the pit lake reaches the contact with alluvium (2089) with a concentration of 0.0085 mg/L.
- Within 20 years following pit water contact in the alluvium, the model predicts that lead will exceed the hardness-based water quality standard of 0.0044 mg/L. This result is due to the natural occurrence of lead in one groundwater sample approximately an order of magnitude higher than other locations (Appendix A), and it is likely that this lead result in unimpacted groundwater is not representative.

Overall, this model scenario demonstrates that even with conservative assumptions regarding groundwater inflow chemistry (the single largest pit inflow), pit chemical concentrations relative to water quality standards are similar to the baseline scenario, although it does highlight the need to monitor antimony concentrations closely as the pit fills to ensure it will not exceed when lake water begins flowing out of the pit.

8.2 Tailings Solute Release Sensitivity Analysis

As tailings are placed into the pit, they are anticipated to settle/compact and exhibit minimal influence on overlying pit lake water quality in the long term. However, there is some uncertainty as to how residual constituent load may be released from the tailings. As described in Sections 3.3.8 and 4.8, the tailings pore water is accounted for in the model with options for simulating mass transfer/mixing between lake water and tailings water. In addition, it is possible that the tailings may leach additional solutes into solution beyond the solute concentrations present in slurry water at the time of deposition. An option for simulating additional leaching from tailings is included in the model based on tailings MWMP results (Section 4.8).

The base-case model assumes that the tailings pore water remains in full diffusive/mixing contact with the lake through time, but it does not assume additional leaching from tailings. The sensitivity analysis considered here includes a comparison of long-term lake water quality under the following four scenarios:

1) Tailings pore water isolated from the pit lake
2) Tailings pore water in full mixing/diffusive contact with the pit lake (the base-case scenario)
3) Mixing contact between tailings pore water and the pit lake, plus constituent release equivalent to one MWMP cycle

4) Mixing contact between tailings pore water and the pit lake, plus constituent release equivalent to two MWMP cycles

The results of this evaluation are included in Table 11, with comparison of the results for each of the four scenarios when the pit level reaches the alluvium (1421 feet in 2089) and 20 years later (2109).

Overall, the results for these four scenarios are very similar. Arsenic and copper continue to exceed water quality standards in 2089, with increase in arsenic concentrations with additional solute loading, ranging from 0.017 mg/L with no tailings pore water contact, up to 0.051 mg/L with release of tailings pore water and additional tailings leaching. As with the groundwater concentration sensitivity analysis, copper concentrations remain the same because the concentration is governed by mineral solubility. Similar to the groundwater concentration sensitivity analysis, antimony also begins to exceed the water quality standard with additional constituent loading, but the simulations indicate that antimony comes back below the water quality standard within 20 years of pit lake alluvial contact. No other constituents are predicted to exceed water quality standards as the pit lake reaches the alluvium in this scenario.

8.3 Precipitation Sensitivity Analysis

Additional model runs were conducted to evaluate the sensitivity of the pit lake filling and chemistry to variation in annual precipitation at the Site during the post-closure period. The average annual precipitation record was increased and decreased by 20 percent to evaluate the effect on the resulting pit lake filling curve, time to overflow, and pit lake water quality. The year in which the pit lake stage reaches the contact with the alluvium ranges from 2081 to 2101 for the high and low precipitation scenarios, respectively.

Water chemistry results for the high and low precipitation scenarios are presented in Tables 12 and 13, respectively. In the high precipitation scenario, results were similar to the baseline scenario: arsenic and copper are the only two parameters that exceed water quality standards when the pit lake reaches alluvium (2081 in this simulation). In the low precipitation scenario, antimony also exceeds the water quality standard when the pit lake contacts the alluvium in 2101), but it is predicted to come back down below the standard within 20 years following contact with alluvium.

9 Pit Lake Stratification Analysis

Consistent with the previous pit lake model updates, the potential for permanent pit lake stratification was evaluated using several lines of evidence, including pit lake geometry, density gradients, and wind shear stress. This memorandum uses the same methods, updated with the current model results.

As in natural lakes, mine pit lakes may permanently or seasonally stratify vertically. Stratification in pit lakes is caused by density differences in the water column, which are based on temperature and salinity/TDS differences. Factors that affect circulation include geometry of the lake (i.e., surface area to depth ratio) and surface wind shear stress. Mixing or seasonal turnover of lake waters generally results when the shallower portion of the lake exhibits water movement from wind shear and other currents or increasing surface water density due to lower seasonal atmospheric temperatures sufficient to displace the deeper, denser water in the lake.

Permanent stratification of the Fort Knox pit lake would affect pit lake water quality in the developing zones. A permanently stratified (meromictic) lake would result in a bottom layer that does not mix with the upper water column. Based on the Fort Knox closure concepts, the lower layer would likely be dominated by the higher TDS waters from the tailings slurry inflows, decant pond transfers, and heap leach facility draindown water mixed with groundwater. The upper mixed water zones (mixolimnion) would undergo seasonal turnover based on seasonal temperature changes and would generally reflect a mixture of groundwater, surface/pit wall runoff, and direct precipitation. This zone would be in contact with the upper alluvium through which a significant portion of the groundwater discharge is predicted to occur.

Simple analytical equations were applied to provide a screening-level assessment for evaluating stratification potential in the pit lake. These equations were developed by Tchobanoglous and Schroeder (1985), U.S. Army Corps of Engineers (USACE 1986 and 1987), Jewell (2009), and Boehrer and Schultze (2009). Key factors considered in this screening level evaluation are presented in Table 14. During active water transfers to the pit lake (e.g., decant pond pumping, heap leach facility draindown, interception system pumping) and tailings deposition with pit water pumping/reuse for mill process water, it is expected that the pit lake water will be thoroughly mixed. Therefore, stratification potential was evaluated beginning in year 2033 (after active pumping into and out of the pit lake), 9 years after the start of pit lake filling.

The results of the analytical calculations (Table 13) suggest there is a potential for permanent stratification in the pit lake during the post-closure period due to the relatively small pit lake surface area to depth ratio, shallow wind mix depth, and long residence times. Given the higher TDS of tailings slurry water, the densities of the runoff and mixed operational waters are more different than in previous estimates (Arcadis 2024). Although colder surface water in the pit lake during the fall may be sufficiently dense to cause turnover to some depth, there is a strong potential for permanent stratification limiting mixing with deep, high-TDS water. The likelihood and depth of seasonal turnover are uncertain, and additional modeling beyond GoldSim and the analytical expressions used here may be required to assess potential for and ultimate depth of stratification.

If permanent stratification were to occur, it would serve to isolate a portion of the higher TDS water at depth and would be anticipated to improve water quality in the upper portions of the pit lake. As such, the assumption of a well-mixed pit lake in the GoldSim model is conservative for the purposes of water quality evaluation.

10 Conclusions and Recommendations

The pit lake model constructed using GoldSim was updated in 2024 to reflect updated data collected at the Site, as well as updated mine planning reflected in the Fort Knox Mine Reclamation and Closure Plan (FGMI 2024). Conclusions from this updated evaluation include the following:

- During the several decades following mine closure, the pit lake will act as a hydraulic sink with continued inward hydraulic gradients that maintain groundwater flow toward the pit lake. During this period, pit lake water will not discharge to the environment, and the water surface will be separated from the ground surface by steep high walls.
- Based on the current mine reclamation and closure concepts, the updated pit lake water balance model indicates that the pit lake will fill up to the Fish Creek alluvium at an elevation of 1,421 feet amsl in 2089, approximately 65 years after beginning to fill. At that time, pit lake water will begin to flow into the alluvium and to mix with downgradient groundwater.
- After contacting alluvium, the pit lake is predicted to continue to rise, possibly up to the point at which it will flow through waste rock and into engineered drainage channels at the former North Decant Pond at an

elevation of 1542 ft. Ultimately, however, lake water discharging to the alluvium and to TSF drainage channels will all flow to Fish Creek via established wetlands.

- The updated model predictions indicate that the pit lake chemistry will be alkaline (pH approximately 8.11 s.u.), with alkalinity between 90 and 100 mg/L as calcium carbonate, and moderate to high TDS (up to 1,100 mg/L before decreasing) throughout pit filling.
- Most water quality constituents are predicted to remain at concentrations less than the Alaska water quality standards for the entire model simulation period; however, arsenic and copper are currently predicted to exceed water quality standards throughout the model timeframe, remaining above standards when the pit lake contacts alluvium in 2089.
- Due to their predicted exceedances, arsenic and copper are likely to require additional water management strategies, potentially including water treatment. A water treatment scenario was run in this evaluation, demonstrating that an iron-based treatment is likely capable of removing copper and arsenic from pit water.
- Concentrations of nitrate, ammonia, TDS, sulfate, and WAD-cyanide are predicted to be greater than water quality standards during early pit filling; however, these constituent concentrations are predicted to decrease to less than the standards before the pit lake reaches the contact with alluvium.
- Antimony and selenium are also predicted to be greater than water quality standards during early pit filling; however, these constituent concentrations are predicted to decrease to less than the standards before the pit lake reaches the contact with alluvium. Antimony concentrations are predicted to be borderline when the pit lake reaches alluvium, suggesting that antimony will need to be closely monitored and may require additional water management.
- Even with conservative assumptions regarding groundwater inflow chemistry (assuming maximum concentrations from each of the pit dewatering sectors), pit constituent concentrations relative to water quality standards are similar to the baseline scenario. Antimony begins to exceed water quality standards when the pit lake contacts alluvium in certain model sensitivity scenarios (when using maximum groundwater concentrations, when additional tailings leaching is simulated, and under long-term low precipitation conditions).
- Variability in precipitation rates (+/- 20 percent) were evaluated using sensitivity modeling; the rate of filling to the spill point elevation varied by -8 to +12 years, with minimal water quality changes other than an increase in potential antimony exceedances with lower precipitation as noted above.
- A screening-level evaluation of stratification indicates that there is potential for the pit lake to become permanently stratified, with pit lake geometry representing the driving factor. However, the densities of the runoff and operational waters indicate that seasonal turnover could occur to some depth. Permanent stratification would likely improve the water quality of pit lake water discharging to the environment once the lake level reaches the spill point elevation. The near-surface water quality, in direct contact with the alluvium, would likely reflect a mixture of precipitation, surface/pit wall runoff, and groundwater. More detailed modeling may be required to verify stratification and provide additional detail in the water quality predictions.

Based on the updated modeling results, the following recommendations should be considered:

- The pit lake model should be updated, as needed, to reflect any changes in the Fort Knox Mine reclamation and closure plan and water management system and as additional Site data become available.
- Given the prediction that arsenic, copper, and potentially antimony concentrations will exceed water quality standards when the pit lake level reaches the alluvium, additional water management scenarios should be

considered. These considerations should first include potential optimization of mill processes, followed by consideration of short-term or long-term water treatment options. Arcadis understands that FGMI is already in the process of evaluating water management options to mitigate long-term water quality risks.

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Tables

Table 1
Model Updates Summary
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

Model Component/Sub-Unit	Changes Incorporated in the 2024 Pit Lake Evaluation
General	• Precipitation updated to more recent data set (KP, January 2025)
Chemistry Inputs	Input chemistry updated for the following components: • Downgradient pumpback wells (Updated to an average of recent RO2 Feed data) • Barge Pond (updated to average of more recent dataset [December 2024]) • Manh Choh tailings slurry water chemistry (updated to September 2024 tailings filtrate data)
Pit Lake	• Groundwater inflow vs. pit lake stage relationship was updated based on 2024 MODFLOW results • Pumping/dewatering set to end on 7/1/2028. • Runoff term for waste rock total area adjusted from 445 acres to 385 (accounting for increase in Barnes Creek Heap Leach area)
Leach Pads	• Barnes Creek Heap Leach Pond Volume updated from 297 to 357 acres
TSF Seepage	• TSF seepage draindown function start was shifted from 1/1/2029 to 7/1/2028, consistent with maintenance of a TSF decant pond • Similarly, downgradient groundwater pumpback (assumed to occur for 20 years from closure) was shifted to start 7/1/2028 • Downgradient groundwater pumpback rate for 7/1/2028 to 6/30/2028 was updated to 700 gpm based on current observations
TSF Decant Ponds	• Changed mill/process water discrete transfer to 100 acre-feet (instantaneous on 7/1/2028) • Changed North Pond transfer to 2,300 acre-feet from 7/1/2028 to 6/30/2029 (assumed transfer occurs over one year).
Mill Tailings Deposition	• Milling rates for Fort Knox, Gil, and Manh Choh were revised. No Gil tailings sent to pit after September 2024 • Deposition rates of mill tailings slurry in the pit from the three different tailings streams (Fort Knox, combined Fort Knox and Gil, and Manh Choh) were revised. • Slurry Percent Solids was updated for each of the different tailings streams (2024 Average: 30% by mass, Fort Knox/Gil: 33.3% by mass, Manh choch: 43.5% by mass) • Date for beginning water recycle was updated to 6/1/2025 • Water recycle rate (% slurry water input) was adjucted to 108% to decrease lake volume while staying below 3,000 gpm max • Tailings mineral density was updated from 2.6 kg/L to 3.3 kg/L based on tailings density and solids content estimates • Tailings pore water assumed to be in diffusive/mixing contact with lake water

Table 2
Fort Knox Closure Pit Lake Water Balance Summary
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

Closure Pit Lake Modeling Period	Results Date	Pit Filling Elapsed Time (years)	Pit Lake Elevation (feet amsl)	Pit Lake Volume (acre-feet)	Closure Pit Lake Water Balance Modeling Component											
					Cumulative Inflow (acre-feet)										Cumulative Outflow (acre-feet)	
					Direct Precipitation	Undisturbed Catchment Runoff	Disturbed Catchment Runoff	Pit Wall Runoff	Waste Pile Runoff	Groundwater Inflow	TSF Decant Pond Transfers	Interception System Pumping	Net Tailings Water Deposition	Heap Leach Facility Flows	Lake Evaporation	Groundwater Outflow
Pit filling starts (beginning of 2024)	1/1/2024	0	--	--	--	--	--	--	--	--	--	--		--	--	0
End of Milling and Tailings Addition to Pit (Mid-2028)	7/1/2028	5	820	9,654	298	42	566	1,604	226	7	0	3	7,121	0	-213	0
End of North Decant Pond transfer to pit (Mid-2029)	7/1/2029	6	822	16,695	403	55	751	1,608	300	1,364	2,306	3,077	7,121	0	-291	0
Pit lake prior to leach pad draindown	1/1/2032	8	882	27,719	859	92	1,254	1,608	501	4,703	2,306	9,877	7,121	0	-603	0
Heap leach pads initial draindown period (1 year of draindown)	1/1/2033	9	914	33,191	1,063	106	1,439	1,608	575	6,010	2,306	11,421	7,121	2,288	-747	0
20 years of filling	1/1/2044	20	1,091	71,129	3,953	255	3,474	1,608	1,389	19,207	2,306	23,933	7,121	10,676	-2,793	0
40 years of filling	1/1/2064	40	1,275	124,157	11,074	527	7,175	1,608	2,868	39,980	2,306	33,410	7,121	25,928	-7,840	0
Pit lake up to alluvium spill point	9/16/2089	66	1,421	176,320	22,572	879	11,961	1,608	4,782	62,067	2,306	33,410	7,121	45,659	-16,011	-34
Pit lake approximately 20 years after spill to alluvium	9/17/2109	86	1,492	206,153	32,837	1,151	15,662	1,608	6,261	76,318	2,306	33,410	7,121	60,915	-23,289	-8,148

Acronyms and Abbreviations:
-- = not applicable
amsl = above mean sea level
TSF = tailings storage facility

Table 4
Runoff Terms Summary
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

Feature	Area Within Pit Catchment (acres)	Chemistry	Runoff Coefficient	Infiltration Coefficient	Evaporation (inches/year)	Runoff (inches/year)
Pit wall	898 (maximum, decreases as pit fills)	Waste rock MWMP	0.35	Not defined/modeled	Not defined/modeled	5.2
Undisturbed catchment area	23	Background surface water	Ranges from 0 to 0.59. Calculated monthly as: ((precip - evap)/precip)x(1-infil)	0.34	Pan evap with 0.3 scaling factor	7.1
Disturbed catchment area	313	Waste rock MWMP	Ranges from 0 to 0.59. Calculated monthly as: ((precip - evap)/precip)x(1-infil)	0.34	Pan evap with 0.3 scaling factor	7.1
Waste piles	385 (scaled area used = 125)	Waste rock MWMP	Ranges from 0 to 0.59. Calculated monthly as: ((precip - evap)/precip)x(1-infil)	0.34	Pan evap with 0.3 scaling factor	2.3
Heap leach pads	792	Rinsed ore MWMP	Runoff and infiltration are combined because there is a liner with leachate collection. Calculated as net precip minus net evap.		Pan evap with 0.25 scaling factor	14

Acronyms and Abbreviations:
evap = evaporation
infil = infiltration
MWMP = Meteoric Water Mobility Procedure
precip = precipitation

Table 8a
Input Chemistry Data for the 2023 Pit Lake Model Update - Precipitation, Runoff, and Groundwater
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

Water Quality Modeling Input Data			Precipitation	Undisturbed Catchment Runoff	Waste Pile, Disturbed Catchment, and Pit Wall Runoff	Groundwater Inflow to Pit	TSF Seepage and Groundwater Downgradient of the TSF
Parameter	Alaska Water Quality Standards		NADP Site AK01, Fairbanks Site Precipitation Chemistry	Upper Barnes Creek, Background Data	Waste Rock MWMP Data 2007-2017	Flow-Weighted 2016-2018 Dewatering Well Samples	Average of samples from RO2 Feed Water 1/1/2023 through December 2024.
	Standard	Basis					
pH (s.u.)	6.5 - 8.5	WQS	5.2	7.0	NA	7.6	7.06
Alkalinity as $CaCO_3$	> 20	AQ(c)	0	15	116	80	123
Aluminum	0.087	AQ(c)	0	0	0.14	0.016	0.025
Ammonia	5.08	AQ(c)	0.066	0.010	0	0.027	0.045
Antimony	0.006	DW	0	0.0025	0.004	0.006	0.013412
Arsenic	0.01	DW	0	0.003	0.0049	0.016	0.00092
Barium	2	DW	0	0.005	0.0083	0.0034	0.0263
Cadmium	0.00033	AQ(c)	0	0.0001	0.000055	0.00005	0.000026
Calcium	NA	NA	0	4.4	28	33	93.4
Chloride	230	AQ(c)	0.055	0.7	2	1.4	45.7
Chromium	0.1	DW	0	0.0020	0.00041	0.00072	0.0100
Copper	0.0117	AQ(c)	0	0	0.0043	0.00035	0.0009
WAD-cyanide	0.0052	AQ(c)	0	0	0	0	0.0312
Fluoride	1	IRR	0	0.06	0.34	0.34	0.000
Iron	1	AQ(c)	0	0.22	0.049	0.058	0.12
Lead	0.0044	AQ(c)	0	0.0040	0.00020	0.0015	0.000057
Magnesium	NA	NA	0.0053	1.6	4.6	5	21.3
Manganese	0.2	IRR	0	0	0.053	0.023	0.07
Mercury	0.00005	HH	0	0.00030	0	0	0
Nickel	0.065	AQ(c)	0	1.0	0.001	0.0011	0.0080
Nitrate, as N	10	DW	0.14	0.25	2.4	0.93	22.56
Nitrite, as N	1	DW	0	0.01	0	0.11	0.00634
Phosphorus	NA	NA	0	0.08	0.04	0.011	0.123
Potassium	NA	NA	0.012	0.5	8.4	1	6.24
Selenium	0.005	AQ(c)	0	0.002	0.00041	0.00049	0.001560
Silver	0.0064	AQ(a)	0	0.001	0	0	0
Sodium	NA	NA	0.025	2	16	13	66.1
Sulfate	250	WQS	0.13	6.7	0	99	214.6
Zinc	0.150	AQ(c)	0	0.003	0.0091	0.0023	0.006
TDS	500	WQS	0	80	152	247	626

Notes:
1. Shaded cells indicate value exceeds Alaska water quality standards.
2. All data are in milligrams per liter (mg/L), unless otherwise noted.
3. For calculating averages, if all results for a location were nondetect, a value of zero was used for modeling. Otherwise, averages were calculating using one-half of the reporting limit for nondetect results.
4. Alaska water quality standards based on ADEC 18 Alaska Administrative Code 70 (amended as of April 13, 2022) and Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances (ADEC 2022). Value shown is the lowest standard of drinking water, irrigation, stock water, aquatic, or human health standards.
5. Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations in the pit lake at the spill point elevation (Table 9) were used to calculate the hardness value of 124 mg/L as $CaCO_3$.
6. The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spill point elevation (Table 9). The temperature was assumed to be 10 degrees Celsius, which is the long-term average of pit dewatering well groundwater.

Acronyms and Abbreviations:
AC(a) = aquatic standard (acute)
ADEC = Alaska Department of Environmental Conservation
AQ(c) = aquatic standard (chronic)
$CaCO_3$ = calcium carbonate
DW = drinking water standard
HH = human health criteria for noncarcinogens
IRR = irrigation standard
MWMP = Meteoric Water Mobility Procedure
NA = not available or not applicable
NADP = National Atmospheric Deposition Program
s.u. = standard unit
TDS = total dissolved solids
TSF = tailings storage facility
WAD = weak-acid dissociable

Reference:
ADEC. 2022. Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances. September 8.

Table 8b
Input Chemistry Data for the 2023 Pit Lake Model Update - TSF, Leach Pad, and Tailings Deposition
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

Water Quality Modeling Input Data			Current North TSF Decant Pond Chemistry	Heap Leach Draindown Chemistry		Fort Knox Tailings Slurry Filtrate	Fort Knox Tailings Leachate	Fort Knox/Gil Tailings Slurry Filtrate	Fort Knox/Gil Tailings Leachate	Manh Choh Tailings Slurry Filtrate	Manh Choh Tailings Leachate	Final Process Water Transfer
Parameter	Alaska Water Quality Standards		Average of 2024 Quarterly Barge Pond Water Quality Samples	Average of Pregnant Leach Solution Samples, January 2019 through October 2023	Post-Final Rinse MWMP Extract (column testing, 2010)	Fort Knox Tailings Filtrate Median (2015-2021), reported in Gil Mine Geochemistry Report (Table 4)	Fort Knox Tailings MWMP Median (2015 - 2021), reported in Gil Mine Geochemistry Report (Table 5)	Scaled from Fort Knox/Gil Tailings Leachate Results as Described in Report	Gil Year 2 + Fort Knox MWMP results, reported in Gil Mine Geochemistry Report (Table 5)	Tailings Filtrate Data, September 2024	Detoxified Tailings - Manh Choh Master Composite (Air) (2022 Updated Bulk Leach), reported in Manh Choh Geochemical Characterization Report	50/50 Mixture of Fort Knox and Manh Choh Tailings Slurry Filtrate
	Standard	Basis										
pH (s.u.)	6.5 - 8.5	WQS	7.17	10	9.2	9.5	9.2	7.9	7.9	9.38	7.9	9.4
Alkalinity as $CaCO_3$	> 20	AQ(c)	113	147	48	55	102	54	54	106	73	81
Aluminum	0.087	AQ(c)	0.078	0.203	0.32	1.89	0.669	0.195	0.069	0.132	0.669	1.0
Ammonia	5.08	AQ(c)	2.13	16.9	NA	0	0	0	0.71	14.7	0	7
Antimony	0.006	DW	0.0123	0.00645	0	0.021	0.0153	0.00892	0.0065	0.004	0.010	0.013
Arsenic	0.01	DW	0.0331	0.0325	0.021	0.060	0.070	0.434	0.19	0.504	0.70	0.282
Barium	2	DW	0.0363	0.0139	0	0.040	0.0050	0.040	0	0.005	0.0050	0.022
Cadmium	0.00033	AQ(c)	0.000047	0.0043	0	0.00020	0	0.00020	0	0.0001	0	0.00014
Calcium	NA	NA	112.7	152	5	42.0	4.5	42.0	6.1	245	4.5	144
Chloride	230	AQ(c)	53.2	92.3	0	63.0	45.2	63.0	2.8	207	45.2	135
Chromium	0.1	DW	0	0.0085	0	0	0.0009	0	0	0	0	0
Copper	0.0117	AQ(c)	0.501	0.609	0	0.300	0.0010	0.30	0	29.60	0.17	14.95
WAD-cyanide	0.0052	AQ(c)	0.514	54.5	0.027	11	0.0060	11	0.053	10.50	0.20	10.8
Fluoride	1	IRR	0.46	0.578	0	0.80	2.0	0.8	0	0.31	0	0.56
Iron	1	AQ(c)	0.196	1.54	0	1.67	0.612	1.67	0.14	1.2	0.50	1.4
Lead	0.0044	AQ(c)	0.000103	0.000138	0	0.0019	0.0003	0.0019	0	0.00064	0.17	0.0013
Magnesium	NA	NA	17.57	0.905	0	0.90	0.30	0.90	0	3.00	0.30	1.95
Manganese	0.2	IRR	0.072	0.012	0	0.0060	0	0.024	0.012	0.010	0.010	0.0080
Mercury	0.00005	HH	0	0.00141	0	0	0	0	0	0	0	0
Nickel	0.065	AQ(c)	0.046	0.13	0	0.060	0	0.060	0	0.069	0	0.065
Nitrate, as N	10	DW	32.47	100	0	28	1.18	28	0	45.4	11	36.7
Nitrite, as N	1	DW	0.397	6.93	0.065	1.26	0.060	1.26	0.15	0.49	0	0.9
Phosphorus	NA	NA	0.04	0.0155	0	0.030	0.030	0.030	0	0.157	0.030	0.094
Potassium	NA	NA	7.56	5.55	1.9	15.8	20	15.8	2.2	8.77	20	12.3
Selenium	0.005	AQ(c)	0.00216	0.00905	0	0.0034	0.00080	0.0034	0	0.061	0.030	0.0323
Silver	0.0064	AQ(a)	0	0.020	0	0	0	0.098	0	0	0	0
Sodium	NA	NA	94.1	143	18	120	84.5	120	24	238	200	179
Sulfate	250	WQS	278	99	8	153	17.7	153	8.4	644	760	399
Zinc	0.150	AQ(c)	0	0.817	0	0.100	0	0.10	0	0	0	0.050
TDS	500	WQS	784	1091	100	584	280	226	79	1660	1500	1122

Notes:
1. Shaded cells indicate value exceeds Alaska water quality standards.
2. All data are in milligrams per liter (mg/L), unless otherwise noted.
3. For calculating averages, if all results for a location were nondetect, a value of zero was used for modeling. Otherwise, averages were calculating using one-half of the reporting limit for nondetect results.

4. Alaska water quality standards based on ADEC 18 Alaska Administrative Code 70 (amended as of April 13, 2022) and Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances (ADEC 2022). Value shown is the lowest standard of drinking water, irrigation, stock water, aquatic, or human health standards.

5. Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations in the pit lake at the spill point elevation (Table 9) were used to calculate the hardness value of 124 mg/L as $CaCO_3$.

6. The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spill point elevation (Table 9). The temperature was assumed to be 10 degrees Celsius, which is the long-term average of pit dewatering well groundwater.

Acronyms and Abbreviations:
AC(a) = aquatic standard (acute)
ADEC = Alaska Department of Environmental Conservation
AQ(c) = aquatic standard (chronic)
$CaCO_3$ = calcium carbonate
DW = drinking water standard
HH = human health criteria for noncarcinogens
IRR = irrigation standard
MWMP = Meteoric Water Mobility Procedure
MWMP = Meteoric Water Mobility Procedure
NA = not available or not applicable
NADP = National Atmospheric Deposition Program
s.u. = standard unit
TDS = total dissolved solids
TSF = tailings storage facility
WAD = weak-acid dissociable

Reference:
ADEC. 2022. Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances. September 8.

Table 9
2024 Closure Pit Lake Water Chemistry Predictions: Base Case Scenario
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

		Date	1/1/2025	7/1/2028	7/1/2029	1/1/2033	1/1/2044	1/1/2064	9/16/2089	9/17/2109
		Years of Pit Lake Filling	1	5	6	9	20	40	66	86
		Pit Lake Elevation (feet)	737	820	822	915	1092	1276	1421	1493
Parameter	Alaska Water Quality Standards		1 year of filling	End of Milling and Tailings Addition to Pit (Mid-2028)	End of North Decant Pond transfer to pit (Mid 2029)	Heap leach pads initial draindown period (1 year of draindown)	20 years of filling	40 Years of Filling	Pit Lake up to Alluvium Spill Point	Pit Lake Approximately 20 Years after Spill to Alluvium
	Standard	Basis								
pH (s.u.)	6.5 - 8.5	WQS	7.82	7.18	7.89	8.07	8.12	8.12	8.11	8.10
Alkalinity as $CaCO_3$	> 20	AQ(c)	55	< 15	62	89	96	96	91	89
Aluminum	0.087	AQ(c)	0.0048	< 0.004	0.0058	0.0085	0.0094	0.0093	0.0090	0.0088
Ammonia	5.08	AQ(c)	2.1	8.2	5.0	3.4	1.6	1.0	0.7	0.6
Antimony	0.006	DW	0.0125	0.0091	0.00996	0.00962	0.00814	0.00687	0.00576	0.00523
Arsenic	0.01	DW	0.082	0.232	0.141	0.070	0.034	0.023	0.020	0.019
Barium	2	DW	0.0321	0.0169	0.0200	0.0180	0.01404	0.01100	0.00851	0.00743
Cadmium	0.00033	AQ(c)	0.000169	0.000115	0.000083	0.000282	0.000152	0.000104	0.000086	0.000078
Calcium	NA	NA	69.4	152.9	124.3	98.9	70.6	55.1	44.6	40.0
Chloride	230	AQ(c)	77.9	136.3	94.7	63.8	38.3	25.89	18.58	15.46
Chromium	0.1	DW	< 0.0002	< 0.0002	0.00193	0.00402	0.00379	0.00308	0.00229	0.00194
Copper	0.0117	AQ(c)	1.95	0.97	0.88	0.60	0.13	0.13	0.13	0.13
WAD-cyanide	0.0052	AQ(c)	9.92700	9.54300	5.59000	3.75800	0.19400	0.00322	< 0.001	< 0.001
Fluoride	1	IRR	0.69	0.48	0.37	0.28	0.22	0.22	0.23	0.23
Iron	1	AQ(c)	0.1757	0.0135	0.0240	0.0064	< 0.002	< 0.002	< 0.002	< 0.002
Lead	0.00444	AQ(c)	0.00029	0.00062	0.00019	0.00020	0.00026	0.00033	0.00039	0.00041
Magnesium	NA	NA	1.52	2.44	8.26	10.37	9.76	8.30	6.69	5.96
Manganese	0.2	IRR	0.01	0.01	0.02	0.02	0.00	0.0013	0.0005	0.00041
Mercury	0.00005	HH	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel	0.065	AQ(c)	0.0575	0.0604	0.0437	0.0323	0.0190	0.0140	0.0122	0.0114
Nitrate, as N	10	DW	31.3	43.8	34.4	29.6	18.2	12.6	9.3	7.8
Nitrite, as N	1	DW	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phosphorus	NA	NA	0.048	0.099	0.088	0.078	0.062	0.049	0.037	0.032
Potassium	NA	NA	14.11	11.06	8.80	6.67	4.97	4.08	3.54	3.32
Selenium	0.005	AQ(c)	0.01131	0.03508	0.02091	0.01140	0.00573	0.00352	0.00257	0.00216
Silver	0.0064	AQ(a)	< 0.00002	< 0.00002	0.00092	0.00276	0.00219	0.00166	0.00119	0.00099
Sodium	NA	NA	127	174.2	127.2	90.2	59.1	44.1	35.5	31.8
Sulfate	250	WQS	209	409	322	234	166.4	129.4	104.5	93.1
Zinc	0.150	AQ(c)	0.0755	0.0347	0.0212	0.0542	0.0282	0.0184	0.0144	0.0127
TDS	500	WQS	577	952	767	594	428	339	279	252

Notes:
1. Shaded cells indicate value exceeds Alaska water quality standards.
2. All data are in milligrams per liter (mg/L), unless otherwise noted.
3. The basis for Alaska water quality standards are summarized in Tables 8a and 8b.
4. Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations within the potential receiving water (upper wetlands) were used to calculate an average hardness value of 130 mg/L as $CaCO_3$.
5. The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spill point elevation. The temperature was assumed to be 10 degrees Celsius, which is the long-term average of pit dewatering well groundwater and the middle of the range observed at the Fresh Water Reservoir.

Acronyms and Abbreviations:
< = calculated value was less than typical laboratory reporting limit; value shown is the typical reporting limit
> = greater than
AC(a) = aquatic standard (acute)
AQ(c) = aquatic standard (chronic)
$CaCO_3$ = calcium carbonate
DW = drinking water standard
HH = human health criteria for noncarcinogens
IRR = irrigation standard
NA = not available or not applicable
s.u. = standard unit
TDS = total dissolved solids
WQS = Water Quality Standard

Table 10
Maximum Groundwater Concentration Sensitivity Analysis Results
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

		Date	1/1/2025	7/1/2028	7/1/2029	1/1/2033	1/1/2044	1/1/2064	9/16/2089	9/17/2109
		Years of Pit Lake Filling	1	5	6	9	20	40	66	86
		Pit Lake Elevation (feet)	737	820	822	915	1092	1276	1421	1493
Parameter	Alaska Water Quality Standards		1 year of filling	End of Milling and Tailings Addition to Pit (Mid-2028)	End of North Decant Pond transfer to pit (Mid 2029)	Heap leach pads initial draindown period (1 year of draindown)	20 years of filling	40 Years of Filling	Pit Lake up to Alluvium Spill Point	Pit Lake Approximately 20 Years after Spill to Alluvium
	Standard	Basis								
pH (s.u.)	6.5 - 8.5	WQS	7.82	7.18	7.89	8.07	8.12	8.12	8.10	8.09
Alkalinity as $CaCO_3$	> 20	AQ(c)	55	< 15	61	89	96	95	91	89
Aluminum	0.087	AQ(c)	0.0048	< 0.004	0.0058	0.0084	0.0093	0.0093	0.0089	0.0087
Ammonia	5.08	AQ(c)	2.1	8.2	5.0	3.4	1.6	1.0	0.7	0.6
Antimony	0.006	DW	0.0125	0.0091	0.01059	0.01100	0.01021	0.00935	0.00846	0.00797
Arsenic	0.01	DW	0.082	0.232	0.141	0.071	0.035	0.025	0.023	0.021
Barium	2	DW	0.0321	0.0169	0.0204	0.0189	0.01536	0.01257	0.01023	0.00917
Cadmium	0.00033	AQ(c)	0.000169	0.000115	0.000083	0.000282	0.000153	0.000106	0.000088	0.000080
Calcium	NA	NA	69.4	152.9	124.6	99.6	71.7	56.3	46.0	41.4
Chloride	230	AQ(c)	77.9	136.3	94.9	64.3	39.1	26.76	19.53	16.41
Chromium	0.1	DW	< 0.0002	< 0.0002	0.00383	0.00820	0.01005	0.01056	0.01046	0.01022
Copper	0.0117	AQ(c)	1.95	0.97	0.88	0.60	0.14	0.13	0.13	0.13
WAD-cyanide	0.0052	AQ(c)	9.92700	9.54300	5.59000	3.75800	0.19400	0.00322	< 0.001	< 0.001
Fluoride	1	IRR	0.69	0.48	0.41	0.36	0.35	0.37	0.39	0.39
Iron	1	AQ(c)	0.175700	0.013540	0.023980	0.006402	< 0.002	< 0.002	< 0.002	< 0.002
Lead	0.00444	AQ(c)	0.00029	0.00062	0.00058	0.00129	0.00260	0.00372	0.00444	0.00467
Magnesium	NA	NA	1.52	2.44	8.80	11.55	11.53	10.42	9.01	8.31
Manganese	0.2	IRR	0.01	0.01	0.03	0.02	0.01	0.0030	0.0014	0.00111
Mercury	0.00005	HH	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel	0.065	AQ(c)	0.0575	0.0604	0.0450	0.0352	0.0233	0.0191	0.0177	0.0171
Nitrate, as N	10	DW	31.3	43.8	34.5	29.7	18.5	12.9	9.6	8.2
Nitrite, as N	1	DW	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phosphorus	NA	NA	0.048	0.099	0.090	0.083	0.070	0.058	0.047	0.043
Potassium	NA	NA	14.11	11.07	9.41	8.00	6.96	6.46	6.14	5.95
Selenium	0.005	AQ(c)	0.01131	0.03508	0.02093	0.01144	0.00579	0.00359	0.00264	0.00223
Silver	0.0064	AQ(a)	< 0.00002	< 0.00002	0.00092	0.00276	0.00219	0.00166	0.00119	0.00099
Sodium	NA	NA	127	174.2	128.0	92.0	61.8	47.4	39.0	35.3
Sulfate	250	WQS	209	409	326	242	179.1	144.5	121.0	109.8
Zinc	0.150	AQ(c)	0.0755	0.0347	0.0217	0.0554	0.0300	0.0205	0.0167	0.0151
TDS	500	WQS	577	952	773	608	449	364	306	280

Notes:
1. Shaded cells indicate value exceeds Alaska water quality standards.
2. All data are in milligrams per liter (mg/L), unless otherwise noted.
3. The basis for Alaska water quality standards are summarized in Tables 8a and 8b.
4. Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations within the potential receiving water (upper wetlands) were used to calculate an average hardness value of 130 mg/L as $CaCO_3$.
5. The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spill point elevation. The temperature was assumed to be 10 degrees Celsius, which is the long-term average of pit dewatering well groundwater and the middle of the range observed at the Fresh Water Reservoir.

Acronyms and Abbreviations:
< = calculated value was less than typical laboratory reporting limit; value shown is the typical reporting limit
> = greater than
AC(a) = aquatic standard (acute)
AQ(c) = aquatic standard (chronic)
$CaCO_3$ = calcium carbonate
DW = drinking water standard
HH = human health criteria for noncarcinogens
IRR = irrigation standard
NA = not available or not applicable
s.u. = standard unit
TDS = total dissolved solids
WQS = Water Quality Standard

Table 11
Tailings Solute Release Sensitivity Analysis
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

Date			9/16/2089 - Pit Lake up to Alluvium Spill Point				9/17/2109 - Pit Lake Approximately 20 Years after Spill to Alluvium			
Years of Pit Lake Filling			62				82			
Pit Lake Elevation (feet)			1421				1498			
Parameter	Alaska Water Quality Standards		Isolated Tailings Pore Water	Mixed Tailings Pore Water	Pore Water + 1 Additional Leach	Pore Water + 2 Additional Leaches	Isolated Tailings Pore Water	Mixed Tailings Pore Water	Pore Water + 1 Additional Leach	Pore Water + 2 Additional Leaches
	Standard	Basis								
pH (s.u.)	6.5 - 8.5	WQS	8.11	8.11	8.12	8.13	8.10	8.10	8.11	8.12
Alkalinity as $CaCO_3$	> 20	AQ(c)	93	91.3	94	97	90	89	91	94
Aluminum	0.087	AQ(c)	0.0091	0.0090	0.0092	0.0095	0.0089	0.0088	0.0090	0.0092
Ammonia	5.08	AQ(c)	0.6	0.7	0.7	0.7	0.5	0.6	0.6	0.6
Antimony	0.006	DW	0.0057	0.0058	0.0061	0.0065	0.0052	0.0052	0.0055	0.0058
Arsenic	0.01	DW	0.017	0.020	0.036	0.051	0.017	0.019	0.032	0.045
Barium	2	DW	0.0084	0.0085	0.0087	0.0088	0.00730	0.00743	0.00755	0.00768
Cadmium	0.00033	AQ(c)	0.000085	0.000086	0.000086	0.000086	0.000077	0.000078	0.000078	0.000078
Calcium	NA	NA	43.1	44.6	44.8	44.9	38.6	40.0	40.1	40.2
Chloride	230	AQ(c)	16.8	18.6	20.0	21.3	14.0	15.46	16.57	17.69
Chromium	0.1	DW	0.00232	0.00229	0.00229	0.00230	0.00197	0.00194	0.00195	0.00195
Copper	0.0117	AQ(c)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
WAD-cyanide	0.0052	AQ(c)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Fluoride	1	IRR	0.22	0.23	0.24	0.26	0.23	0.23	0.24	0.25
Iron	1	AQ(c)	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Lead	0.00444	AQ(c)	0.00040	0.00039	0.00037	0.00036	0.00042	0.00041	0.00039	0.00038
Magnesium	NA	NA	6.76	6.69	6.70	6.71	6.01	5.96	5.97	5.98
Manganese	0.2	IRR	0.00	0.00	0.00	0.00	0.00	0.0004	0.0004	0.00041
Mercury	0.00005	HH	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel	0.065	AQ(c)	0.0114	0.0122	0.0122	0.0121	0.0108	0.0114	0.0114	0.0114
Nitrate, as N	10	DW	8.7	9.3	9.5	9.8	7.4	7.8	8.0	8.2
Nitrite, as N	1	DW	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phosphorus	NA	NA	0.036	0.037	0.038	0.039	0.032	0.032	0.033	0.034
Potassium	NA	NA	3.42	3.54	4.14	4.75	3.22	3.32	3.81	4.31
Selenium	0.005	AQ(c)	0.00209	0.00257	0.00326	0.00394	0.00176	0.00216	0.00272	0.00329
Silver	0.0064	AQ(a)	0.00121	0.00119	0.00119	0.00119	0.00100	0.00099	0.00099	0.00099
Sodium	NA	NA	33	35.5	40.7	45.9	30.0	31.8	36.0	40.3
Sulfate	250	WQS	100	105	122	139	89.3	93.1	107.3	121.7
Zinc	0.150	AQ(c)	0.0140	0.0144	0.0144	0.0143	0.0124	0.0127	0.0127	0.0127
TDS	500	WQS	269	279	305	332	244	252	274	296

Notes:

1. Shaded cells indicate value exceeds Alaska water quality standards.
2. All data are in milligrams per liter (mg/L), unless otherwise noted.
3. The basis for Alaska water quality standards are summarized in Tables 8a and 8b.
4. Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations within the potential receiving water (upper wetlands) were used to calculate an average hardness value of 130 mg/L as $CaCO_3$.
5. The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spill point elevation. The temperature was assumed to be 10 degrees Celsius, which is the long-term average of pit dewatering well groundwater and the middle of the range observed at the Fresh Water Reservoir.

Acronyms and Abbreviations:

< = calculated value was less than typical laboratory reporting limit; value shown is the typical reporting limit
> = greater than
AC(a) = aquatic standard (acute)
AQ(c) = aquatic standard (chronic)
$CaCO_3$ = calcium carbonate
DW = drinking water standard
HH = human health criteria for noncarcinogens
IRR = irrigation standard
NA = not available or not applicable
s.u. = standard unit
TDS = total dissolved solids
WQS = Water Quality Standard

Table 12
High Precipitation Sensitivity Analysis Results
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

		Date	**1/1/2025**	**7/1/2028**	**7/1/2029**	**1/1/2033**	**1/1/2044**	**1/1/2064**	**6/15/2081**	**6/16/2101**
		Years of Pit Lake Filling	**1**	**5**	**6**	**9**	**20**	**40**	**57**	**78**
		Pit Lake Elevation (feet)	**740**	**820**	**822**	**922**	**1111**	**1310**	**1421**	**1507**
Parameter	**Alaska Water Quality Standards**		**1 year of filling**	**End of Milling and Tailings Addition to Pit (end of 2028)**	**End of North Decant Pond transfer to pit (end of 2029)**	**Heap leach pads initial draindown period (1 year of draindown)**	**20 years of filling**	**40 Years of Filling**	**Pit Lake up to Alluvium Spill Point**	**Pit Lake Approximately 20 Years after Spill to Alluvium**
	Standard	**Basis**								
pH (s.u.)	6.5 - 8.5	WQS	7.83	7.26	7.89	8.07	8.11	8.11	8.10	8.09
Alkalinity as $CaCO_3$	> 20	AQ(c)	56	15.7	62	89	95	93	89	86
Aluminum	0.087	AQ(c)	0.0050	< 0.004	0.0058	0.0084	0.0092	0.0091	0.0088	0.0085
Ammonia	5.08	AQ(c)	2.0	7.9	5.0	3.4	1.6	0.9	0.7	0.6
Antimony	0.006	DW	0.0123	0.0089	0.00980	0.00941	0.00773	0.00638	0.00554	0.00490
Arsenic	0.01	DW	0.0809	0.22610	0.139300	0.069220	0.033330	0.023010	0.020640	0.01898
Barium	2	DW	0.0317	0.0167	0.0197	0.0177	0.01338	0.01028	0.00847	0.00720
Cadmium	0.00033	AQ(c)	0.000167	0.000114	0.000083	0.000273	0.000144	0.000097	0.000083	0.000073
Calcium	NA	NA	68.6	149.5	122.7	97.1	67.4	51.5	43.7	38.1
Chloride	230	AQ(c)	76.5	132.8	93.5	62.8	36.6	24.10	18.77	15.08
Chromium	0.1	DW	< 0.0002	< 0.0002	0.00186	0.00387	0.00356	0.00283	0.00225	0.00185
Copper	0.0117	AQ(c)	1.93800	0.88520	0.86900	0.57910	0.13490	0.13400	0.13410	0.13420
WAD-cyanide	0.0052	AQ(c)	9.74300	9.30200	5.55300	3.67900	0.18510	0.00317	< 0.001	< 0.001
Fluoride	1	IRR	0.68	0.47	0.37	0.28	0.22	0.21	0.22	0.22
Iron	1	AQ(c)	0.168100	0.018760	0.023320	0.005703	< 0.002	< 0.002	< 0.002	< 0.002
Lead	0.00444	AQ(c)	0.00028	0.00053	0.00019	0.00019	0.00026	0.00032	0.00035	0.00036
Magnesium	NA	NA	1.57	2.48	8.06	10.07	9.23	7.69	6.50	5.63
Manganese	0.2	IRR	0.01	0.01	0.02	0.01	0.00	0.0013	0.0005	0.00041
Mercury	0.00005	HH	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel	0.065	AQ(c)	0.0568	0.0594	0.0436	0.0324	0.0189	0.0140	0.0127	0.0118
Nitrate, as N	10	DW	30.7	42.7	33.9	28.9	17.3	11.7	9.3	7.6
Nitrite, as N	1	DW	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phosphorus	NA	NA	0.048	0.098	0.087	0.077	0.059	0.046	0.037	0.032
Potassium	NA	NA	13.99	10.97	8.81	6.68	4.91	4.03	3.63	3.37
Selenium	0.005	AQ(c)	0.01111	0.03416	0.02074	0.01131	0.00553	0.00332	0.00261	0.00212
Silver	0.0064	AQ(a)	< 0.00002	< 0.00002	0.00089	0.00266	0.00205	0.00152	0.00119	0.00095
Sodium	NA	NA	125	170.1	125.7	88.9	57.0	42.0	35.6	31.2
Sulfate	250	WQS	205	398	317	229	157.8	119.5	100.8	87.0
Zinc	0.150	AQ(c)	0.0742	0.0341	0.0212	0.0527	0.0268	0.0171	0.0142	0.0122
TDS	500	WQS	569	930	757	584	409	318	273	241

Notes:

1. Shaded cells indicate value exceeds Alaska water quality standards.
2. All data are in milligrams per liter (mg/L), unless otherwise noted.
3. The basis for Alaska water quality standards are summarized in Tables 8a and 8b.
4. Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations in the pit lake at the spill point elevation were used to calculate the hardness value of 115 mg/L as $CaCO_3$.
5. The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spill point elevation. The temperature was assumed to be 10 degrees Celsius, which is the long-term average of pit dewatering well groundwater and the middle of the range observed at the Fresh Water Reservoir.

Acronyms and Abbreviations:

< = calculated value was less than typical laboratory reporting limit; value shown is the typical reporting limit
> = greater than
AC(a) = aquatic standard (acute)
AQ(c) = aquatic standard (chronic)
$CaCO_3$ = calcium carbonate
DW = drinking water standard
HH = human health criteria for noncarcinogens
IRR = irrigation standard
NA = not available or not applicable
s.u. = standard unit
TDS = total dissolved solids
WQS = Water Quality Standard

Table 13
Low Precipitation Sensitivity Analysis Results
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

Date			1/1/2025	7/1/2028	7/1/2029	1/1/2033	1/1/2044	1/1/2064	9/19/2101	9/19/2121
Years of Pit Lake Filling			1	5	6	9	20	40	78	98
Pit Lake Elevation (feet)			735	816	822	908	1073	1241	1421	1478
Parameter	Alaska Water Quality Standards		1 year of filling	End of Milling and Tailings Addition to Pit (Mid-2028)	End of North Decant Pond transfer to pit (Mid-2029)	Heap leach pads initial draindown period (1 year of draindown)	20 years of filling	40 Years of Filling	Pit Lake up to Alluvium Spill Point	Pit Lake Approximately 20 Years after Spill to Alluvium
	Standard	Basis								
pH (s.u.)	6.5 - 8.5	WQS	7.81	7.07	7.89	8.07	8.13	8.13	8.12	8.11
Alkalinity as $CaCO_3$	> 20	AQ(c)	53	< 15	61	90	99	99	94	93
Aluminum	0.087	AQ(c)	0.0047	< 0.004	0.0058	0.0085	0.0095	0.0096	0.0092	0.0091
Ammonia	5.08	AQ(c)	2.1	8.4	5.1	3.5	1.7	1.0	0.7	0.6
Antimony	0.006	DW	0.0127	0.0092	0.01012	0.00984	0.00860	0.00746	0.00608	0.00567
Arsenic	0.01	DW	0.0839	0.23780	0.141400	0.069740	0.034360	0.023980	0.020140	0.01913
Barium	2	DW	0.0326	0.0171	0.0204	0.0184	0.01478	0.01184	0.00859	0.00771
Cadmium	0.00033	AQ(c)	0.000171	0.000117	0.000083	0.000291	0.000161	0.000113	0.000090	0.000084
Calcium	NA	NA	70.3	156.5	125.9	100.8	74.2	59.3	46.1	42.4
Chloride	230	AQ(c)	79.4	140.0	95.8	64.9	40.3	27.98	18.41	15.87
Chromium	0.1	DW	< 0.0002	< 0.0002	0.00201	0.00417	0.00406	0.00338	0.00233	0.00205
Copper	0.0117	AQ(c)	1.96700	1.19200	0.88320	0.62970	0.13490	0.13370	0.13360	0.13360
WAD-cyanide	0.0052	AQ(c)	10.12000	9.79700	5.62000	3.83900	0.20390	0.00327	< 0.001	< 0.001
Fluoride	1	IRR	0.70	0.48	0.37	0.28	0.23	0.22	0.24	0.24
Iron	1	AQ(c)	0.183300	0.008779	0.024610	0.007217	< 0.002	< 0.002	< 0.002	< 0.002
Lead	0.00444	AQ(c)	0.00030	0.00072	0.00020	0.00020	0.00027	0.00035	0.00044	0.00046
Magnesium	NA	NA	1.46	2.40	8.49	10.68	10.36	9.03	6.97	6.39
Manganese	0.2	IRR	0.01	0.01	0.02	0.02	0.00	0.0014	0.0004	0.00037
Mercury	0.00005	HH	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Nickel	0.065	AQ(c)	0.0582	0.0615	0.0437	0.0323	0.0191	0.0139	0.0115	0.0109
Nitrate, as N	10	DW	31.8	44.9	34.9	30.2	19.3	13.7	9.3	8.1
Nitrite, as N	1	DW	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phosphorus	NA	NA	0.048	0.100	0.089	0.079	0.065	0.052	0.037	0.033
Potassium	NA	NA	14.23	11.16	8.79	6.66	5.03	4.14	3.42	3.24
Selenium	0.005	AQ(c)	0.01152	0.03605	0.02106	0.01147	0.00595	0.00375	0.00253	0.00220
Silver	0.0064	AQ(a)	< 0.00002	< 0.00002	0.00096	0.00287	0.00235	0.00182	0.00120	0.00103
Sodium	NA	NA	130	178.6	128.6	91.6	61.5	46.6	35.3	32.3
Sulfate	250	WQS	213	420	328	239	176.1	141.1	110.0	101.1
Zinc	0.150	AQ(c)	0.0769	0.0354	0.0211	0.0558	0.0299	0.0198	0.0147	0.0133
TDS	500	WQS	586	975	777	605	449	363	287	266

Notes:
1. Shaded cells indicate value exceeds Alaska water quality standards.
2. All data are in milligrams per liter (mg/L), unless otherwise noted.
3. The basis for Alaska water quality standards are summarized in Tables 8a and 8b.
4. Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations in the pit lake at the spill point elevation were used to calculate the hardness value of 131 mg/L as $CaCO_3$.
5. The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spill point elevation. The temperature was assumed to be 10 degrees Celsius, which is the long-term average of pit dewatering well groundwater and the middle of the range observed at the Fresh Water Reservoir.

Acronyms and Abbreviations:
< = calculated value was less than typical laboratory reporting limit; value shown is the typical reporting limit
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AC(a) = aquatic standard (acute)
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$CaCO_3$ = calcium carbonate
DW = drinking water standard
HH = human health criteria for noncarcinogens
IRR = irrigation standard
NA = not available or not applicable
s.u. = standard unit
TDS = total dissolved solids
WQS = Water Quality Standard

Table 14
Stratification Analyses Summary
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

Parameter	Description	Result in 2033	Unit	Indicators for Stratification
Density of pit wall runoff	Uses a temperature of 4 °C and pit wall runoff TDS of 152 mg/L to compute the maximum density of surface inflow.	1000.12	kg/m^3	N/A
Density of mixed operational inflows through 2032	Density of mixed operational water at 10 °C and mixed TDS of 978 mg/L to compute the density of the pit lake water in year 2032, when operational flows are no longer directed to the pit lake.	1000.49	kg/m^3	N/A
Density difference	Operational flow density at year 2032 minus pit wall runoff density	0.3743	kg/m^3	Positive number indicates heavier water at depth, supporting the potential for stratification.
Pit lake depth	Pit lake surface elevation minus pit lake bottom elevation.	476	feet	Relative to most natural lakes, the pit lake is deep (maximum depth of 1,000 feet once completely full). Deeper lakes are more likely to stratify than shallow lakes.
Reservoir length	Based on the pit lake area. Assumed the area was a circle to use average diameter.	3,090	feet	Used to determine thermocline depth and wind mixing.
Relative depth	Ratio of maximum depth to diameter of the reservoir.	15%	%	Smaller relative depths indicate greater influence of wind in disrupting thermal stratification.
Hydraulic residence time	Volume of the pit divided by net inflow rate	10	years	Once operational transfers are complete, the net inflow rate to the pit is very small compared to the total volume of water, so residence time is long.
Flushing rate	Inverse of hydraulic residence time. Inflow rate to the pit divided by total volume of the pit.	0.11	day^{-1}	If flushing rate is less than 10 day^{-1}, the reservoir may stratify. The result for Fort Knox is very small, so this indicates that stratification is likely.
Storm event flushing rate	Flushing rate of a single storm event. Average inflow rate for a 5-inch, 1-day precipitation event divided by reservoir volume.	0.0065	day^{-1}	If flushing rate is less than 0.5, the storm may not mix the reservoir.
Wind mix depth	The maximum wind mixing depth given surface temperature and wind speed. Assumes no wind mixing during the winter when the lake is covered in ice.	14.8	feet	Lakes with depths greater than the wind mix depth will be likely to stratify.
Froude number	Ratio of inertial to buoyancy forces. The geometry of the system heavily influences this number, as well as the density gradient.	<0.1	unitless	Values less than 1/pi Indicates strong potential for stratification.
Thermocline depth	Thermocline thickness is a function of wind strength and duration, but the calculation used is an empirical estimate relating thermocline thickness to reservoir length.	14.9	feet	Compared to pit lake maximum depth, this number is small, indicating that the lake may stratify.
Wedderburn number	Comparison of density gradient to velocity shear.	2.7 to 7.8	unitless	Values greater than 1 indicate that wind mixing is less likely to cause pit turnover, supporting stratification.

Acronyms and Abbreviations:
°C = degree Celsius
kg/m^3 = kilogram per cubic meter
mg/L = milligram per liter
N/A = Not applicable
TDS = total dissolved solids

Figures

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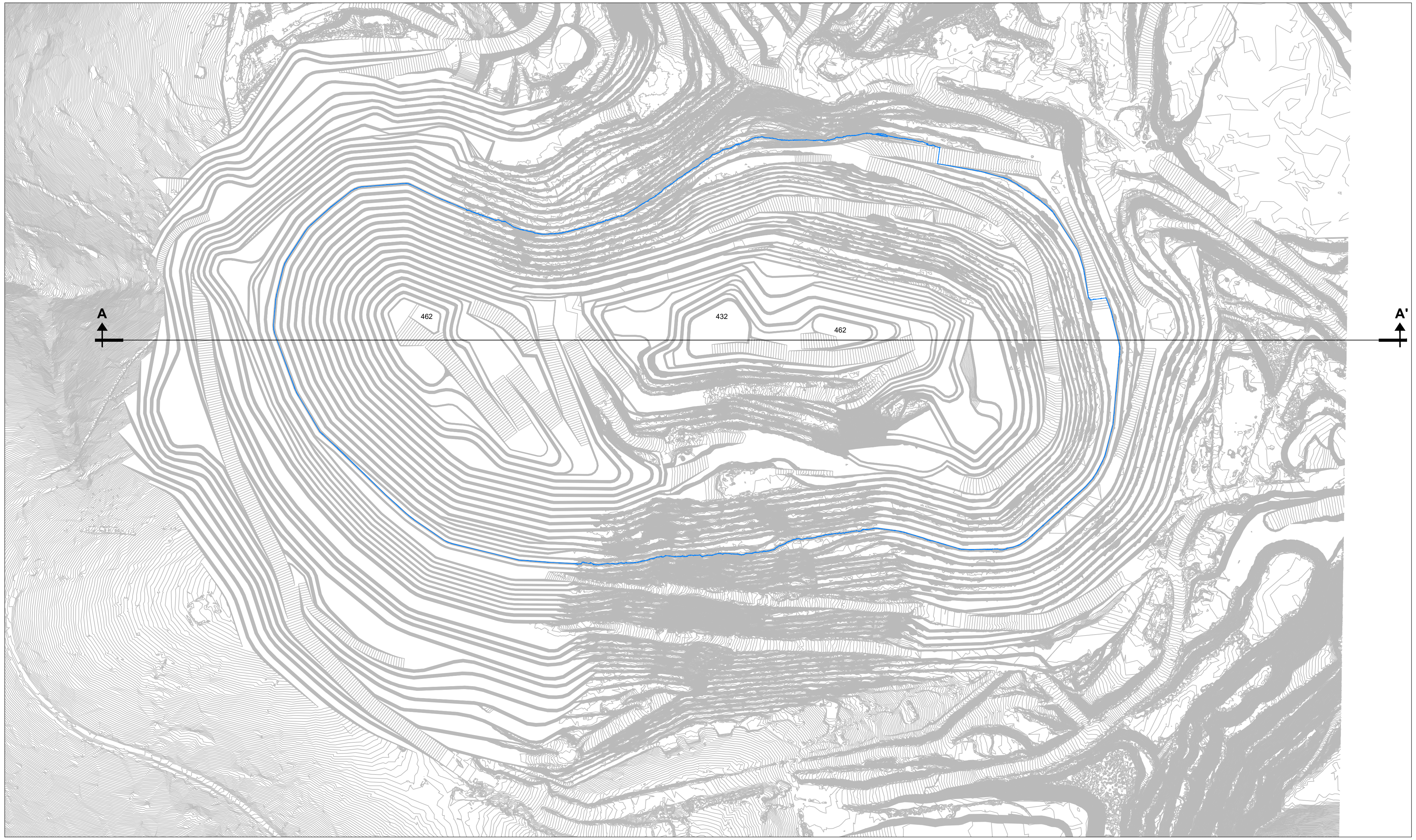

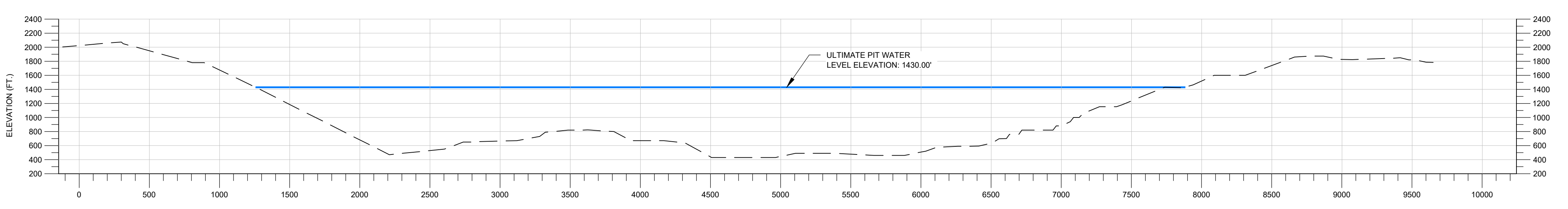

CROSS SECTION A-A'

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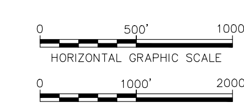
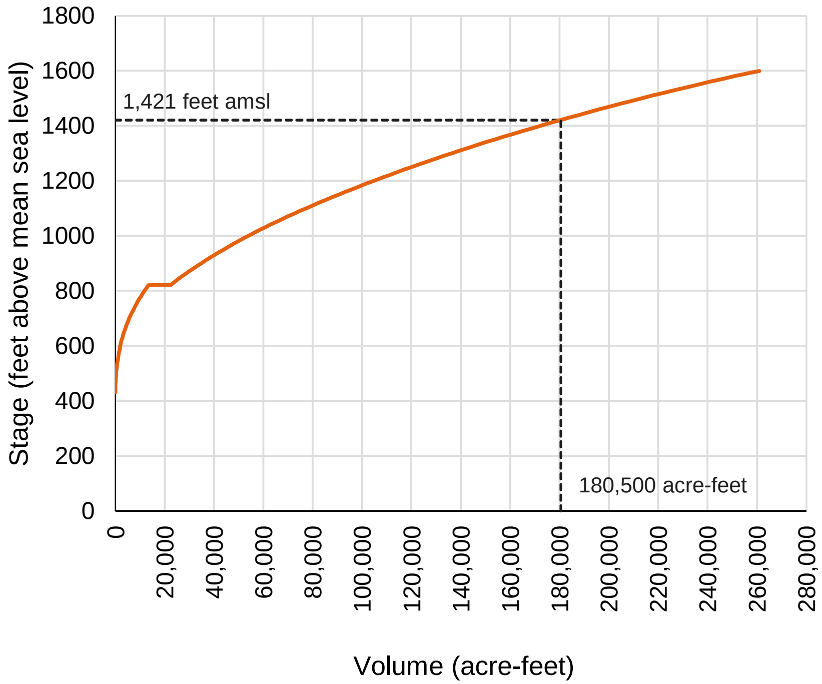


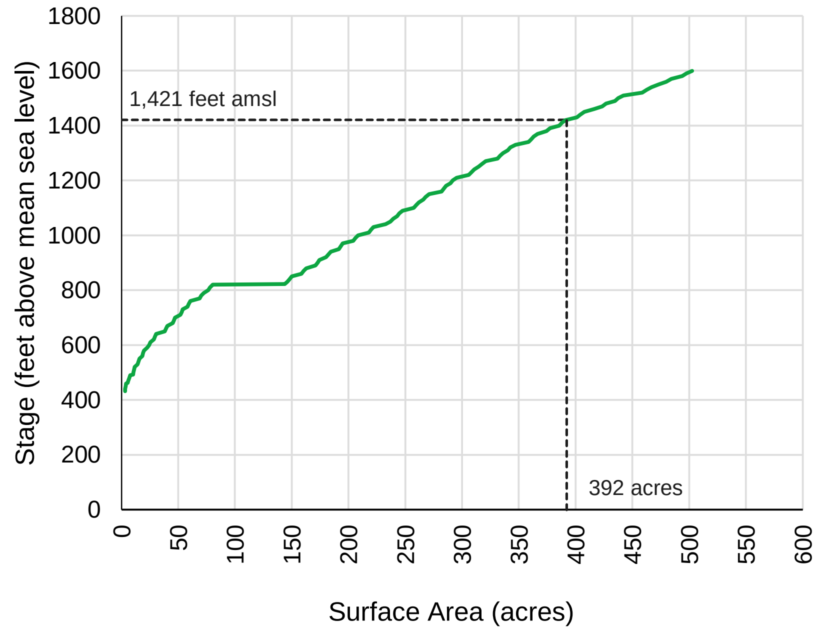
FAIRBANKS GOLD MINING, INC.
FORT KNOX MINE
FAIRBANKS, ALASKA

PIT LAKE CROSS SECTION

ARCADIS

FIGURE
1





Legend

- Stage-volume curve
- Stage-surface area curve
- Contact with alluvium

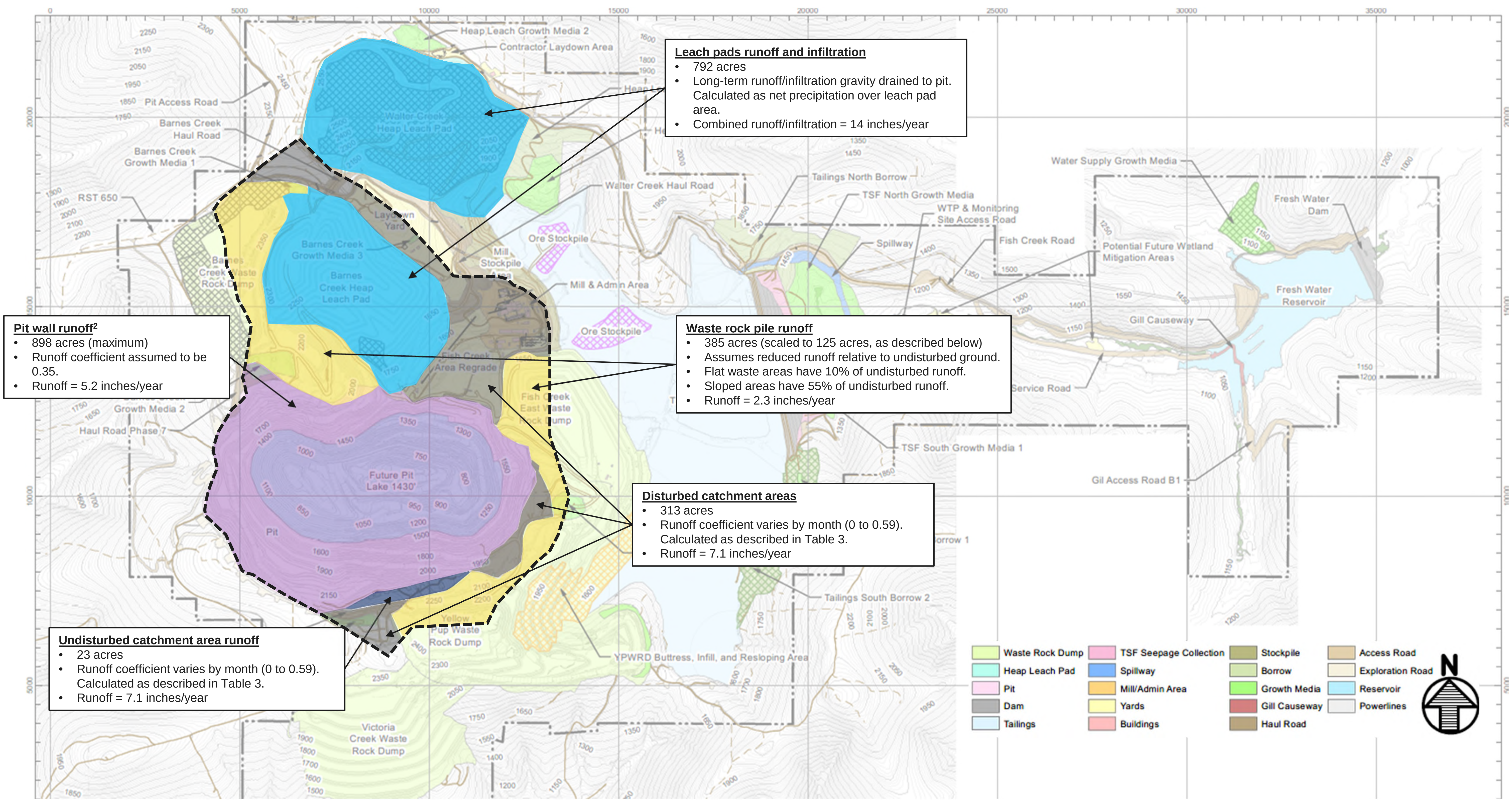
Note:
amsl = above mean sea level

FAIRBANKS GOLD MINING, INC.
FORT KNOX MINE
FAIRBANKS, ALASKA

PIT STAGE-VOLUME AND STAGE-SURFACE AREA CURVES

ARCADIS

FIGURE
2



Legend

Pit drainage basin

Note:
1. Figure modified from Figure 2-3 of the Fort Knox Mine Reclamation and Closure Plan.
2. Pit wall runoff explicitly accounted for in the pit lake model from 2024 through mid-2028 while pit lake pumping wells are active. Starting in July 2028, pit wall runoff is lumped with the groundwater inflow term calculated within the groundwater flow model.

Reference:

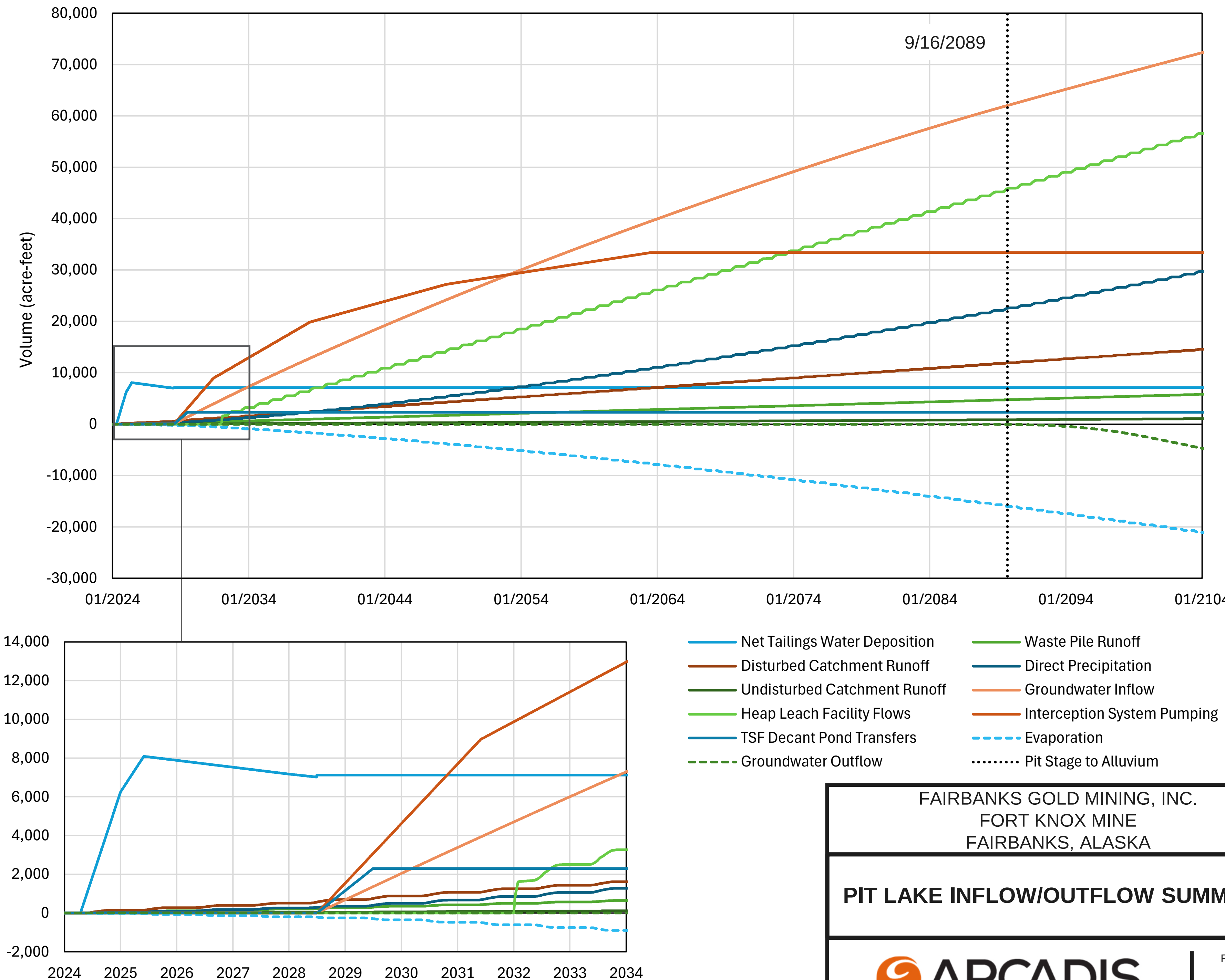
Fairbanks Gold Mining, Inc. 2024. Fort Knox Mine Reclamation and Closure Plan - DRAFT. December.

FAIRBANKS GOLD MINING, INC.
FORT KNOX MINE
FAIRBANKS, ALASKA

PIT LAKE CATCHMENT AREA

ARCADIS

FIGURE
3



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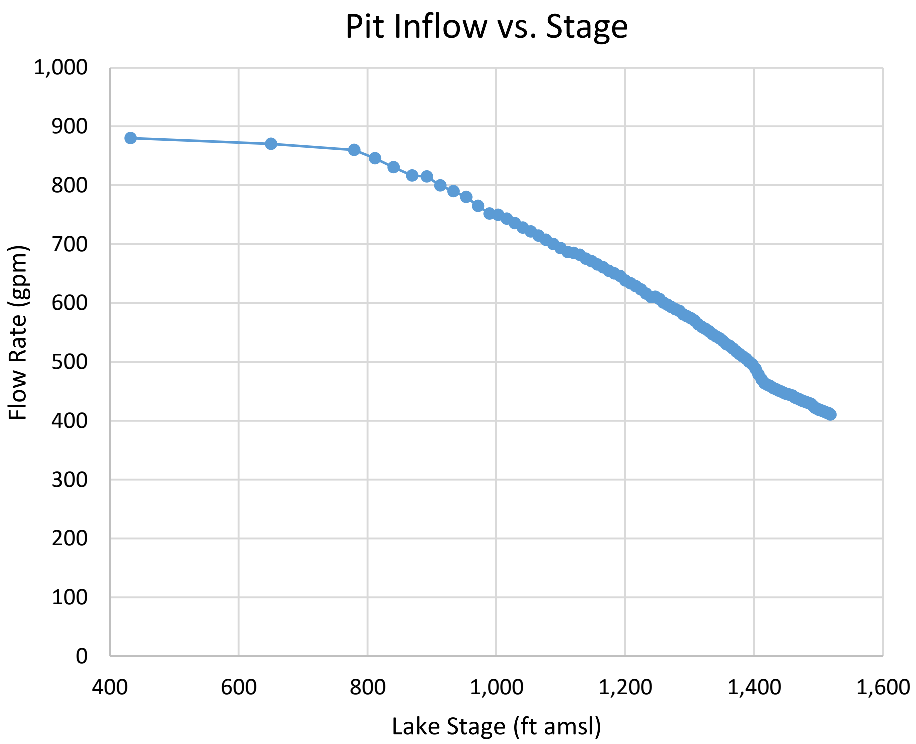
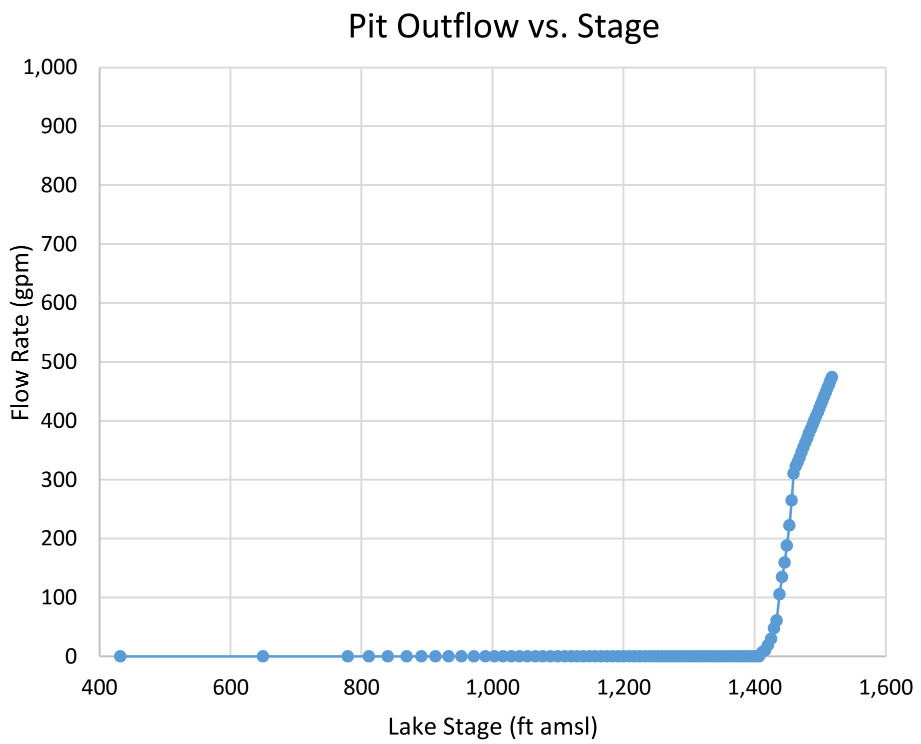
FORT KNOX MINE
FAIRBANKS, ALASKA

PIT LAKE INFLOW/OUTFLOW SUMMARY

ARCADIS

FIGURE
4





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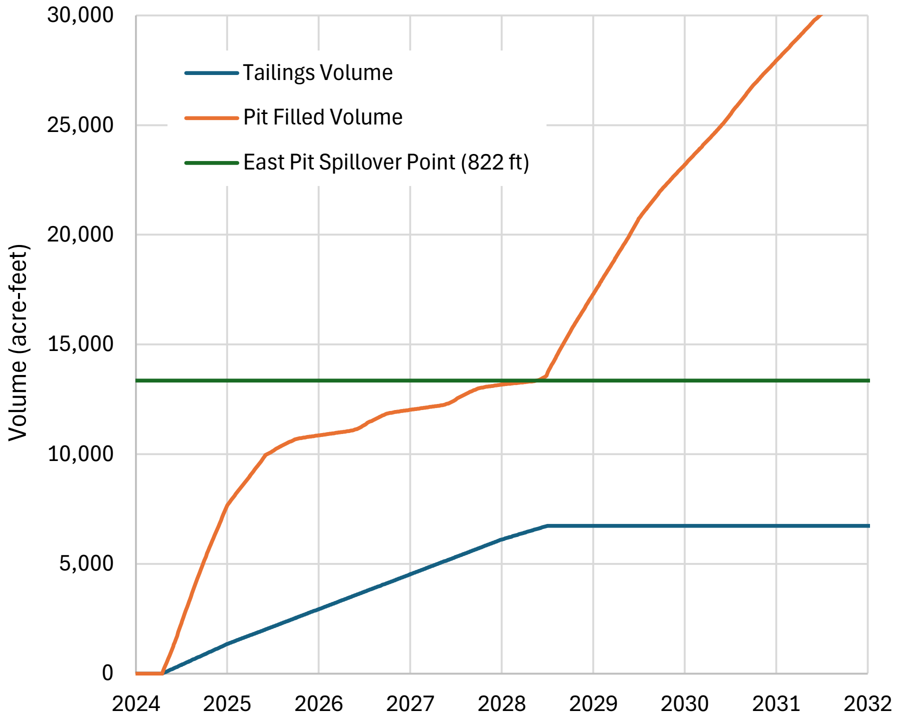
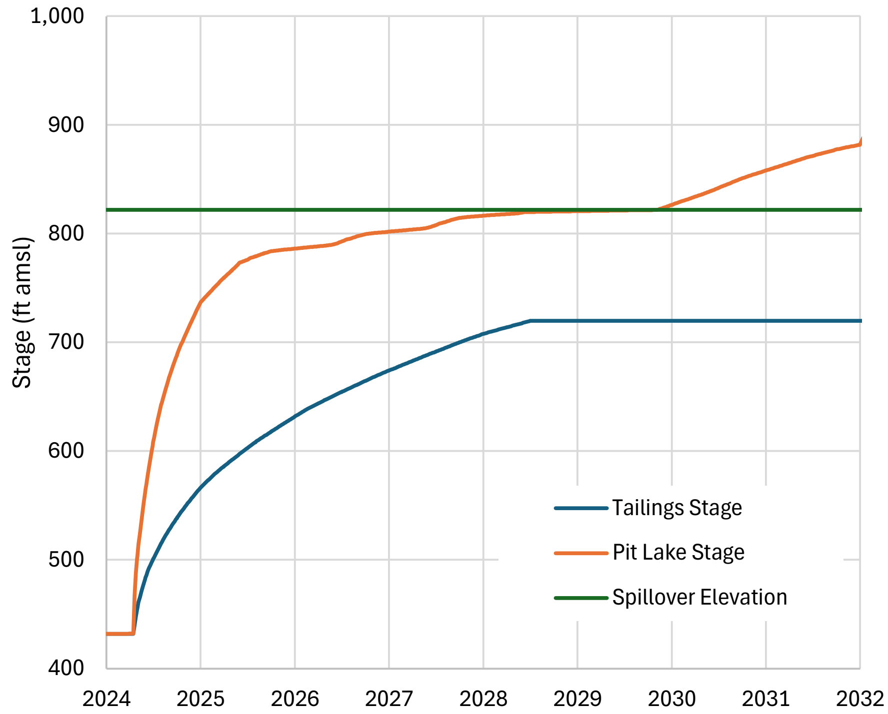
FORT KNOX MINE
FAIRBANKS, ALASKA

GROUNDWATER INFLOW AND OUTFLOW vs. LAKE STAGE

ARCADIS

FIGURE
5





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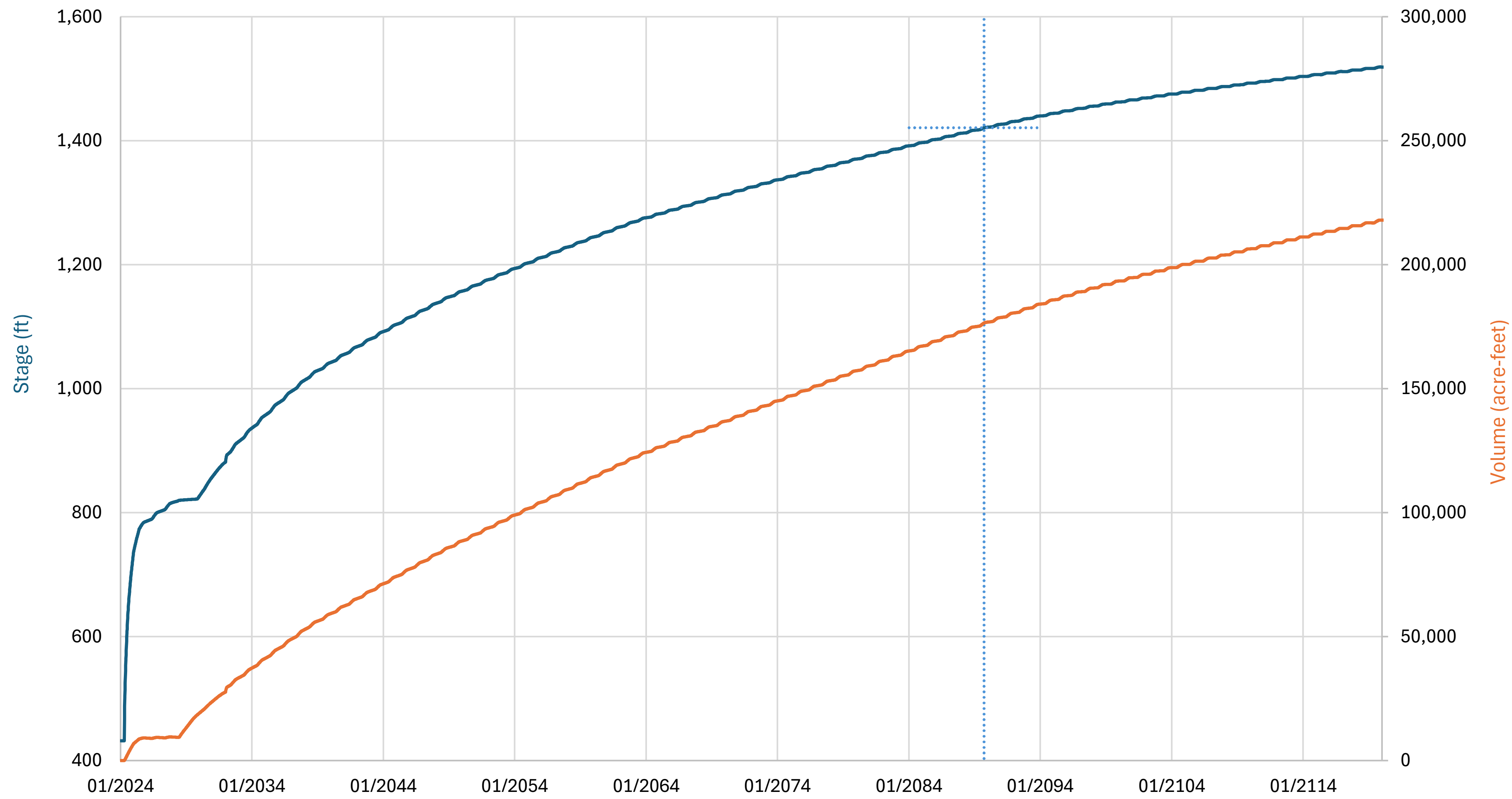
FORT KNOX MINE
FAIRBANKS, ALASKA

IN-PIT TSF LEVELS AND VOLUMES

ARCADIS

FIGURE
6



Legend

- Pit lake stage
- Pit lake volume
- Contact with alluvium

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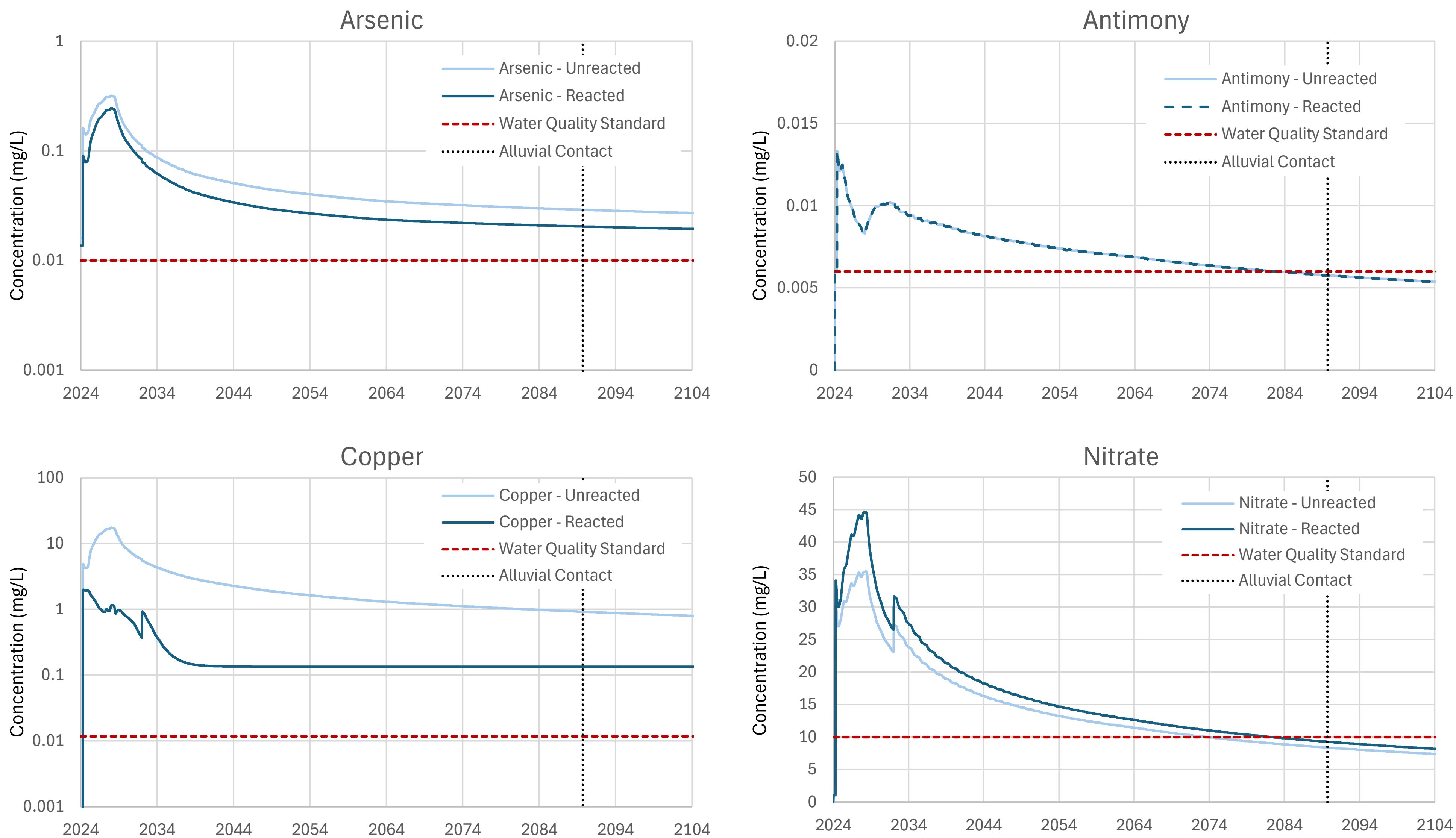
FORT KNOX MINE
FAIRBANKS, ALASKA

MODELED PIT LAKE STAGE AND VOLUME

ARCADIS

FIGURE
7



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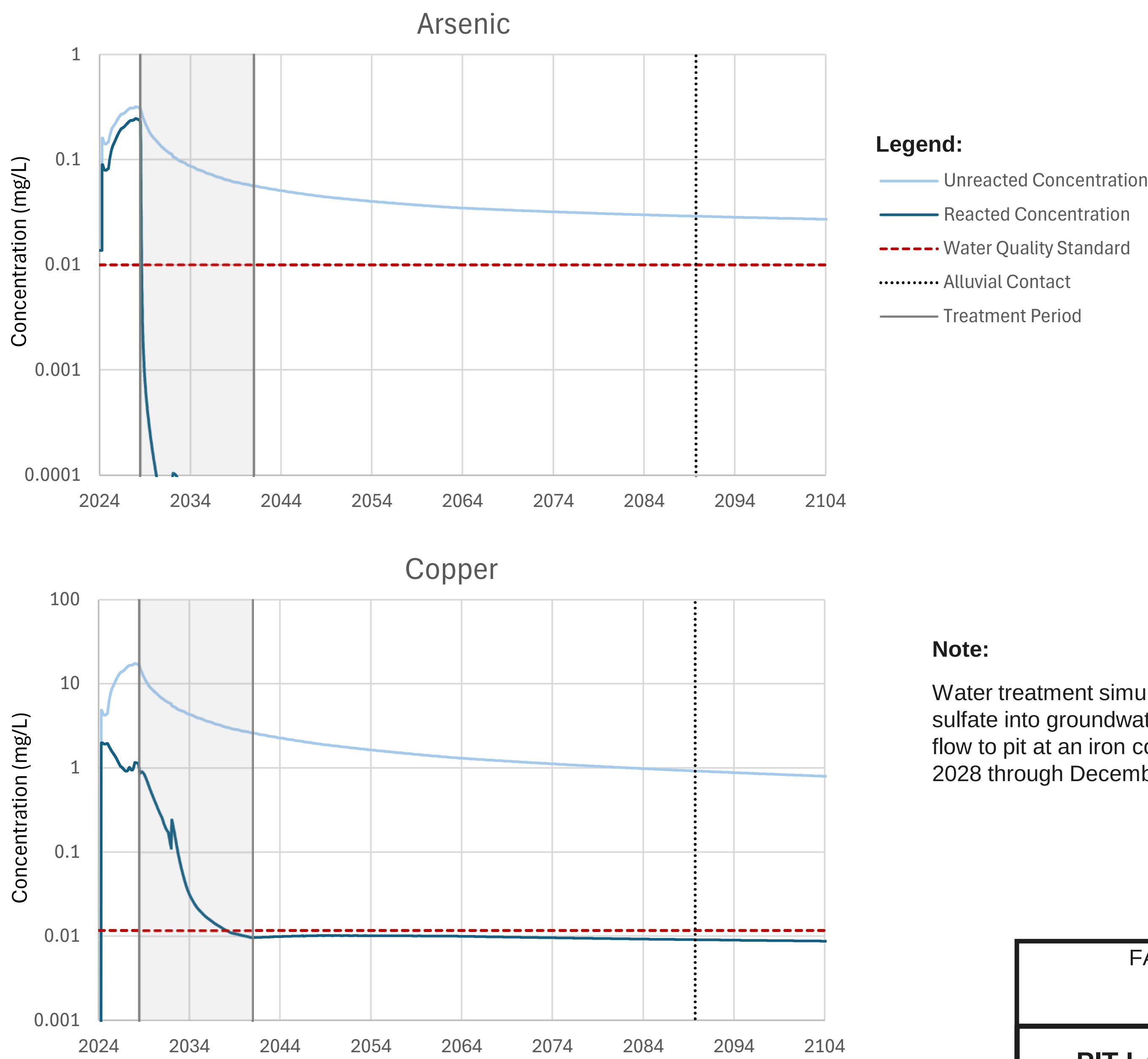
FORT KNOX MINE
FAIRBANKS, ALASKA

PIT LAKE CONCENTRATIONS:
BASE CASE SCENARIO

ARCADIS

FIGURE
8



Note:

Water treatment simulation includes dosing of ferrous sulfate into groundwater interceptor/TSF seepage water flow to pit at an iron concentration of 150 mg/L from July 2028 through December 2040.

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FORT KNOX MINE
FAIRBANKS, ALASKA

PIT LAKE ARSENIC AND COPPER: IRON BASED WATER TREATMENT

ARCADIS

FIGURE
9

Appendix A

Pit Area Groundwater Chemistry Data

Appendix A
Pit Area Groundwater Chemistry Data
Fairbanks Gold Mining, Inc.
Fort Knox Mine
Fairbanks, Alaska

ARCADIS

Water Quality Modeling Input Data			Pit Area Groundwater (2019 Update)		Dewatering Wells - Pit Well Sectors (Piteau, 2018)									
					East Pit Granite / Lower East Wall Average	Lower West Wall Average	Monte Cristo Average	North Wall Average	Northeast Wall Average	Northwest Wall Average	South Wall Average	Upper West Wall Granite Average	Upper West Wall Schist Average	West Pit Granite Average
					112 gpm	30 gpm	200 gpm	10 gpm	158 gpm	16 gpm	20 gpm	66 gpm	19 gpm	329 gpm
Parameter	Alaska Water Quality Reference Standards		"RO Feed" from pit dewatering wells (geometric mean, 2016-2019)	Flow-weighted average 2016-2018 dewatering well samples	12%	3%	21%	1%	16%	2%	2%	7%	2%	34%
	Reference Standard	Basis			DW09-226; DW09-233; DW09-234; DW15-372; DW16-389	DW17-446	DW08-196; DW11-268; DW13-322; DW17-430	DW17-430	DW09-211; DW10-237; DW12-298; DW18-453	DW17-416; DW17-420	DW15-360; DW17-449	DW08-200; DW14-354; DW15-375; DW16-383; DW16-408; DW17-421	DW11-276; DW15-357; DW17-445	DW14-345; DW14-356; DW16-381; DW16-388; DW16-390
pH (su)	6.5 - 8.5	WQS	7.8	7.6	7.5	8.1	7.6	7.8	7.6	8.2	7.4	7.8	8.0	7.5
Alkalinity as CaCO3	> 20	AQ(c)	no data	80	83	83	91	83	83	83	83	88	83	70
Aluminum	0.087	AQ(c)	no data	0.016	0.016	0.016	0.015	0.016	0.016	0.016	0.016	0.020	0.015	0.015
Ammonia	5.08	AQ(c)	no data	0.027	0.028	0.028	0.025	0.028	0.028	0.028	0.028	0.035	0.025	0.025
Antimony	0.006	DW	0.0056	0.0060	0.0059	0.0137	0.00029	0.0073	0.013	0.0049	0.00020	0.0085	0.0069	0.0053
Arsenic	0.01	DW	0.021	0.016	0.029	0.018	0.0017	0.0006	0.0083	0.022	0.00036	0.025	0.0051	0.025
Barium	2	DW	no data	0.0034	0.0030	0.0030	0.0015	0.0030	0.0030	0.0030	0.0030	0.0039	0.0015	0.0050
Cadmium	0.00033	AQ(c)	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
Calcium	NA	NA	no data	33	33	33	27	33	33	33	33	36	31	37
Chloride	230	AQ(c)	0.54	1.4	0.8	1.2	1.0	1.2	4.1	1.2	1.2	0.39	0.80	0.82
Chromium	0.1	DW	0.00026	0.00072	0.00025	0.00025	0.00025	0.00025	0.00025	0.00037	0.00032	0.00025	0.02384	0.00025
Copper	0.0117	AQ(c)	0.00033	0.00035	0.00032	0.00066	0.00020	0.00020	0.00044	0.00058	0.00020	0.00040	0.00068	0.00035
WAD-cyanide	0.0052	AQ(c)	0	0	0	0	0	0	0	0	0	0	0	0
Fluoride	1	IRR	0.35	0.34	0.80	0.60	0.21	0.07	0.08	0.16	0.18	0.30	0.12	0.40
Iron	1	AQ(c)	no data	0.058	0.083	0.083	0.017	0.083	0.083	0.083	0.083	0.105	0.170	0.040
Lead	0.0044	AQ(c)	0.00033	0.0015	0.0005	0.0004	0.0025	0.00010	0.0023	0.00021	0.00024	0.00026	0.019	0.00031
Magnesium	NA	NA	no data	5.3	5.3	5.3	11.9	5.3	5.3	5.3	5.3	4.2	3.4	1.6
Manganese	0.200	IRR	0.014	0.023	0.017	0.020	0.007	0.058	0.065	0.046	0.006	0.017	0.10	0.010
Mercury	0.00005	HH	0	0	0	0	0	0	0	0	0	0	0	0
Nickel	0.065	AQ(c)	0.00085	0.0011	0.00030	0.00035	0.00030	0.0041	0.0030	0.00059	0.00036	0.00033	0.017	0.00030
Nitrate, as N	10	DW	2.3	0.93	0.63	0.63	0.39	0.63	0.63	0.63	0.63	0.30	0.080	1.75
Nitrite, as N	1	DW	no data	0.11	0.070	0.07	0.01	0.07	0.07	0.07	0.07	0.02	0.005	0.25
Phosphorus	NA	NA	no data	0.011	0.011	0.011	0.010	0.011	0.011	0.011	0.011	0.016	0.010	0.010
Potassium	NA	NA	no data	1.0	1.0	1.0	1.4	1.0	1.0	1.0	1.0	0.7	1.1	0.9
Selenium	0.0050	AQ(c)	no data	0.00049	0.00042	0.00042	0.00035	0.00042	0.00042	0.00042	0.00042	0.00033	0.00030	0.00070
Silver	0.0064	AQ(a)	no data	0	0	0	0	0	0	0	0	0	0	0
Sodium	NA	NA	no data	13	10	10	3.2	10	10	10	10	8.4	4.9	23
Sulfate	250	WQS	96	99	146	118	60	51	134	46	78	40	30	109
Zinc	0.15	AQ(c)	0.0025	0.0023	0.0020	0.0014	0.0041	0.0010	0.0019	0.0013	0.0013	0.0012	0.0048	0.0016
TDS	500	WQS	239	247	297	344	171	211	347	166	222	158	123	252

Notes:

Shaded cells indicate value exceeds Alaska water quality standards.
"<" Indicates calculated value was less than typical laboratory reporting limit. Value shown is the trypical reporting limit.
All data are in mg/L, unless otherwise noted.
The basis for Alaska water quality standards are summarized in Tables 8a and 8b.
Aquatic standards for cadmium, copper, lead, nickel, silver, and zinc are hardness-based. The estimated calcium and magnesium concentrations in the pit lake at the spill point elevation were used to calculate the hardness value of 124 mg/L as CaCO3.
The ammonia standard is based on the estimated pH and temperature of the pit lake. The pH was set equal to 8.19, which is the modeled pH of the pit lake at the spil point elevation. The temperature was assumed to be 10 degrees celsius, which is the long-term average of pit dewtaering welll groundwater.

Abbreviations:

-- = not applicable or not available
AC(a) - Aquatic standard (acute)
AQ(c) - Aquatic standard (chronic)
DW - Drinking water standard
HH - Human health criteria for non-carcinogens
IRR – Irrigation standard
NA - not available or not applicable

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