KINROSS

FORT KNOX GOLD MINE

MONITORING PLAN

Prepared by:

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1 INTRODUCTION

Fairbanks Gold Mining, Inc. (FGMI), a wholly owned subsidiary of Kinross Gold U.S.A., Inc., is submitting this updated monitoring plan for the Fort Knox Mine to the Alaska Department of Environmental Conservation (ADEC) in accordance with AS 46.03.0100, 18 AAC 60.005, 18 AAC 15.090 and 18 AAC 72.600. Concurrently, the plan is being submitted to the U.S. Army Corps of Engineers (COE) as required by Section 404 Permit Number 4-920574 Fish Creek 23.

The Fort Knox Mine and all operating and ancillary facilities are located on private land and legally filed and held State mining claims. The State mining claims are on land administered by Alaska Department of Natural Resources (ADNR). State Water Rights are held by FGMI for the entire upper drainage of Fish, Solo, and Last Chance creeks with the point of use identified as the water supply reservoir.

It is the goal of FGMI to operate the mine and milling processes at the Fort Knox Mine in a manner that will ensure zero discharge for the protection and enhancement of surface and groundwater quality. This monitoring plan will assist FGMI in the establishment and refinement of operating procedures to ensure the long-term protection of State of Alaska land, wildlife, and water resources. Periodic updates of the monitoring plan will coincide with regulatory changes, five-year reviews, process modifications, or anomalies noted as a result of monitoring and sampling.

This monitoring plan is a part of the comprehensive environmental and operational management system for the Fort Knox Mine. The overall project and each process component have specific management plans, which dovetail with this monitoring plan. To minimize duplication of information and rationale for specific monitoring and sampling requirements the reviewer needs to reference the following management plans:

- Fort Knox Project Water Resources Management Plan, March 1994;
- Fort Knox Mine Tailing Storage Facility Operation and Maintenance Manual, April, 2011;
- Fort Knox Mine Water Dam Operation and Maintenance Manual, January 2010:
- Fort Knox Project Reclamation & Closure Plan, April 2011;
- Walter Creek Heap Leach Facility Project Description, January 2006;
- Walter Creek Heap Leach Facility Operations and Maintenance Manual Rev 2, August 2011
- Waste Management Permit for Fort Knox Mine, 2006-DB0043, July 2007;
- Fort Knox Mine Drinking Water Monitoring Plan PWSID#314093, June 2004;
- Fort Knox Water Monitoring QA/QC and Field Procedures Manual, January 2007.

Access by Federal and State regulatory personnel to the Fort Knox Mine facilities for the purpose of inspecting for reclamation, wildlife mortalities, or other appropriate compliance areas are statutory/regulatory mandates and will be adhered to by FGMI, with the request that agents contact mine security to gain access. The health and safety of FGMI employees and that of regulatory personnel is the rationale for this request. Mining is regulated under the Mine Safety and Health Administration (MSHA) and their regulations require minimum training for employees and visitors for Hazard Recognition and Safety. Visitors, as well as employees, must wear safety equipment approved by MSHA. FGMI requests consideration by the regulatory agencies to conduct routine inspections during weekdays when administration and process managers are available to answer questions and, if necessary, accompany agents to different process components.

1.1 Applicant Information

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1.2 Site Description

The Fort Knox Mine is an open pit gold mine on the north flank of Gilmore Dome about 15 miles northeast of Fairbanks, Alaska (Figure 1.1). Using conventional open pit mining and milling technology and operating year round, 40,000 to 45,000 tons of ore per day are being processed, producing approximately 300,000 to 350,000 ounces of gold per year.

Access to the site is via the Steese Highway, Fish Creek Road, and an access road. Fish Creek and its tributaries drain the project area. In the beneficiation procedures, the gold ore is crushed, then ground, and processed as slurry in a mill adjacent to the mine. The gold is extracted in tanks containing a cyanide solution that dissolves the gold. Next the gold is captured by activated carbon, then stripped from the carbon and recovered from solution by electrolysis. Once the gold is removed, the remaining slurry goes to the thickener that recovers a majority of the cyanide, other reagents, and heated water before the tailing slurry is released to the Tailing Storage Facility (TSF). The cyanide concentration in the tailing is maintained within permit limits using the INCO process when necessary. The INCO process combines sodium bisulfate and copper sulfate with air, in an agitated tank, to destroy the cyanide. Typically, maintaining the cyanide concentration in discharged tailing material does not require the use of the INCO process, but is controlled by the recovery of cyanide solution and the addition of freshwater to the thickened tailing. Tailing is piped to the TSF from the mill and deposited in the TSF sub-aerially using multiple discharge points. The valley fill heap leach is located in the upper end of the Walter Creek drainage upstream from the tailing impoundment.

Ore for the heap leach will consist of run-of-mine rock from the Fort Knox Pit and various stockpiles. The ore is characterized by relatively high permeability that will promote solution flow and drainage for rapid rinsing at closure. In-heap storage of process solution and storm water will be accomplished by constructing an embankment in the downstream toe of the heap. The pregnant solution from the heap is piped to a Carbon-in-Columns plant that captures the gold. The carbon is then processed through existing facilities in the mill.

Tailings are deposited in the tailings impoundment. The tailing dam is an earth-filled structure designed to hold all process water from the mill, as well as surface runoff water. The dam is designed and maintained to contain the 100-year, 24-hour storm event in addition to the average 30-day spring breakup. The water in the impoundment is intended to contain levels of certain contaminants above drinking and/or aquatic water standards. Contaminant levels will be maintained below toxic levels for avian and terrestrial wildlife species. Impoundment water is not discharged but is recycled to the mill for reuse in the beneficiation process of the gold ore.

In November 2006, FGMI discovered a small seep just below the downstream toe of the dam on the south abutment. Since that time, FGMI has taken numerous steps to explore and address this issue, in conjunction with state and federal agencies. From the time the seep was discovered until the update of this report, extensive sampling has indicated that no process water has escaped FGMI's containment system. Down-gradient groundwater and wetland areas continue to be free from cyanide.

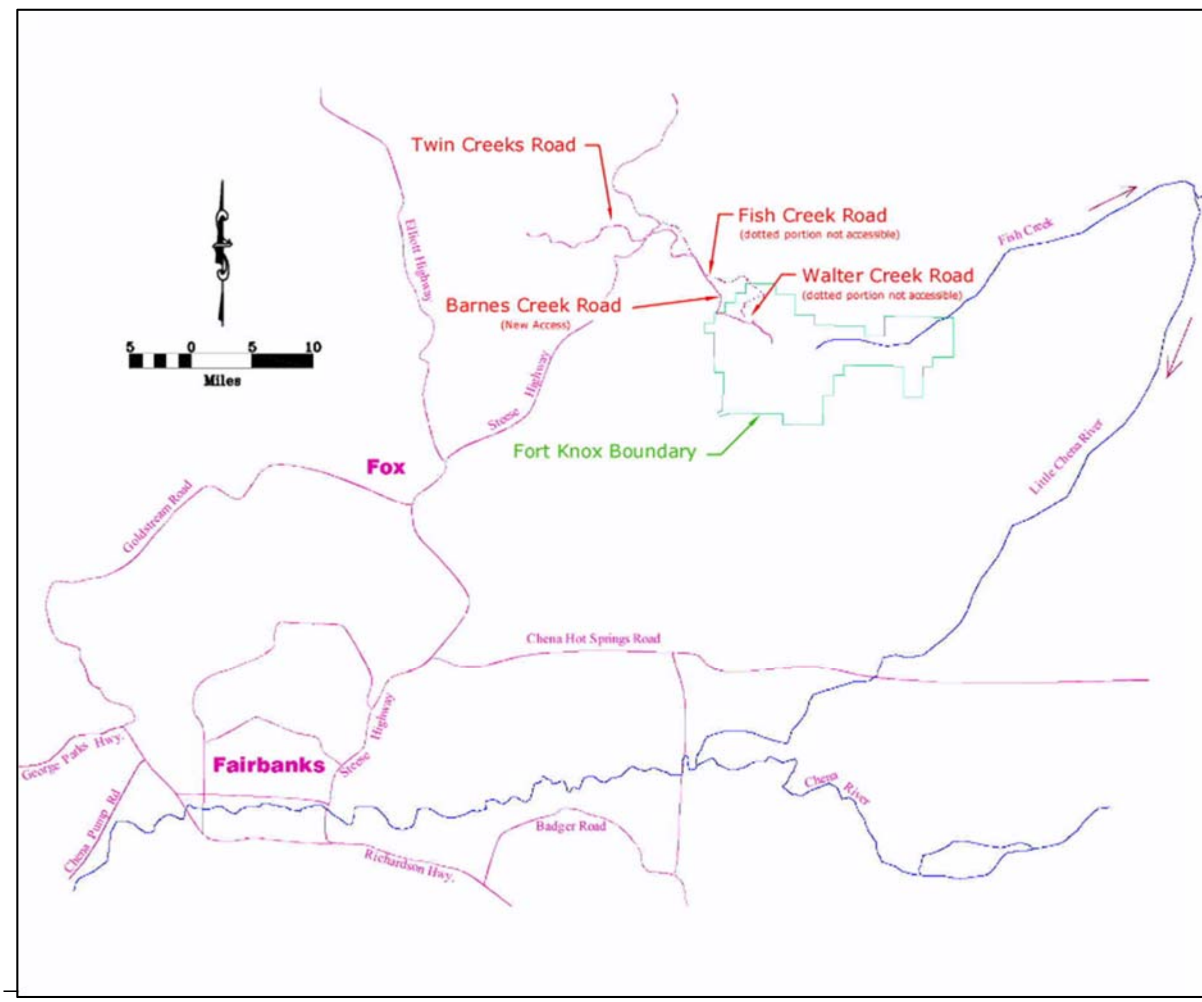
To ensure zero discharge, a seepage control system located at the toe of the dam collects subsurface flow and returns it to the tailing impoundment. A series of twelve groundwater interceptor wells (designated as IW-1, IW-2, IW-3, IW-4, IW-5, IW-6, IW-7, IW-8, IW-11, MW-1, MW-3, and 401) along with Sites 501 and 801 are located down gradient of the seepage control system. These wells collect a combination of groundwater and seepage. Well production is pumped to the tailing seepage sump and subsequently to the tailing impoundment. Three additional groundwater monitoring wells are installed downstream of the interceptor wells to monitor water quality. They are designated as MW-5, MW-6, and MW-7.

A fresh water supply reservoir is located on Fish Creek three miles below the tailing dam. Fresh water is supplied from the reservoir to the mill for mixing reagents, gland water, and make-up water for the milling process when necessary.

1.3 Objectives

Baseline monitoring for the Fort Knox Mine was started in 1989 and continued throughout the permitting process. The objective of baseline monitoring was to collect data that described the pre-mining surface water and groundwater quality in the project area. These data were used to determine the potential impacts caused by development and operation of the Fort Knox Mine. Construction of the mine commenced in the spring of 1995 and the first bar of ore was poured in December 1996. Compliance monitoring was initiated on November 14, 1996 when mill operations commenced. The objective of compliance monitoring is to ensure that the Fort Knox Mine operates within permit limitations minimizing impact to the environment.

Figure 1-1 Site Location



2 REGULATORY FRAMEWORK

This monitoring plan has been developed to meet the requirements of Title 18 Chapters 60 and 70 of the Alaska Administrative Code (AAC). Specifically, this document follows the guidelines set forth in Article 7 of 18.AAC.60; Monitoring and Corrective Action Requirements (Title 18 Chapter 60 Section 800-860) with the objective of meeting the requirements of 18 AAC 70.

Fort Knox operates the Tailing Storage Facility (TSF) under the Waste Management Permit # 2006-DB0043. The permit is subject to the surface water and groundwater monitoring requirements of 18.AAC.60.810 and 18.AAC.60.825, respectively. A summary of the relevant portions of these regulations is provided below.

2.1 Surface Water Monitoring

Per 18.AAC.60.810 (a-g) the surface water monitoring program reflects the following requirements:

- 18.AAC.60.810(b) The points of compliance have been chosen so that highest concentrations of hazardous constituents migrating off the facility will be detected and so that interference from sources of pollution unrelated to the facility's waste management operations will be minimized.
- The criteria of 18.AAC.60.825(c) specifically applicable to surface water including;
    - 4(B) the volume and physical and chemical characteristics of the leachate;
    - 4(F) the existing quality of the groundwater, including other sources of pollution and their cumulative effects on the groundwater, and whether the groundwater is used or might reasonably be expected to be used for drinking water;
- 18. AAC.60.810 (d) Monitoring parameters have been selected that are indicative of the type of hazardous constituents associated with the type of waste handled at the facility.

The surface water monitoring program reflects these regulations in the following manner:

- The compliance points are located to ensure detection of changes in water quality and minimize the influence of historical mining activities
- A set of indicator parameters has been established that reflects the composition of the decant water in the TSF
- A compliance monitoring and reporting program based on indicator parameters has been defined to reflect the composition of the decant water and site-specific background water quality
- Tolerance intervals have been established for selected parameters to identify if statistically significant increases occur over background conditions

2.2 Groundwater monitoring

The groundwater monitoring program reflects the following components of 18 AAC 60 and 18 AAC 70:

- 18. AAC.60.825 (a-e) The monitoring system has been designed to meet the requirements in terms of location, design, local hydrogeologic conditions, facility design, the ability to detect potential releases and local physiographic constraints.

- 18.AAC.60.825(a1B) Sampling at other wells will provide an indication of background groundwater quality that is at least as representative as that provided by upgradient wells.
- 18.AAC.60.825(c) Has established relevant points of compliance which reflect local hydrogeologic conditions, the volume and physical and chemical characteristics of the leachate (i.e. decant water), the existing quality of the groundwater, including other sources of pollution and their cumulative effects on the groundwater, and whether the groundwater is used or might reasonably be expected to be used for drinking water.
- 18.AAC 60.830 A compliance monitoring and reporting program based on indicator parameters has been defined to reflect the composition of the decant water and site-specific background water quality.

Similar to the surface water monitoring program the groundwater monitoring program reflects these regulations in the following manner:

- The compliance wells are located to ensure detection of changes in water quality and minimize the influence of historical mining activities.
- A set of indicator parameters has been established that reflects the composition of the decant water in the TSF.
- Appropriate tolerance levels have been established for parameters to appropriately reflect background conditions and allow detection of statistically significant increases.
- A compliance program and indicator parameters have been defined to reflect the composition of the decant water and site-specific background water quality.

For surface water and groundwater, the indicator parameters have been selected to provide definitive evidence if the TSF ceases to function as a zero discharge facility. They reflect parameters which are relatively conservative and at significantly higher concentrations in the decant pond relative to ambient downgradient water.

2.3 Background conditions

Before depositing any waste in the TSF, Fort Knox collected baseline water quality data in the Fish Creek Drainage from 1989 through 1995. In the area downstream of the TSF, which was disturbed before 1989 by placer mining, the baseline period identified several parameters in both surface and ground water with concentrations exceeding Alaska Water Quality Standards. ADEC recognizes and acknowledges that concentrations of iron and manganese were elevated within the Fish Creek drainage after placer mining and before Fort Knox operations. Appendix A presents an analysis of the baseline data.

Due to their elevated concentrations below the TSF prior to mine operations, iron and manganese were specifically excluded from the suite of parameters chosen to indicate seepage and compliance with the mine’s zero discharge requirements. This is consistent with the need to minimize the interference of conditions unrelated to the mining operation relative to the effectiveness of the monitoring plan.

3 MONITORING NETWORK

3.1 Mill and Tailing Facilities Process Fluids

Process fluids are any liquids including meteoric waters, which are intentionally or unintentionally introduced into any portion of the beneficiation process. All process fluids are controlled under the fluid management system, which consist of the following components:

- Mill/heap leach/process recovery plant including but not limited to all existing tanks, basins, sumps, pumps and piping necessary to interconnect the components that contain process fluid within this plant;
- Tailing impoundment, the main embankment (all phased lifts), tailing discharge lines, seepage collection within the main embankment, and the recycling system to return all seepage flows to the tailing basin;
- Interceptor wells to recover seepage that bypasses the reclaim system in the embankment toe and groundwater.
- Monitoring wells down gradient to assure interceptor system is performing as designed.

The process fluid monitoring network includes the following:

- Tailing at Mill (post cyanide detox)
- Tailing Liquor (filtrate)
- Tailing Solids
- Tailing Decant Solution
- Tailing Seepage Reclaim
- Site's 501 & 801
- Interceptor Wells (IW-1, IW-2, IW-3, IW-4, IW-5, IW-6, IW-7, IW-8, IW-11, MW-1, MW-3, and 401)
- Compliance Monitoring Wells (MW-5, MW-6, and MW-7)

The location for these points is illustrated on Figure 3.1 (Note tailing solids and liquor are sampled in the plant).

3.2 Heap Leach Process Fluids

The Walter Creek Heap Leach Facility Project Description (FGMI, 2006b) has a complete description of the various process components associated with the heap leach. Please refer to this document for more in-depth explanations of the heap and ancillary facilities.

The Walter Creek Valley Heap Leach Facility monitoring network includes:

- leak detection monitoring in the LCRS and Process Component Monitoring System (PCMS) sumps;
- the heap underdrain monitoring wells at the base platform, the bench of the in-heap storage pond embankment, and the crest of the in-heap storage pond embankment;

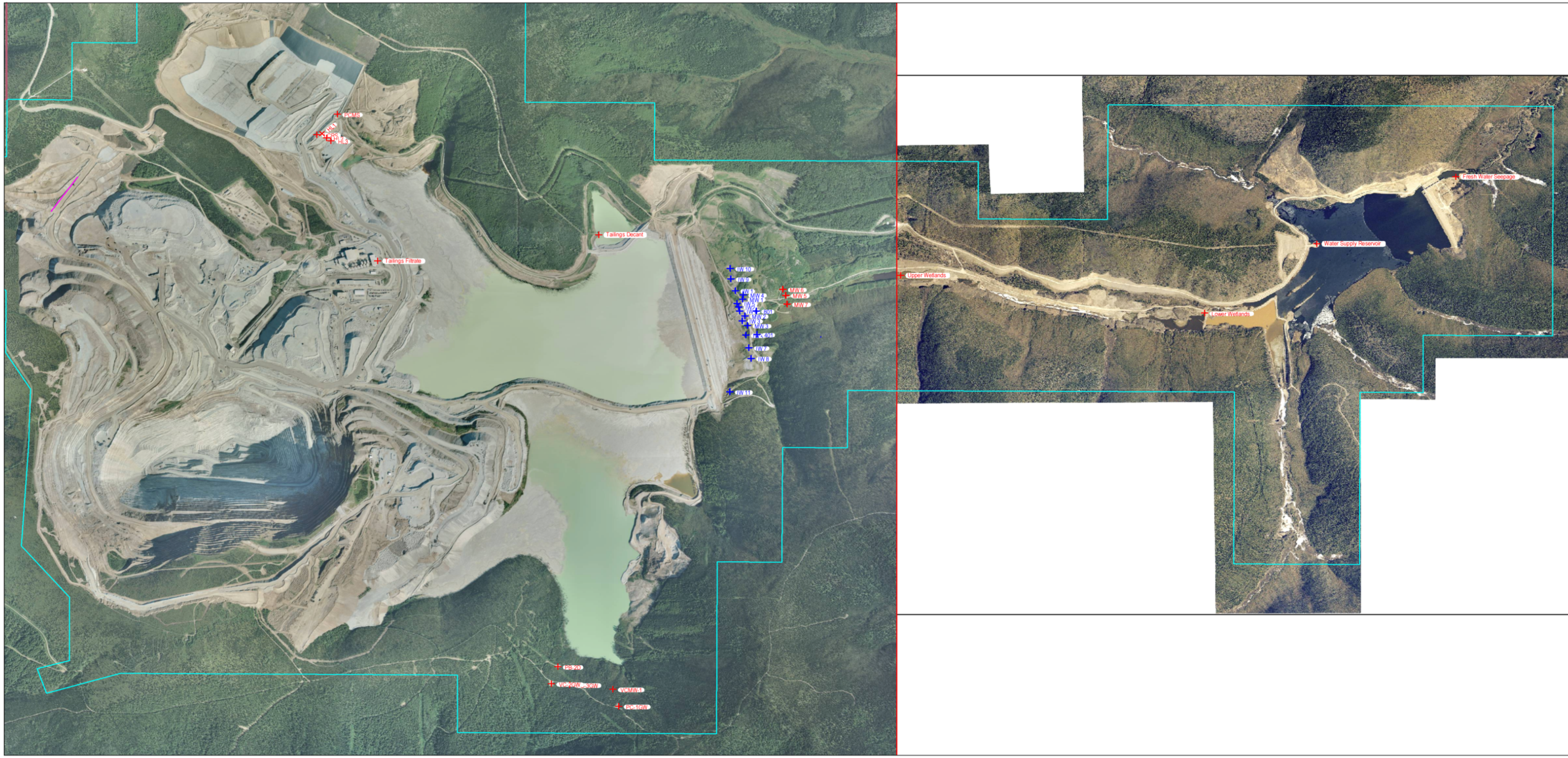
- monitoring well at the old batch plant (OL-296).

Developed wetlands and water supply reservoir

The monitoring network employed for the developed wetlands and water supply reservoir includes:

- Upper developed wetlands
- Lower developed wetlands
- Water supply reservoir
- Surface water below the Water Supply Reservoir (Freshwater Seepage)

Figure 3-1: Locations of Monitoring Points



Fort Knox Monitoring Plan

Compliance Monitoring

Date: December 27, 2011

KINROSS Fort Knox

Notes:

LT. Blue Line - Mill Site Lease Boundary

N

1" = 2000' 0 1000' 1500' 4000'

4 INDICATOR PARAMETERS AND TOLERANCE LEVELS

The Fort Knox TSF functions as a zero discharge facility. All contact water is captured within the facility as a result of surface water controls and the groundwater interception system. The purpose of the indicator parameter monitoring and reporting is to confirm that the TSF continues to function as a zero discharge facility. The indicator parameters represent constituents present in the decant pond that are at concentrations significantly higher than the downgradient surface water and groundwater. The parameters are relatively conservative in the environment and provide unambiguous data regarding the performance of the controls responsible for maintaining zero discharge.

4.1 Decant Water Composition

Decant water is characterized by high pH, high total dissolved solids, and elevated concentrations of nitrogen and many trace metals. Decant water is predominantly alkaline, with a pH range from 7 to 10, and an average of 8.4. When plotted on a tri-linear diagram, most decant water samples are of the calcium-sodium/sulfate type (Figure 4.1).

A number of parameters are found in high concentrations, which contributes to high total dissolved solids concentrations (average of 796 mg/L). The most common constituents are sulfate (average concentration 359.2 mg/L), calcium (average concentration 120.3 mg/L), and sodium (average concentration 85.86 mg/L). Trace constituents include relatively high levels of iron, cyanide, Weak Acid-Dissociable (WAD) cyanide, antimony, arsenic, manganese, and barium. Full descriptive statistics can be found in Table 4.1.

4.2 Indicator Parameters

Indicator parameters were selected as those most likely to give an unambiguous chemical signature at monitoring locations in the event of a release from the tailing storage facility. Parameters were selected which showed a clear difference in concentration between decant waters and waters naturally found at monitoring locations. In selecting parameters, preference was also given to relatively conservative ions to reduce the possibility that these parameters would attenuate through chemical processes between the time of a possible release and when the constituents would arrive at the monitoring locations.

Based on these criteria, chloride, sulfate, nitrate, arsenic, cadmium, cyanide, nitrite, nitrogen as ammonia, and WAD cyanide were selected as indicator parameters. These parameters show significant differences in concentration between decant and ambient downgradient water (Table 4.2 for a summary). These parameters are all conservative, and those most likely to undergo chemical reactions (ammonia, nitrate, nitrite, cyanide and WAD cyanide), are also likely to yield another of those parameters as a product, which will still indicate a potential discharge.

Table 4-1: Summary Statistics for Tailings Pond Decant Water

Variable	Number of		Fraction	Statistics Calculated Using Detected Observations Only (mg/L)				
	Detections	Non-Detects	Non-Detects	Minimum	Maximum	Mean	Median	Standard Deviation
Lab pH	41	0	0.00%	7	10	8.376	8.2	0.601
TDS	41	0	0.00%	180	1170	795.6	803	194.9
TSS	32	9	21.95%	1.2	175	25.98	21.5	29.7
Ca	59	0	0.00%	18	233	120.3	118	39.97
Mg	59	0	0.00%	0.94	12.7	5.809	5.6	2.131
Na	59	0	0.00%	8.6	119	85.86	88.5	21.76
K	59	0	0.00%	3.8	34.6	15.41	15.1	4.823
SI	59	0	0.00%	4	36.2	6.613	5.7	4.17
CL	41	0	0.00%	0.83	92	34.31	29.8	19.23
SO4	41	0	0.00%	5.33	637	359.2	353	133.8
NO3	41	0	0.00%	0.5	20.6	9.013	7.9	4.994
F	35	6	14.63%	0.1	1	0.395	0.36	0.162
Fe	46	13	22.03%	0.03	5.15	0.533	0.38	0.783
Mn	58	1	1.69%	0.008	0.307	0.062	0.0435	0.0521
As	58	1	1.69%	6.00E-03	1.09	0.326	4.00E-02	0.393
Cd	8	51	86.44%	5.00E-04	0.009	0.0027	7.35E-04	0.00378
Cn	38	3	7.32%	2.00E-02	3.8	0.828	2.50E-01	1.057
Cr	3	56	94.92%	3.00E-04	0.05	0.0169	4.00E-04	0.0287
Cu	59	0	0.00%	3.00E-02	3.04	0.88	0.447	0.933
Pb	11	48	81.36%	1.00E-04	0.012	0.0035	0.003	0.0032
Zn	19	40	67.80%	0.002	0.04	0.0159	0.01	0.0107
NO2	39	2	4.88%	1.00E-01	13.8	1.889	0.93	2.64
Ag	2	57	96.61%	2.00E-04	0.01	0.0051	0.0051	0.00693
Ba	59	0	0.00%	0.016	0.194	0.0357	0.032	0.0226
BI	0	59	100.00%	N/A	N/A	N/A	N/A	N/A
Hg	0	59	100.00%	N/A	N/A	N/A	N/A	N/A
Sb	47	12	20.34%	0.002	2.42	0.796	0.545	0.804
Se	33	26	44.07%	0.006	0.065	0.0261	0.023	0.0153
Nitrogen(as Ammonia)	39	2	4.88%	4.4	50.1	18.9	15.9	11.46
WAD Cyanide	38	3	7.32%	0.01	2.6	0.566	0.14	0.765
Total Alkalinity	41	0	0.00%	37	92	61.04	59	14.05
Bicarbonate Alkalinity	40	1	2.44%	5	86	51.37	53	20.43
PO4	25	17	40.48%	0.01	0.44	0.162	0.12	0.136

Table 4-2: Summary Statistics for Indicator Parameters in Decant and Monitoring Location Waters

		Number of		Proportion	Statistics Calculated Using Detected Observations Only (mg/L)				
	Variable	Detections	Non-Detects	Non-Detects	Minimum	Maximum	Mean	Median	SD
Decant Water	CL	41	0	0.00%	0.83	92	34.31	29.8	19.23
	SO4	41	0	0.00%	5.33	637	359.2	353	133.8
	NO3	41	0	0.00%	0.5	20.6	9.013	7.9	4.994
	AS	58	1	1.69%	6.00E-03	1.09	0.326	4.00E-02	0.393
	CD	8	51	86.44%	5.00E-04	0.009	0.00268	7.35E-04	0.00378
	CN	38	3	7.32%	2.00E-02	3.8	0.828	2.50E-01	1.057
	NO2	39	2	4.88%	1.00E-01	13.8	1.889	0.93	2.64
	Nitrogen (as Ammonia)	39	2	4.88%	4.4	50.1	18.9	15.9	11.46
	WAD Cyanide	38	3	7.32%	0.01	2.6	0.566	0.14	0.765
Groundwater Sites	CL	55	50	47.62%	0.7	26	2.941	2	4.961
	SO4	74	31	29.52%	0.39	910	31.65	18.5	105.1
	NO3	12	91	88.35%	0.01	13	2.28	0.09	4.243
	AS	45	92	67.15%	5.00E-04	0.0031	0.00128	0.0012	6.18E-04
	CD	2	136	98.55%	3.00E-04	6.00E-04	4.50E-04	4.50E-04	2.12E-04
	CN	4	102	96.23%	0.007	0.235	0.107	0.0935	0.115
	NO2	5	93	94.90%	0.01	0.12	0.046	0.02	0.0456
	Nitrogen (as Ammonia)	41	65	61.32%	0.05	0.43	0.13	0.1	0.0849
	WAD Cyanide	4	102	96.23%	0.011	0.091	0.0393	0.0275	0.0368
Surface Water Sites	CL	4	62	93.94%	0.7	1.7	0.975	0.75	0.486
	SO4	69	0	0.00%	1	58	16.77	15	10.78
	NO3	28	41	59.42%	0.02	1.6	0.331	0.205	0.402
	AS	8	61	88.41%	0.003	0.0437	0.0158	0.01	0.0145
	CD	0	69	100.00%	N/A	N/A	N/A	N/A	N/A
	CN	0	69	100.00%	N/A	N/A	N/A	N/A	N/A
	NO2	3	66	95.65%	0.04	0.95	0.357	0.08	0.514
	Nitrogen (as Ammonia)	45	24	34.78%	0.05	1.7	0.279	0.17	0.326
	WAD Cyanide	0	69	100.00%	N/A	N/A	N/A	N/A	N/A

Surface water sites include: Upper and Lower developed wetlands

Groundwater sites include monitoring wells MW-5, MW-6, and MW-7

Decant water is collected at the barge

4.3 Tolerance Limits

A number of methods are available to detect statistically significant deviations from baseline water quality. Among these methods, tolerance intervals have already been established as an acceptable method of detecting deviations from baseline conditions at the Fort Knox site in the Baseline Water Quality Analysis Memo (WMC, 2008). Appendix A contains explanations and references for tolerance interval techniques, along with citations for the ProUCL 4.0 software used to calculate tolerance limits and other statistics.

Before calculating tolerance limits, monitoring locations were divided into groups where necessary. This prevents inappropriately applying the same upper tolerance limits to monitoring locations with different water chemistries. Differences were identified using the Gehan test, a non-parametric method suitable for identifying differences between site chemistries. The Gehan test was selected over other methods because it is effective even when considering a high proportion of non-detected observations and multiple detection limits as are found in the monitoring location data for the indicator parameters (ProUCL Version 4.0 Technical Guide, 2007).

The results of the Gehan tests found that both surface water sites (the Upper Wetlands and Lower Wetlands monitoring locations) belonged to the same group. The groundwater monitoring locations were segregated into one group containing MW-5 & MW-6, and one grouping encompassing MW-7. This result confirms results of other analyses such as water typing using tri-linear diagrams, which also show that MW-7 has a distinct chemistry relative to the other monitoring wells (Figure 4.2).

Upper tolerance limits with 95 percent coverage and 95 percent confidence were calculated for each group of monitoring locations using non-parametric methods, which were selected because of the high percentage of non-detected data (for a fuller explanation of the tolerance interval approach, consult Appendix A). Tolerance limits were computed using dissolved concentrations for groundwater sites and total concentrations for surface water sites. For parameters with no observations above the detection, the detection limit was used to define the upper tolerance limit. Results are summarized in Table 4.3 and Table 4.4.

Table 4-3: Upper Tolerance Limits for Groundwater Monitoring Locations

Indicator Parameter	MW-5, MW-6 Upper tolerance limit* (mg/L)	MW-7 Upper tolerance limit* (mg/L)
As	0.005	0.002
Cu	0.02	0.02
Sb	0.002	0.0155
Cl	17	26
CN WAD	0.020	0.020
NO2	1	1
NO3	3.87	13
NH4	0.33	0.36
SO4	70	910

**Dissolved concentrations*

Note: If the minimum level (ML) for any indicator parameter is greater than the calculated tolerance limit, the ML will be adopted as the tolerance limit.

Table 4-4: Upper Tolerance Limits for Surface Water Monitoring Locations

Parameter:	Upper and Lower Wetlands Upper tolerance limit*(mg/L)
As	0.044
Cu	0.01
Cl	2.5
CN WAD	0.020
NO2	1
NO3	1.4
NH4	1.1
Sb	0.005
SO4	53

** Total concentrations*

Note: If the minimum level (ML) for any indicator parameter is greater than the calculated tolerance limit, the ML will be adopted as the tolerance limit.

Other parameters will continue to be monitored as set forth in Sections 5 and 6. For wells and surface waters down gradient of the facility, monitoring of parameters other than indicator parameters is to provide continuing reference data for overall water quality within the system, rather than for compliance purposes.

5 ANALYTICAL PROFILES

The current analytical profiles used for surface water, groundwater, and organic parameters are summarized in Tables 5.1 through 5.3. Analytical methods are all USEPA and State approved. Baseline samples were analyzed for organic parameters only once. The results were below detection for all parameters and the analysis was not repeated.

Table 5-1: Analytical Profile I - Surface Water Inorganic Parameters

Major ion chemistry	Minor ion chemistry	Trace ion chemistry
Lab pH	* Arsenic	* Antimony
Lab Conductivity	Cyanide	* Aluminum
Temperature (field)	Total	* Barium
Turbidity	WAD	* Bismuth
Settleable Solids	Fluoride	* Cadmium
Total Suspended Solids	*Iron	* Chromium
Total Dissolved Solids	* Manganese	* Copper
* Calcium	Nitrogen, Ammonia	* Lead
* Magnesium	Nitrate as Nitrogen	* Mercury
* Potassium	Nitrite as Nitrogen	* Nickel
* Silicon	Total Phosphorus	* Selenium
* Sodium	TPH	* Silver
Chloride		* Zinc
Sulfate		
Alkalinity (as $CaCO_3$)		
Bicarbonate		
Total Hardness		

** Total recoverable*

Table 5-2: Analytical Profile II - Groundwater Inorganic Parameters

Major ion chemistry	Minor ion chemistry	Trace ion chemistry
Lab pH	* Arsenic	* Antimony
Lab Conductivity	Cyanide	* Aluminum
Temperature (field)	Total	* Barium
Turbidity	WAD	* Bismuth
Total Suspended Solids	Fluoride	* Cadmium
Total Dissolved Solids	*Iron	* Chromium
* Calcium	* Manganese	* Copper
* Magnesium	Nitrogen, Ammonia	* Lead
* Potassium	Nitrate as Nitrogen	* Mercury
* Silicon	Nitrite as Nitrogen	* Nickel
* Sodium	Total Phosphorus	* Selenium
Chloride	Sulfide	* Silver
Sulfate		* Zinc
Alkalinity (as CaCO3)		
Bicarbonate		
Total Hardness		

**Dissolved*

On August 15, 2003 FGMI received approval from ADEC to reduce the water quality analysis for both Profile I and Profile II for Fort Knox. Approval was given to conduct analyses for dissolved constituents in groundwater samples and to conduct total recoverable analyses in surface water samples. Previously, analyses were performed for both total recoverable and dissolved constituents for both profiles.

6 COMPLIANCE MONITORING AND SAMPLING

6.1 Mill and Tailing Facilities Process Fluids

Monitoring requirements for the fluid management system associated with the Mill and Tailing Facilities are shown in Table 6.1. Analytical profiles are described in Section 5.0.

Table 6-1: Monitoring Requirements for Process Fluid Monitoring Network

Identification	Parameter	Frequency
Tailing at Mill (post cyanide detox)	pH and WAD CN	2 per day
Tailing Liquor (filtrate)	Profile I	Quarterly
Tailing Solids at Mill (post cyanide detox)	Profile II	Quarterly
	Acid/Base Accounting	Quarterly
Tailing Decant Solution	Profile I	Quarterly
Tailing Seepage Reclaim	Profile I	Quarterly
Interceptor Wells[1]	Profile II	Quarterly
Compliance Monitoring Wells[2]	Profile II	Quarterly
	Static Water Depth	Weekly

1 Includes IW-1, IW-2, IW-3, IW-4, IW-5, IW-6, IW-7, IW-8, IW-11, MW-1, MW-3, and Sites 401, 501, 801

2 MW-5, MW-6, MW-7

Results of analysis for the two samples per day collected from the mill tailings at the post cyanide detox point are recorded on the mill operations log and available for review. Mill tailing samples are drawn at two hour intervals on each of the two 12 hour shifts. The sample analyzed and reported represents a composite of the six, two hour interval, post cyanide detox, samples collected during each shift. The information is summarized on the quarterly report indicating maximum, minimum and average pH/WAD cyanide readings for the quarter.

Individual parameters may be reduced after additional sampling. The criteria for reducing parameters will be based on consistent results of analysis below the detection limit and the potential for changes that could result in water quality concerns.

6.2 Heap Leach Process Fluids

Table 6.2 summarizes the monitoring requirements for the Walter Creek Heap Leach Facility. Monitoring is required for the heap leach LCRS and PCMS and the underdrain system due to their potential to be affected by process fluids. The LCRS and the PCMS will be checked for flow weekly, and if fluid is present a monthly sample will be analyzed for WAD CN and pH. The underdrain system will be sampled quarterly. Underdrain system samples will be analyzed using the Profile II list of analytes (Table 5.2). The pregnant solution will also be sampled quarterly and analyzed for WAD CN and pH. The elevation of the in-heap storage pond will be monitored and controlled automatically.

Table 6-2: Summary of Heap Leach Monitoring Requirements

Identification	Parameter	Frequency
LCRS	WAD CN/pH	Monthly
PCMS	WAD CN/pH	Monthly
Under drain– HL1, HL2, HL3	Profile II	Quarterly
Pregnant Solution	WAD CN/pH	Quarterly
In-Heap Storage Pond	Elevation	Continuous Automatic Monitoring
Solution Recirculation/Rinsing	Profile II	Quarterly[1]

1 Begins after economic leaching is completed.

Required monitoring locations will include the Walter Creek Valley Heap Leach Facility discharges, which include: 1) heap water to the TSF, 2) leak detection monitoring in the LCRS and Process Component Monitoring System (PCMS) sumps, 3) the heap underdrain system consisting of three monitoring wells in the following locations: the base platform, the bench of the in-heap storage pond embankment, and the crest of the in-heap storage pond embankment. The old batch plant well will be sampled as well. (OL296)

If WAD cyanide concentration above 10 mg/L is detected in the heap's PCMS sumps, then all sump water must remain contained within heap leach system. The Alaska Department of Environmental Conservation (ADEC) must be notified within one working day of discovery.

If WAD cyanide concentration above 0.2 mg/L is detected in the underdrain system, the permittee must notify ADEC within one working day of discovery. Then, the permittee must demonstrate to the department's satisfaction that all water reports to the TSF.

The specific Method Detection Level (MDL), 0.005 mg/L, and Minimum Level (ML), 0.020 mg/L, for WAD cyanide concentration values between the MDL and ML provide a margin of safety indicating increasing trends prior to any exceedances. Based on the rate and magnitude of a trend, ADEC may require corrective action. When a MDL is exceeded, the permittee shall verbally notify ADEC within 60 days of the end of the calendar quarter when it occurred and provide written notification within 7 days of verbal notice.

FGMI will conduct periodic audits for the purpose of reviewing performance under this permit and approvals, and the agencies' regulatory oversight of such performance, and to aid in updating the Reclamation and Closure Plan and associated closure and post closure monitoring cost estimate. The first audit occurred in 2011.

The Walter Creek Valley Heap Leach Facility must be closed before the TSF is closed. Until closure of the TSF, any surface, groundwater, heap process water, and any other water originating from Walter Creek Valley must meet the following requirements; the tailing waste slurry shall be neutralized to contain a monthly average of 10 mg/L or less of WAD cyanide. The maximum concentration of WAD cyanide in the slurry discharge shall be 25 mg/L. These discharge limits will be changed in accordance with the current Waste Management Permit ~~No. 2006-DB0043~~.

6.3 Developed Wetlands and Water Supply Reservoir

The monitoring requirements for the developed wetlands and water supply reservoir are summarized in Table 6.3. Individual parameters may be reduced after additional sampling. The criteria for reducing parameters will be based on consistent result of analysis below the detection limit and the potential for changes that could result in water quality concerns.

Table 6-3: Developed Wetlands and Water Supply Reservoir

Identification	Parameter	Frequency
Upper developed wetlands	Profile I	Quarterly
Lower developed wetlands	Profile I	Quarterly
Water supply reservoir	Profile I	Quarterly
Surface water below the water supply reservoir (Freshwater Seepage)	Profile I	Quarterly

Pearl Creek/Victoria Creek Monitoring Wells and Surface Water Sites

Identification	Parameter	Frequency
Monitoring Wells		
PC-1GW, PC-2GW, PC-3GW, & PB-2D	Profile II	Quarterly[1]
Surface Sites		
Upper Victoria Creek	Profile I	Quarterly
Pearl Creek	Profile I	Quarterly

1 Monthly for first year

6.4 Characterization of Acid Generation Potential

Annual characterization of overburden/topsoil, B-stockpile, waste rock, and ore will continue over the life of the mine. Collection of representative samples will be based on annual operational and geological records identifying materials mined. Meteoric Water Mobility Procedure (MWMP) and acid/base accounting (ABA) will be performed on the samples. If ABA results show less than a 3 to 1 ratio of net neutralization potential to net acid generation, kinetic testing (12-week humidity cell testing) will be completed.

Tailing solids are submitted quarterly for ABA and Meteoric Water Mobility analysis. If these test results indicate less than 3 to 1 net neutralization potential, a 12-week humidity cell test will be completed. MWMP testing will also be performed on the tailings solids, using Profile II analysis.

6.5 Solid Waste Landfill Monitoring

Inert construction and demolition materials from the mine and mill operations will be disposed of in the solid waste land fill trenches in accordance with the current Fort Knox Waste Management Permit ~~2006-DB0043~~. For a more detailed discussion of permit requirements please refer to the Fort Knox Mine Solid Waste Management Plan. Since materials disposed of within the landfill trenches are inert, the potential for leachate is minimal. Furthermore landfill trenches will be located at least 100 feet from any surface water body, greater than 200 feet from any surface drinking water source and all surface water runoff will be diverted away or around landfill trenches to minimize infiltration. Additionally, trench bottoms will be located more than 10 feet above existing or expected future groundwater table. Therefore, no special groundwater or surface water monitoring is planned.

Weekly visual inspections will be made to ensure that landfill trenches are being operated properly and in compliance with the current Fort Knox Waste Management Permit ~~# 2006-DB0043~~. A summary of monitoring requirements for an active landfill is shown in Table 6.4.

Table 6-4: Summary of Monitoring Requirements for an Active Landfill

Frequency	**Action**
Weekly	Landfill inspection
Monthly	Litter cleanup, site wide, during snow free months (begin within 2 weeks of snowmelt)
Spring	Cover waste with 6" compacted soil
Fall	Cover waste with 6" compacted soil
Annually	Landfill Locations, report in Annual Report
As Needed	Cover light debris (foam, packing material) within 24 hrs of placement to prevent windblown debris
As Needed	Vector control (flies/rodents) to prevent health hazards

6.6 Embankment Monitoring

The TSF, Heap Leach and the Water Supply Reservoir embankments are routinely monitored. For a complete description of monitoring requirements, please refer to the most up to date Operations and Maintenance manuals for the Fort Knox Mine Tailing Storage Facility, Walter Creek Valley Fill Heap Leach Pad and, the Fort Knox Mine Water Dam. Tables 6.5, 6.6, and 6.7 summarize the respective inspection schedule.

Table 6-5: Tailing Storage Facility Inspection Schedule

DAILY

1. Mill operator's Daily Report: inspection of tailing barge/reclaim pumps, seepage pumps and ballast readings. Barge and seepage water samples.
2. Tailing Embankment Inspection: Look for seepage, movement, subsidence or erosion of the upstream slope, downstream slope, downstream toe, and crest of dam.
3. Barge Inspection Form: record tailing discharge point, pool depth, instantaneous flow, totalizer flow, general housekeeping.
4. Inspection of tailing discharge lines, process water pipeline and discharge point.
5. Automatic collection of electronic depth-to-water data for Interceptor Wells (IW) 1–8 and 11, Monitor Wells (MW) 1 and 3, and seepage sump levels.

WEEKLY

1. Record totalizer flow for Interceptor Wells, MW-1 and MW-3.
2. Record Instantaneous flow for Interceptor Wells, MW-1 and MW-3.
3. Static water levels for MW-2 and MW-4 through MW-7.
4. Inspection of automatically collected depth-to-water data in mill control Data Collection System.

MONTHLY

1. Record Impoundment elevation level, record data graphically.
2. Read piezometers, record and convert raw data to pore pressures and equivalent head and graph.
3. Record total volume pumped and average flow rates to tails pond and mill.
4. Survey monuments as construction activities allow. Survey is expected to resume after final lift is completed in 2013.

SEMI-ANNUALLY

1. Inspect the sub-aqueous deposition.

ANNUALLY

1. Complete detailed facility inspection including all exposed earthwork, concrete, structural steelwork (bridge), pump house, sumps, valves, and exposed piping.
2. Review and update Water Dam Operation and Maintenance Manual, as necessary.
3. Review and update Emergency Action Plan, as necessary.

AS REQUIRED

1. Carry out checks and services, as specified by the manufacturer, on pumps, valves, and controls.

Table 6-6: Walter Creek Valley Fill Heap Leach Inspection Schedule

DAILY

1. Heap leach embankment inspection: inspect upstream slope, downstream slope, abutment and downstream toe. Inspect for settlement, misalignment and adequate freeboard.
2. Pregnant and barren pipeline corridor – inspect and record surface movements indicating problems with the pipe in the trench or the trench itself, excessive snow load, erosion, or maintenance needed for the corridor, including the discharge flow rate at the end of the pipe trench.

WEEKLY

1. Record LCRS, PCMS flows.
2. Surface water collection system – inspect for excessive erosion, debris, diversion ditch integrity of liner systems, channels, and ice jams during applicable weather conditions.

QUARTERLY

1. Survey monuments S-1 though S-7, read piezometers record and graph.
2. Record flow rates of the underdrain sump.

ANNUALLY

1. Annual Performance report per most current Certificate of Approval to Operate a Dam.
2. Review Emergency Action Plan, conduct orientation class and perform an internal drill exercise.

TRI-ANNUALLY

1. Periodic Dam Inspection.
2. Table top exercise of the Emergency Action Plan with all responsible parties. Revise Plan as required.

As Required

1. Carry out checks and services, as specified by the manufacturer, on pumps, valves, and controls.

Table 6-7: Water Supply Reservoir Inspection Schedule

DAILY

1. Check pump station including trash screens, heater, piping and valves when operating
2. Record instantaneous flow rates to tails pond and mill (when operating).
3. Check spillway for blockage damage.
4. Check condition of: Upstream slope, Downstream slope, Downstream toe, Crest of Dam.
5. Visually check seepage flow rate and clarity.

WEEKLY

1. Check pump station condition.
2. Record pond elevation weekly.
3. Check spillway and outlet works for blockage/damage.
4. Check embankment condition.
5. Observe flow into seepage sump, rate and clarity.
6. Check sump overflow line.
7. Check Solo Creek causeway.
8. Check Solo Creek culvert and riprap.
9. Check security and safety devices.

MONTHLY

1. Note pond elevation fluctuation.
2. Record total volume pumped and average flow rates to tails pond and mill.
3. Summarize pertinent weekly and daily comments.

QUARTERLY

1. Read piezometers, update graphs.

ANNUALLY

1. Complete detailed facility inspection including all exposed earthwork, concrete, structural steelwork (bridge), pump houses, sumps, valves, and exposed piping.
2. Review and update Water Dam Operation and Maintenance Manual, if necessary.
3. Review and update Water Dam Operation and Maintenance Manual, if necessary.
4. Review and update Emergency Action Plan, if necessary.

AS REQUIRED

1. Carry out checks and services, as specified by the manufacturer, on pumps, valves, and controls.

6.7 Potable Water Supply Monitoring

Routine sampling and analysis of water from the potable water system at appropriate points and times are completed in accordance with 18 AAC 80.200. Reporting requirements conform to 18 AAC 80.260. Presently, a detailed monitoring plan for the potable water system is described in the Fort Knox Mine Drinking Water Monitoring Plan PWSID#314093, January 2004. Table 6.8 summarizes the monitoring requirements for the potable water system.

Table 6-8: Summary of Potable Water Monitoring Requirements

Analyte	Analytical Method	Frequency	Report
Free Chlorine	Pocket Colorimeter	Monthly	Submit to ADEC
Bact-T	Laboratory	Monthly	Submit to ADEC
TTHM&HAA5	Laboratory	1Sample Annually	Submit to ADEC
Lead & Copper	Laboratory	1Sample Annually	Submit to ADEC
Nitrate	Laboratory	1Sample Annually	Submit to ADEC
Sanitary Survey	ADEC Certified Inspector	Every Five Years	Submit to ADEC

6.8 Avian and Terrestrial Wildlife Monitoring

Frequent visual inspection of the tailing impoundment surface focuses on the decant pool and unconsolidated tailing depositional areas. No open pools of process solution were included in the heap leach design; therefore inspections would focus on any unusual occurrences of surface ponding of solution. Although all employees are directed to report unusual circumstances involving wildlife to security; all environmental, mill and mine maintenance, and mill and mine operations personnel have specific responsibility to thoroughly inspect and report wildlife mortalities and terrestrial animals mired in unconsolidated tailing.

Operational standards require the tailing discharge from the mill and the resultant decant pool to be non-toxic to avian and terrestrial wildlife species. However, realizing that all wildlife species have a finite life span, some natural mortalities will occur within the boundaries of the mine site. Occurrences within specific process component areas, such as the tailing impoundment, will require special collection and sampling.

All wildlife mortalities will be immediately reported to the security officer on duty. The species and a decant water or heap leach solution sample, will be collected. The decant/solution water sample will be collected as close to the site of the carcass as standing solution is present. The solution sample will be preserved immediately with sodium hydroxide to attain a pH >10 and submitted to an outside laboratory for WAD cyanide analysis. The collected wildlife species will be immediately preserved by freezing (size dependent) and temporarily stored in a facility under the control of mine security.

U.S. Fish & Wildlife Service (USFWS), the Alaska Department of Fish & Game (ADFG), and ADEC will be contacted to report mortalities within 24-hours or during their next scheduled workday. A written follow-up report (Appendix B) will be submitted to USFWS and ADFG with the date the mortality was discovered, identification of species, and WAD cyanide level of solution sample. The follow-up report will be submitted within seven (7) days of the initial verbal notification to allow verification of analytical results.

Contact:
U.S. Fish & Wildlife Service
Ecological Service
101- 12th Avenue
Fairbanks, Alaska 99701
Telephone (907) 456-0388

Alaska Department of Fish & Game
1300 College Road
Fairbanks, Alaska 99701-1599
Telephone (907) 451-6292

Alaska Department of Environmental Conservation
610 University Avenue
Fairbanks, Alaska 99709
Telephone (907) 451-2360

All carcasses will be available for final collection by USFWS or ADFG, depending on species (i.e., migratory bird or game species). Laboratory results of analysis for WAD cyanide concentration from solution samples will determine final disposal procedure for all carcasses collected. WAD cyanide levels >25 mg/L will trigger a necropsy to determine cause of death. WAD cyanide levels <25 mg/L will not require further analytical analysis. Final deposition of all carcasses will be determined by the appropriate agency.

Terrestrial animals mired in unconsolidated tailing material will be extracted and moved or herded to a safe area. All attempts to extract mired animals will be based on evaluation as to the health and safety of employees and that of the animal.

6.9 Mine Closure Monitoring

For a complete description of monitoring after mine closure please refer to the Fort Knox Reclamation and Closure Plan. Table 6.9 is a summary of closure monitoring requirements for the pit lake, decant pond, seepage collection system, injection system, groundwater compliance wells and surface water compliance point. Table 6.10 shows a summary of monthly and quarterly analytes.

Table 6-9: Summary of Closure Monitoring

Monitoring location	0 to 2 years		3 to 5 years		+ 6 years	
	Frequency	Parameter list	Frequency	Parameter list	Frequency	Parameter list
Decant pond	Quarterly	Complete	Quarterly	Complete	Quarterly	Complete
Pit lake	Annual	Complete	Annual	Complete	Annual	Complete
Seepage collection system	Monthly	Indicator	Quarterly[1]	Complete	NA	NA
Injection system	Monthly	Indicator	Quarterly[1]	Complete	NA	NA
compliance wells	Monthly	Indicator	Quarterly	Complete	Annual	Complete
Surface water compliance point	NA	NA	NA	NA	Monthly[2]	Indicator

1 Only if operational

2 Discharges predicted to begin after about 12 years

Table 6-10: Summary of Monthly and Quarterly Analyte Lists

Monthly samples	Quarterly samples
pH	pH
TDS	TDS
Sulfate	TSS1
Alkalinity	Calcium
Arsenic	Magnesium
Antimony	Sodium
Cadmium	Potassium
Copper	Chloride
Iron	Sulfate
Manganese	Alkalinity
Selenium	Arsenic
Cyanide	Antimony
WAD cyanide	Cadmium
	Copper
	Iron
	Manganese
	Selenium
	Zinc
	Nitrate
	Nitrite
	Ammonia
	Cyanide
	WAD cyanide

1 Surface water only

7 MONITORING/SAMPLE RECORDS AND REPORTING

7.1 Documentation of Measurements, Sampling, and Inspections

For each measurement or sample taken pursuant to this monitoring plan, the following information shall be recorded on the field data sheet:

- The exact place, date, and time of inspection, observation, measurement, or sampling;
- The person(s) who inspected, observed, measured, or sampled;

7.2 Retention of Records

During operation, closure and reclamation all records of monitoring activities and results, calibrations, and maintenance records will be retained for a period of three years.

7.3 Monitoring Reports and Submission Schedules

Indicator parameters have been selected to represent constituents present in the decant pond that are at concentrations significantly higher than the downgradient surface water and groundwater. The indicator parameters have been selected because they are relatively conservative in the environment and provide the best indication of performance of controls responsible for maintaining zero discharge. Monitoring results for indicator parameters will be compared with the upper tolerance limits established in Section 4.3. If an indicator parameter exceeds its established tolerance limit, this exceedance will be reported to the State.

Other parameters will continue to be monitored as set forth in Sections 5 and 6. For wells and surface waters downgradient of the facility, monitoring of parameters other than indicator parameters is to provide continuing reference data for overall water quality within the system, rather than for compliance purposes. This is consistent with operation of a zero-discharge facility where the primary purpose of monitoring is to confirm performance of discharge controls rather than measuring changes in downgradient water quality.

Monitoring results will be reported quarterly to ADEC. All quarterly reports will be submitted within 60 days of the end of the quarter. An Annual Activity Report will be presented to the ADEC, ADNR, U.S. Army Corps of Engineers (COE) and U.S. Environmental Protection Agency (EPA) during the first quarter of the following year summarizing monitoring results. Along with previous requirements from the Fort Knox Monitoring Plan, the annual report prepared for the ADEC, ADNR, COE and EPA will address the following:

- The groundwater collection system is operating adequately to collect all groundwater from the tailing impoundment.
- The LCRS and PCMS and underdrain groundwater collection systems are operating adequately.
- An updated annual water accounting including the heap leach.
- Contaminant levels within the tailing impoundment and documentation of any increases that would indicate toxic concentrations to wildlife.
- Reports will be on forms or in a data base format, which is agreeable to ADEC, ADNR, COE and EPA.

In addition, a trend analysis will be completed on selected parameters as a confirmation that the TSF continues to function as zero-discharge.

8 REFERENCES – ***UPDATE THIS SECTION***

FGMI, (1994) Fort Knox Project Water Resources Plan, March 1994. Fairbanks Gold Mining, Inc. Fairbanks, Alaska

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FGMI, (2004b) Fort Knox Mine Water Dam Operation and Maintenance Manual, January 2010 Fairbanks Gold Mining, Inc. Fairbanks, Alaska

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FGMI, (2006b) Walter Creek Heap Leach Facility Project Description, January 2006. Fairbanks Gold Mining, Inc. Fairbanks, Alaska

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WMC (2005b) Fort Knox Mine Closure Management Plan for the Proposed Heap Leach Facility, Water Management Consultants, Inc. Denver, Colorado.

WMC, (2008) Baseline Water Quality Analysis Technical Memorandum to Delbert Parr, March 5, 2008.