FORT KNOX MINE
MONITORING PLAN

prepared by

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FORT KNOX MINE

MONITORING PLAN

Submitted to:

Alaska Department of Natural Resources
Division of Mining, Land and Water
3700 Airport Way
Fairbanks, Alaska 99709

Alaska Department of Environmental Conservation
Division of Air and Water Quality
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Fairbanks, Alaska 99709-3643

and

Department of the Army
U.S. Army Engineer District, Alaska
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1.0 INTRODUCTION

Fairbanks Gold Mining, Inc. (FGMI), a wholly owned subsidiary of Kinross Gold U.S.A., Inc., is submitting this monitoring plan for the Fort Knox Mine to the Alaska Department of Environmental Conservation (ADEC) in accordance with AS 46.03.010, 18 AAC 60.015, and 18 AAC 80.005. 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 insure 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 an intricate part of the 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 Dam Operation and Maintenance Manual, June 2004;*
- *Fort Knox Mine Water Dam Operation and Maintenance Manual, July 2004;*
- *Fort Knox Project Reclamation & Closure Plan, January 2006;*
- *Walter Creek Heap Leach Facility Project Description, January 2006;*
- *Fort Knox Mine Solid Waste Management Plan, January 2006;*
- *Fort Knox Mine Drinking Water Monitoring Plan PWSID#314093, June 2004;*
- *Fort Knox Water Monitoring QA/QC and Field Procedures Manual, January 2006.*

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 rational 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 General Information

Location: The project is located in portions of Sections 8-12, 13-17,20-23, and 26-27, T2N, R2E, Fairbanks Meridian; and Sections 7-8 and 17-19, T2N, R3E, Fairbanks Meridian.

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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). Using conventional open pit mining and milling technology and operating year-around, 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 a 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 ammonium 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 covering 315 acres will be located in the upper end of the Walter Creek drainage upstream from the tailing impoundment. The heap leach pad has an ultimate capacity of 161 million tons. 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 a 1,556-acre 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.

To ensure zero discharge, a seepage control system at the toe of the dam collects any seepage and returns it to the tailing impoundment. A series of six groundwater interceptor wells and two monitoring wells, just downgradient of the seepage control system, collect groundwater and seepage and pump the water back to the tailing seepage sump. This is then pumped back to the tailing impoundment. Three other groundwater monitoring wells are installed downstream of the interceptor wells to track water quality.

A water supply reservoir of approximately 173 acres is located on Fish Creek three miles below the tailing dam. Fresh water is supplied 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. Construction of the mine commenced in the spring of 1995 and the first bar of dore was poured in December 1996. Compliance monitoring was initiated on November 14, 1996 when mill operations commenced.

The objective of baseline monitoring was to collect data that described the pre-mining surface water and groundwater systems in the project area. These data were used to determine the potential impacts caused by development and operation of the Fort Knox Mine. The objective of compliance monitoring is to ensure that the Fort Knox Mine operates within permit limitations minimizing impact to the environment.

2.0 COMPLIANCE MONITORING AND SAMPLING

2.1 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 components. 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.

Heap leach monitoring requirements during operation are addressed in Section 2.2. Monitoring requirements for the remainder of the fluid management system are shown in Table 1. Analytical profiles are described in Section 3.0.

Table 1 Monitoring Requirements for Fluid Management System

Identification	Parameter	Frequency
Tailing at mill (post cyanide detox)	pH and WAD CN	2 per day
Tailing liquor (filtrate)	Profile II	Quarterly
Tailing solids (residue)	Profile II Acid/Base Accounting	Quarterly Quarterly
Tailing decant solution	Profile I	Quarterly
Tailing seepage reclaim	4 metals* Profile II	Monthly Quarterly
Interceptor wells (IW-1, IW-2, IW-3, IW-4, MW-1 & MW-3)	Profile II Static water depth	Quarterly Daily
Compliance monitoring wells (MW-5, MW-6, MW-7)	Profile II Static water depth	Quarterly Daily

* Antimony, Arsenic, Selenium, and Lead are tested on a monthly basis and the results sent to ADEC.

Results of analysis for the two samples per day collected from the post cyanide detox point are recorded on the mill operations log and available for review. The information is summarized on the quarterly report indicating maximum, minimum and average pH/WAD cyanide readings for the quarter.

Tailing solids are submitted for Static Acid/Base Accounting quarterly. If these test results indicating less than 3 to 1 net neutralization potential Humidity Cell Testing will be required. A Meteoric Water Mobility Procedure will also be performed on the tailings solids, using Profile II analysis.

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.

Figure 2 shows the Fort Knox Mine general arrangement and compliance monitoring locations including process water sampling locations, interceptor well and monitoring well locations, the developed wetlands and the Water Supply Reservoir.

2.2 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 leach processes. The monitoring program established for the closure of the heap leach is presented in Section 8.

Monitoring is required for the heap leach LCRS and PCMS and the underdrain system due to their potential to be affected by process fluids (Table 2). During the first six months of heap operation the LCRS and the PCMS will be checked for flow weekly, and if fluid is present a sample will be analyzed for WAD CN and pH. If no flow is visible, monitoring frequency for the LCRS and the PCMS will be reduced to once a month. The underdrain system will be sampled monthly for WAD CN and pH in addition to quarterly sampling for the Profile II list of analytes (Table 8). The underdrain system will be sampled via a well completed on the base platform which extends into the base of the underdrain material located within the ancestral drainage channel. 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 2 Summary of Operational Heap Leach Monitoring Requirements

Identification	Parameter	Frequency
LCRS	Flow	Weekly* Monthly
PCMS	WAD CN/pH	Weekly* Monthly
Underdrain	WAD CN/pH Profile II	Monthly Quarterly
Preg Solution	WAD CN/pH	Quarterly
In-Heap Storage Pond	Elevation	Continuous Automatic Monitoring
Solution Recirculation/Rinsing	Profile II	Quarterly**

* During initial 6 months of operation, monitoring reduced if no flow
** Begins after economic leaching is completed-continuing for approximately one year

An Action Plan has been developed to provide the ability to respond appropriately in the event monitoring data suggest the facility is not functioning as designed. The monitoring components included in the Action Plan are the LCRS and the underdrain. The LCRS is considered part of the facility operations and will be used as a comparison against flow rates anticipated in the design. Under normal operating pond levels flow rates are expected to range between 10 and 200 gpm (Knight Piesold, 2006). Flows within this general range will be considered normal and consistent with expected facility performance. In addition, flow rates in excess of 200 gpm for short periods of time may not necessarily be considered anomalous depending on the variability in flow established during normal operational monitoring. Increases in flow rates for sustained periods of time above the expected maximum will trigger increased monitoring of the underdrain system.

The underdrain monitoring is focused more specifically on liner performance and, as such, will be used as the primary trigger for increased downgradient monitoring and, if necessary, solution management. Table 3 summarizes the Action Plan components.

Table 3 Operational Action Plan

Component	Monitoring	Expected operating range	Trigger event	Response
LCRS	Flow rate	10 to 200 gpm	Sustained flows >200 gpm for more than 14 consecutive days	Increase monitoring frequency of the underdrain system to weekly
PCMS	pH and WAD CN values	pH 6.5 to 8.0 Average Monthly WAD ≤ 10 mg/l	pH >8.5 25 >WAD CN > 10 mg/l for individual sampling events Average Monthly WAD CN >10 mg/l	Increase frequency of underdrain and decant pond monitoring to weekly. Begin monitoring underdrain water levels weekly.
			pH > 8.5 WAD CN > 25 mg/l for more than 14 consecutive days	Continue monitoring as above. Begin solution recovery via underdrain well.
Underdrain	pH and WAD CN values	pH 6.5 to 8.0 Average Monthly WAD ≤ 10 mg/l	pH >8.5 25 >WAD CN > 10 mg/l for individual sampling events Average Monthly WAD CN >10 mg/l	Increase frequency of underdrain and decant pond monitoring to weekly. Begin monitoring underdrain water levels weekly.
			pH > 8.5 WAD CN > 25 mg/l for more than 14 consecutive days	Continue monitoring as above. Begin solution recovery via underdrain well.

2.3 Developed Wetlands and Water Supply Reservoir

Surface water samples include those sources with the potential to be affected by process fluids. Storm water run-off above the tailing dam reports to the tailing impoundment and is used as reclaim water.

Diversion ditches were constructed to channel storm water run-off from the area above the tailing impoundment and routed to the detention basin located below the interceptor wells and at the head of the developed wetlands.

The surface flows and storm water run-off from the drainage area below the tailing facility collect in the developed wetlands and the water supply reservoir. Inflow to the water supply reservoir from Last Chance and Solo creeks is not sampled, as process fluids do not impact these drainages.

Compliance monitoring locations for the developed wetlands and water supply reservoir are shown in Figure 2. Monitoring requirements for the developed wetlands and water supply reservoir are as follows (Table 4):

Table 4 Monitoring Requirements for the Developed Wetlands and the Water Supply Reservoir

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

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.

2.4 Characterization for Acid Rock Drainage

Annual characterization of overburden/topsoil, B-stockpile, waste rock, and ore will continue over the life of the mine. Sampling for representative samples will be based on annual operational and geological records identifying materials mined. Meteoric Water Mobility Procedure and Acid/base accounting will be performed on the samples. If static evaluations 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 performed.

2.5 Monitoring for Solid Waste Landfill Leachate

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 Fort Knox Construction and Demolition Debris Landfill Permit #9931-BA001. For a more detailed discussion of permit requirements please refer too 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 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 Fort Knox Construction and Demolition Debris Landfill Permit #9931-BA001. A summary of monitoring requirements for an active landfill is shown in Table 5.

Table 5 Summary of Monitoring Requirements for an Active Landfill

Frequency	Action
Weekly	Landfill Inspection
Monthly	Litter clean-up, 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	Report to ADEC by December 31 of each year
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

2.6 Embankment Monitoring

The Tailing Storage Facility embankment and the Water Supply Reservoir embankment are routinely monitored. For a completed description of monitoring requirements please refer to the *Fort Knox Mine Tailing Dam Operation and Maintenance Manual June, 2004* and the *Fort Knox Mine Water Dam Operation and Maintenance Manual June, 2004.* Table 6 shows the Tailing Storage Facility inspection schedule and Table 7 shows the Water Supply Reservoir inspection schedule.

Table 6 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: check condition of upstream slope, downstream slope, downstream toe, 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), Monitor Wells (MW) 1 & 3, and seepage sump levels.

WEEKLY

1. Record Totalizer Flow for Interceptor Wells, MW-1 & MW-3.
2. Record Instantaneous Flow for Interceptor Wells, MW-1 & MW-3.
3. Static water levels for MW-4 through MW-7 & AW-1.
4. Inspection of automatically collected depth-to-water data in mill control Data Collection System.
5. Record Tailing Impoundment water elevation.
6. Check Freeboard

MONTHLY

1. Record impoundment elevation level, record data graphically.
2. Read piezometers, record data graphically.
3. Record total volume pumped and average flow rates to tails pond and mill.
4. Survey embankment settlement monuments (until July 1997).
5. Summarize pertinent weekly and daily comments and unusual wildlife sightings.

SEMI-ANNUALLY

1. Survey embankment monuments (after July 1997).

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 Fort Knox Water Dam Operation and Maintenance Manual, if necessary.
3. 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.

Table 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 Solos Creek causeway 8. Check Solo creek culvert and rip rap 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. Survey embankment settlement monuments (until July 1997) 4. Summarize pertinent weekly and daily comments
QUARTERLY 1. Read Piezometers, update graphs
SEMI-ANNUALLY 1. Survey embankment monuments (after July 1997)
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 Fort Knox Water Dam Operation and Maintenance Manual, if necessary 3. Review and update Emergency Action Plan, if necessary
AS REQUIRED 2. Carry out checks and services, as specified by the manufacturer, on pumps, valves and controls

3.0 ANALYTICAL PROFILES FOR LIQUID SAMPLES

Tables 8, 9 and 10 summarize the analytical profiles used for surface water, ground water, and organic parameters. Baseline samples were analyzed for organic parameters only once. As no results of analysis indicated areas of concern the analysis was not repeated.

Table 8 Analytical Profile I -- Surface Water Inorganic Parameters

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

* Total Recoverable

Table 9 Analytical Profile II -- Groundwater Inorganic Parameters

Major Ion Chemistry	Minor Ion Chemistry	Trace Ion Chemistry
Lab pH	*Arsenic	*Antimony
Lab Conductivity	Cyanide	*Barium
Temperature (field)	Total	*Bismuth
Turbidity	WAD	*Cadmium
Total Suspended Solids	Fluoride	*Chromium
Total Dissolved Solids	*Iron	*Copper
*Calcium	*Manganese	*Lead
*Magnesium	Nitrogen, Ammonia	*Mercury
*Potassium	Nitrate as Nitrogen	*Selenium
*Silicon	Nitrite as Nitrogen	*Silver
*Sodium	Total Phosphorus	*Zinc
Chloride	TPH	
Alkalinity (as $CaCO^3$)		
Bicarbonate		
Total		
Calcium Hardness		
Magnesium Hardness		

* Dissolved

On August 15, 2003 FGMI received approval from ADEC to reduce the water quality analysis involved with both the 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 collected. Previously, analyses were performed for both total recoverable and dissolved constituents on both profiles.

Table 10 Analytical Profile III -- Organic Parameters

Benzene	Lindane
Carbon tetrachloride	Methoxychlor
Chlordane	Methyl ethyl ketone
Chlorobenzene	Nitrobenzene
Chloroform	Pentachlorophenol
o-Cresol	Pyridine
m-Cresol	Tetrachloroethylene
p-Cresol	Toluene
2,4-D	Toxaphene
1,4-Dichlorbenzene	Trichloroethylene
1,1-Dichloroethylene	2,4,5-Trichlorophenol
Endrin	2,4,6-Trichlorophenol
Ethyl Benzene	2,4,5-TP (silvex)
Heptachlor	Vinyl chloride
Hexachlorobenzene (and its hydroxide)	PCB
Hexachlor-1, 3-butadiene	Xylene (total)
Hexachloroethane	

4.0 MONITORING/SAMPLE RECORDS AND REPORTING

4.1 Documentation of Measurements, Sampling, Inspections

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

- The exact place, date, and time of inspection, observation, measurement, or sampling;
- The person(s) who inspected, observed, measured, or sampled;
- The dates the analyses were performed and by which analytical facility;
- The analytical techniques or methods used;
- The accuracy of the analytical method (detection limits); and
- The results of all required analysis.

4.2 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.

4.3 Monitoring Reports and Submission Schedules

Monitoring results will be submitted quarterly to ADEC. All quarterly reports will be submitted on or before the 15th day of the month following the quarter. An Annual Activity Report will be presented to the ADEC, ADNR, Corps of Engineers (COE) and 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 ground water from the tailing impoundment.
- The LCRS and PCMS and Underdrain groundwater collection system 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.

5.0 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The *Fort Knox Water Monitoring QA/QC and Field Procedures Manual,* (Appendix A) has been modified to reflect current compliance monitoring at the Fort Knox Mine. The analytical QA/QC program for FGMI's contract laboratory, incorporated into the above referenced document, will be updated routinely or whenever a different laboratory is used.

6.0 POTABLE WATER MONITORING PUBLIC WATER SYSTEM

Routine sampling and analysis of water from the system at appropriate points and appropriate times will be in accordance with 18 AAC 80.200. Reporting requirements will conform to 18 AAC 80.260.

Presently Pioneer Water is trucking potable water to the Fort Knox Mine on a daily basis. A detailed monitoring plan for the potable water system is described in the *Fort Knox Mine Drinking Water Monitoring Plan PWSID#314093, June 2004.* Table 11 summarizes the monitoring requirements for the potable water system.

Table 11 Summary of Potable Water Monitoring Requirements

Analyte	Analytical Method	Frequency	Report
Free Chlorine	Pocket Colorimeter Analysis System	Monthly	Submit to ADEC
Bact-T	Sample to Lab	Monthly	Submit to ADEC
Vendor Bact-T	Copy from Vendor	Monthly	Environmental Department Filing System
TTHM	Sample to Lab	Every Third Year*	Submit to ADEC
HAA5	Sample to Lab	Every Third Year*	Submit to ADEC
Cross-Connection Report	Internal Inspection	Annually	Environmental Department Filing System
Sanitary Survey	ADEC Certified Inspector	Every Five Years**	Submit to ADEC

* If results of test are "no detect" then sampling is only required every third year. First sample in July 2004 was no detect.

** Most recent Sanitary Survey conducted December 2005

7.0 IMPACTS TO AVIAN AND TERRESTRIAL WILDLIFE

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 dependant) and temporarily stored in a facility under the control of mine security.

U.S. Fish & Wildlife Service (USF&WS), the Alaska Office of Habitat Management and Permitting (OHM&P), 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 USF&WS and OHM&P 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 Office of Habitat Management and Permitting
1300 College Road
Fairbanks, Alaska 99701-1599
Telephone (907) 451-6292

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

All carcasses will be available for final collection by USF&WS or OHM&P, 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 PPM will trigger a necropsy to determine cause of death. WAD cyanide levels <25 PPM 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.

8.0 MINE CLOSURE MONITORING

The following paragraphs provide a description of monitoring during and after mine closure. Table 12 is a summary of closure monitoring requirements for the pit lake, decant pond, seepage collection system, groundwater monitoring wells, and surface water monitoring point. Table 13 shows a summary of monthly and quarterly analytes.

The closure monitoring plan will include water quality sampling, water level measurements, and observations of the success of revegetation. The frequency of sampling events will be adjusted as appropriate between the pre- and post-stabilization phases based on observed improvements in water quality.

During the closure process, interim monitoring of groundwater quality will occur at the existing monitoring wells. Prior to the completion of closure, a surface water monitoring point will be established near the terminus of the wetland system. Figure 7.0 illustrates the water monitoring locations.

During the pre-stabilization phase, the tailing pond will be sampled on a quarterly basis. After pre-stabilization, seasonal water discharges will begin from the tailing impoundment (Section 6.2). Discharges will flow into the wetland treatment system on the north side of Fish Creek Valley. Currently, there is no water flow in the north side of Fish Creek and it is expected take a number of years, depending on the seasonal water flow, for the wetland treatment system to reach hydraulic equilibrium. During this phase, water may not be present at the terminus of the wetland treatment system.

Once water is present at the outfall of the wetland system on a consistent basis, water quality will be monitored near the terminus at a surface water monitoring point (a point of monitoring to be specified by ADEC) on a monthly basis during active flow for the first two years. Monthly samples will be analyzed for the indicator parameters summarized in Table 13.

The interceptor and monitoring wells will be sampled quarterly until the seepage collection system is shutdown. Once the seepage collection system is shutdown, the monitoring wells will be sampled quarterly for the first two years following shutdown. At the end of two years following shutdown the interceptor wells will be plugged and abandoned. The monitoring wells will be sampled annually years three through 10. Samples will be analyzed for the parameters summarized in Table 13.

The water quality in the pit will be monitored quarterly while pumping from the decant pond is occurring and on an annual basis throughout the closure period once pumping to the pit ceases.

Table 12 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	Quarterly	Complete	Annual	Complete	Annual	Complete
Seepage collection system	Monthly	Complete	Quarterly[1]	Complete	NA	NA
Groundwater monitoring wells	Monthly	Complete	Quarterly	Complete	Annual	Complete
Surface water monitoring point	NA	NA	Monthly	Indicator	Monthly[3]	Indicator

Notes:
1 Only if operational
2 Monitoring point located at outfall of wetland treatment system.
2 Discharges predicted to begin after about 2 to 3 years.

Table 13 Summary of Monthly and Quarterly Analyte Lists

Monthly samples	Quarterly samples
pH	PH
TDS	TDS
Sulfate	TSS[1]
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

Note: Monthly sampling analyte list will be used as indicator parameters per Table 12.

Water Level Monitoring

Groundwater levels will be monitored in the interceptor wells and monitoring wells on a quarterly basis. Subsequent to decommissioning the interceptor well system, water levels will be monitored concurrent with each water quality sampling event.

Inspection of Surface Stabilization

Visual observation of revegetation success will be performed on an annual basis during the pre-stabilization phase. Inspection for erosion and formation of gullies will be completed quarterly. Pond elevations will be measured on a quarterly frequency until the spillway invert elevation is reached.

8.1 Heap Leach

As outlined in Section 2, the principal components of the operational monitoring plan for the heap leach include the LCRS, PCMS, underdrain system, pregnant solution composition and pond levels. Some of these components will be utilized as part of the closure monitoring program for the facility.

Monitoring of solution chemistry and pond levels will continue after economic leaching has been completed and recirculation/rinsing of the heap leach is in progress. During the recirculation/rinsing period, samples will be collected on a quarterly basis to assess the composition and the rate at which the solution chemistry is improving. Recirculation/rinsing will continue until water quality meets standards for discharge.

Once solution composition meets discharge standards, monitoring of the heap leach LCRS and PCMS and the underdrain system will occur on a quarterly basis (Table 14). The underdrain system will be sampled on a semi-annual basis for the Profile II list of analytes (Table 9). The underdrain system will be sampled via a well completed on the base platform which extends into the base of the underdrain material located within the ancestral drainage channel. During recirculation samples will be collected on a quarterly basis for Profile II analyses. Once water quality meets discharge standards the quarterly samples will be analyzed for WAD CN and pH. After the liner has been punctured sample collection from the solution recovery wells will cease and quarterly measurements of water levels will be made to ensure water is not accumulating within the in-heap pond.

Prior to the liner being punctured, the elevation of the in-heap storage pond will be monitored on a quarterly basis and if possible samples will be collected on a quarterly basis for WAD CN and pH.

Table 14 Summary of Heap Leach Closure Monitoring Requirements

Identification	Parameter	Frequency
LCRS	Flow	Quarterly (during recirculation)
PCMS	Profile II WAD CN/pH	Quarterly (during recirculation) Quarterly (after recirculation)
Underdrain (via monitoring well)	Profile II WAD CN/pH	Quarterly (during recirculation) Quarterly (after recirculation)
Residual Solution (via Storage Pond recovery wells	Profile II	Quarterly (during recirculation)
In-Heap Storage Pond	Elevation	Quarterly

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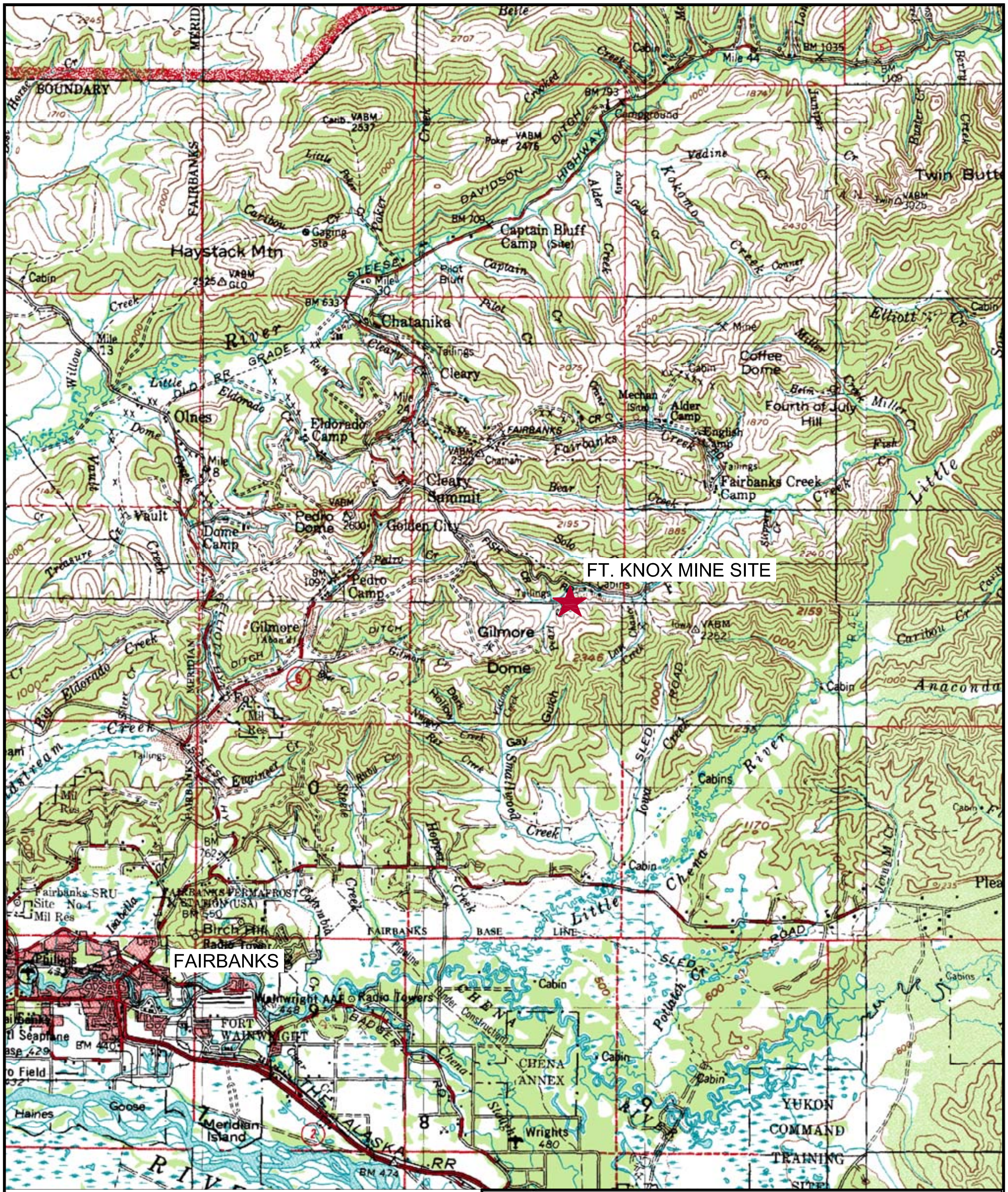
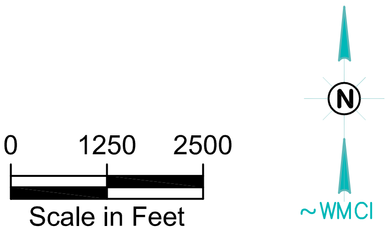
FIGURES



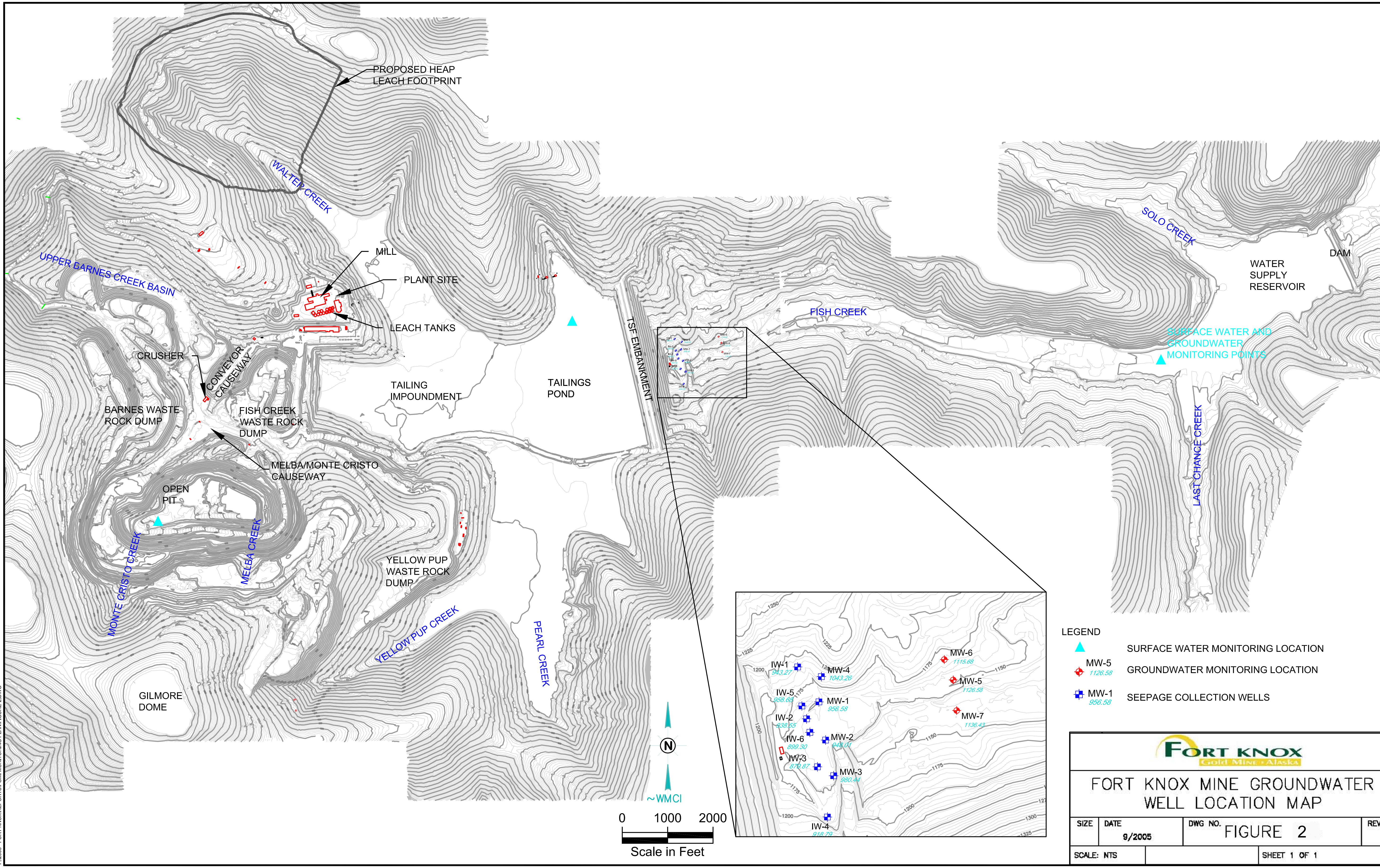


FORT KNOX Gold Mine • Alaska

FORT KNOX MINE GROUNDWATER WELL LOCATION MAP

SIZE	DATE	DWG NO.		REV
	9/2005	FIGURE 1		
SCALE: NTS			SHEET 1 OF 1	

F:\2603 - FORT KNOX\REPORTS\FGMI MONITORING PLAN\FIGURE-1.DWG


PROPOSED HEAP LEACH FOOTPRINT
WALTER CREEK
UPPER BARNES CREEK BASIN
MILL
PLANT SITE
LEACH TANKS
CRUSHER
CONVEYOR CAUSEWAY
BARNES WASTE ROCK DUMP
FISH CREEK WASTE ROCK DUMP
MELBA/MONTE CRISTO CAUSEWAY
TAILING IMPOUNDMENT
TAILINGS POND
TSF EMBANKMENT
FISH CREEK
SOLO CREEK
DAM
WATER SUPPLY RESERVOIR
SURFACE WATER AND GROUNDWATER MONITORING POINTS
LAST CHANCE CREEK
OPEN PIT
MONTE CRISTO CREEK
MELBA CREEK
YELLOW PUP WASTE ROCK DUMP
YELLOW PUP CREEK
PEARL CREEK
GILMORE DOME
~WMCI
0 1000 2000
Scale in Feet
IW-1 943.27
MW-4 1043.26
IW-5 958.68
MW-1 956.58
IW-2 938.55
IW-6 899.30
MW-2 948.01
IW-3 879.87
MW-3 980.44
IW-4 918.79
MW-6 1115.68
MW-5 1126.58
MW-7 1136.43
1250
1225
1200
1175
1150
1300
1325
LEGEND
SURFACE WATER MONITORING LOCATION
MW-5 1126.58 GROUNDWATER MONITORING LOCATION
MW-1 956.58 SEEPAGE COLLECTION WELLS
FORT KNOX Gold Mine • Alaska
FORT KNOX MINE GROUNDWATER WELL LOCATION MAP
SIZE
DATE 9/2005
DWG NO. FIGURE 2
REV
SCALE: NTS
SHEET 1 OF 1

APPENDIX A

Fort Knox Water Monitoring QA/QC and Field Procedures Manual

QUALITY ASSURANCE / QUALITY CONTROL AND FIELD PROCEDURES MANUAL

prepared by

Fairbanks Gold Mining, Inc.
(a subsidiary of Kinross Gold Corporation)
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(907) 488-4653

January 2006

QUALITY ASSURANCE/QUALITY CONTROL
AND
FIELD PROCEDURES MANUAL

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Approval of QA/QC:

______________________________________ Date:__________________
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Project Organization

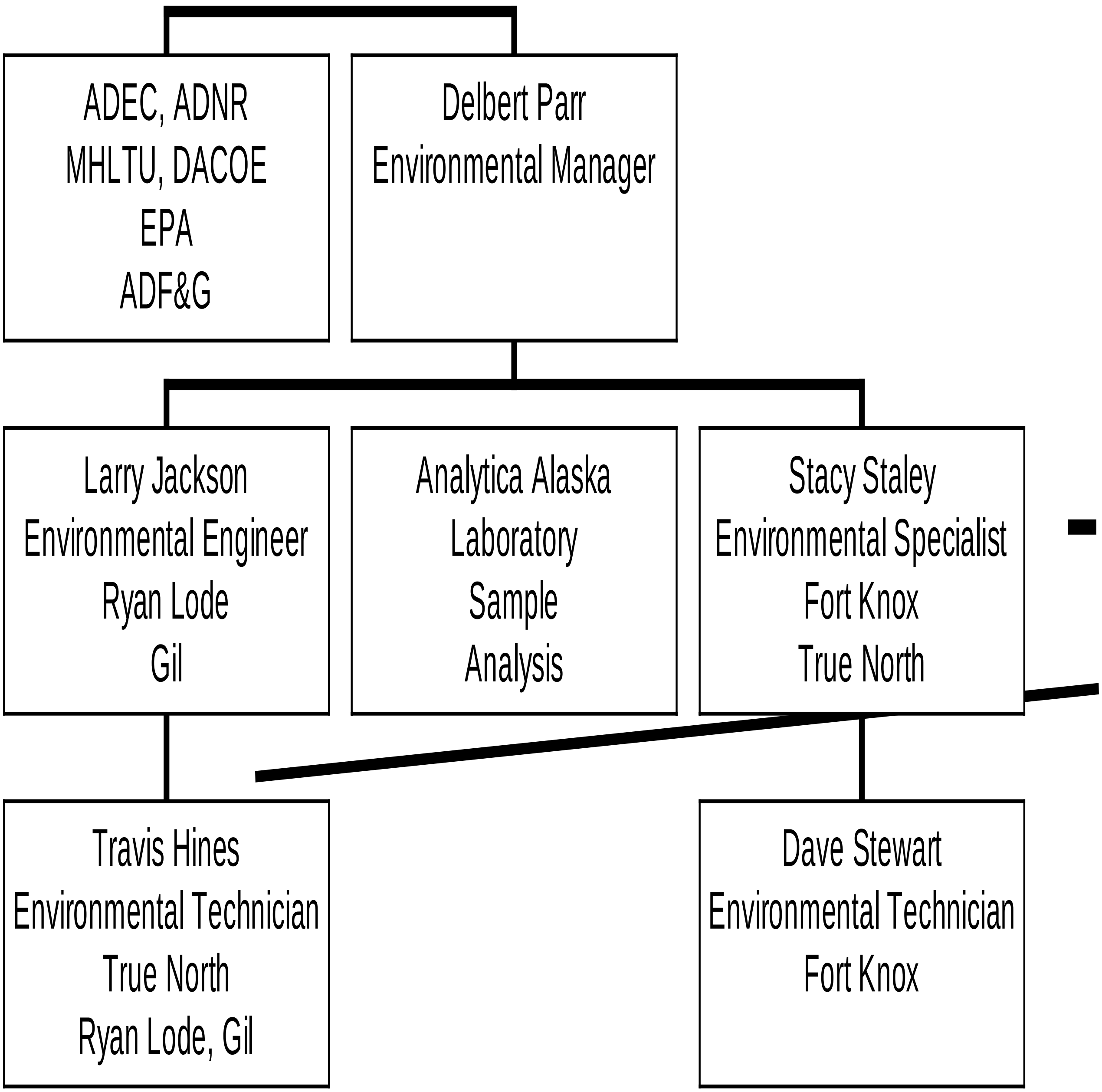
Description of Duties

Environmental Manager: Delbert Parr
Project manager, overseeing quarterly monitoring results as well as the production of the quarterly reports and distribution of reports. Maintains communication with outside agencies. Addresses data discrepancies and takes corrective measures.

Environmental Engineer: Vacant
Environmental Specialist: Vacant
Acting as quality assurance officers, overseer data gathering protocols and verifying proper sample containers & preservatives. Also supervising collection of blank and duplicate samples, handling, labeling and shipping samples as well as field equipment calibration, decontamination and documentation. Responsible for maintaining close communication with analytical laboratories and tracking sample progress as well as verifying all data is within established parameters.

Environmental Technicians: Dave Stewart and Travis Hines
Collecting samples according to approved methods. Labeling and packaging samples according to protocols to prevent leakage or cross-contamination. Properly completing chain of custody forms, and maintaining adequate documentation. Shipping samples at properly maintained temperatures and within holding times. Also responsible for instrument calibration, operation and maintenance procedures.

Compliance Sampling Communication Flow



1.0 INTRODUCTION

1.1 Objectives

This Water Monitoring QA/QC and Field Procedures Manual is for the use of Fairbanks Gold Mining, Inc. (FGMI) operating personnel. This manual will be used to maintain the quality of field activities, sample collection, sample handling, laboratory and data analyses, and to document the quality of data at each processing level. The QA/QC program identifies major aspects of the project requiring specific quality control and demonstrates that quality control is a major focus for this project. Additionally, this manual will be used for training employees in approved field monitoring procedures (i.e. instrument calibrations, measurements, and maintenance).

This document will be periodically reviewed and updated by site personnel to reflect actual site conditions and permit monitoring requirements as they change.

1.2 Quality Assurance/Quality Control Program

The QA/QC program consists of three components:

- **Field QA/QC** identifies the procedures to be used in the field to verify that water samples and field monitoring data are collected according to the requirements of the project. The objective of field QA/QC is to assure that both field measurements and samples collected for laboratory analyses can be demonstrated to be representative of the environment sampled and are of known and acceptable quality.

- **Laboratory QA/QC** identifies the protocols to be used by the laboratories to demonstrate that project data are analyzed according to U.S. Environmental Protection Agency (EPA)-acceptable methodologies, and that reported values are accurate. The objective of the laboratory QA/QC program is to produce data that will meet state and federal analytical requirements.

- **Data QA/QC** identifies the protocols to be used to verify that laboratory and field data have been reported accurately. The objective of the data QA/QC program is to demonstrate that the data reported meets the specified requirements, including comparability with data from previous years.

1.3 Data Uses and Data Quality Objectives

Quality assurance requirements are established in this QA/QC program to achieve the project objectives for the data uses. Applicable quality control procedures, quantitative target limits, and level of effort for assessing the data quality are dictated by the intended use of the data and the nature of the required field and analytical methods. The project objectives are to collect data of known and sufficient quality for FGMI to comply with the analytical permit requirements during operation and ultimately closure. The analyses to be conducted on the various sample types have been presented in the project specific monitoring plans. Protocols and appropriate detection limits are included in the laboratory's QA/QC plan available to all FGMI environmental personnel.

Federal and state levels of concern (i.e. ambient water quality criteria or maximum contaminant levels) exist for many of the parameters being analyzed in the water-monitoring program. EPA-approved analytical methods will always be used and will have detection limits low enough to determine if Alaska Water Quality Standards are being met.

1.4 Data Quality Parameters

The quality of laboratory data is measured by the precision, accuracy, representativeness, comparability, and completeness of the data. These parameters and the applicable quality control procedures and levels of effort are described below.

Precision

Precision is a qualitative measure of the reproducibility of a measurement under a given set of conditions. For duplicate measurements, analytical precision can be expressed as the relative percent difference. A quantitative definition of the relative percent difference is included in the current contract analytical laboratory's QA/QC Manual. Analytica Alaska uses a relative percent difference of 10% (+ or -) to determine their ability to accurately reproduce results. FMGI finds this level of relative percent difference acceptable, as it is the industry standard. The level of effort for precision measurement will be at a minimum frequency of one in 20 (5 percent) or one per batch, whichever is more frequent.

See Appendix B for quantitative definitions of data quality parameters

Accuracy

For samples processed by the analytical laboratory, accuracy will be evaluated through the use of matrix spikes and standard reference materials (SRMs) to establish the average recovery. A quantitative definition of average recovery is included in the current contract analytical laboratory's QA/QC Manual. The laboratory will perform matrix spike and matrix spike duplicate measurements at a minimum frequency of one in 20 samples for organic parameters, and matrix spikes of one in 20 for inorganic or miscellaneous samples, or one per batch, whichever is more frequent.

Representativeness, Precision and Accuracy

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the soil and water sampled. Sampling plan design, sampling techniques, and sample handling protocols (e.g., storage, preservation, and transportation) have been developed and are discussed in other sections of this document. Proposed documentation will establish that protocols have been followed and sample identification and integrity assured. Field blanks (Profile III only) and field duplicates obtained at a minimum frequency of 5 percent or one per Sample event will be used to assess field and transport contamination and method variation. Laboratory sample retrieval, storage, and handling procedures have also been developed and are discussed in other sections of this document. Laboratory method blanks will be run at the minimum frequency of 5 percent or one per set to assess laboratory contamination.

Comparability

Comparability is the level of confidence with which one data set can be compared with another. Comparability of the data will be maintained by using EPA-defined procedures. If unavailable or inappropriate, FGMI and Alaska Department Environmental Conservation, will discuss using other than approved EPA methods before use. A 30% relative percent difference will be considered acceptable for comparing duplicate samples between different laboratories. Comparability will also be maintained by the use of consistent units.

Completeness

Completeness is a measure of the amount of valid data obtained from the measurement system. The target completeness objectives are approximately 90 percent for each analytical parameter; the actual completeness can vary with the intrinsic nature of the samples. The completeness of the data will be assessed during the data review.

2.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

2.1 Purpose

Producing data of known quality that are considered representative of the sampling environment at an appropriate level of detail is achieved by establishing a QA/QC program with specified data gathering protocols overseen by an Environmental Specialist. The main components of the proposed QA/QC program include the following:

- Verification of use of proper sample containers and preservatives
- Collection and analysis of blank and duplicate samples
- Specific procedures for handling, labeling, and shipping samples
- Field equipment calibration
- Equipment decontamination
- Field documentation
- Field corrective action

Each Environmental Technician is responsible for implementing these components in the field. However, the Environmental Specialist will oversee each aspect of field operations to verify that these components are accomplished within the strict requirements of the project.

2.2 Quality Control Samples

To aid in evaluating the accuracy of the analytical data, a rinse blank and duplicate sample are collected and subjected to the same analyses as identified in task samples. One rinse blank is collected for every 20 unknown samples, or one per sampling event (quarterly), whichever is less. In addition, a minimum of one duplicate sample is collected for every 20-task samples, or one per sampling event (quarterly) whichever is less.

Equipment blanks for surface water sampling are taken by pouring distilled water into a decontaminated sample collection bucket, then sample bottles are filled from the sample collection bucket with a decontaminated one-liter plastic pitcher. Blanks will be analyzed along with the unknown samples.

2.3 Sample Collection, Labeling, and Handling Procedures

Sample collection, labeling, and handling procedures are periodically checked by the Environmental Specialist to verify that the following conditions are being met:

- Collection -- Samples are collected according to approved sampling methods.

- Labeling -- Samples are uniquely labeled using a code that prohibits unauthorized personnel from knowing the sampling locations.

- Packaging -- Samples are correctly packaged to prevent leakage or cross-contamination; Sample containers with proper preservatives are used; Amber sample bottles for UV protection are used when necessary.

- Chain-of-custody forms -- Chain-of-custody forms are properly completed to assure sample custody can be adequately documented.

- Shipping -- Samples are hand delivered to the laboratory or proper shipping procedures are used, including maintenance of proper temperatures and specified holding times.

Each Environmental Technician is responsible for implementing the proper sample collection, labeling, and handling procedures. The Environmental Specialist will oversee these activities.

Acids are used in some sample bottles as preservative and it is important to use correct procedures to handle any corrosive substances safely. Some of the commonly used acids are:

- Sulfuric Acid
- Nitric Acid
- Zinc Acid
- Sodium Hydroxide (base)
- Hydrochloric Acid

Personal protective gear, safety glasses and latex gloves, will be worn when opening sample bottles. In some cases an apron may be necessary, or rain gear and a face shield, when handling large quantities of acid or preservatives.

Adequate amounts of clean water will be kept on hand in the field, available for flushing eyes or skin that may come in contact with acids.

It is important to remember, if acid needs to be diluted, never pour water into acid. It is standard procedure to dilute acid by slowly pouring the acid into water.

Surface Water Grab Sampling

Surface water samples are collected in the following order:

1. Total and dissolved metals
2. Settable solids
3. Total suspended solids
4. Ammonia nitrogen
5. Miscellaneous parameters (i.e. fluoride, phosphorous, etc.)
6. TPH

Below, the surface water grab sampling procedure is listed.

1. Decontaminate compositing container (plastic bucket) and one-liter pitcher. Decontamination procedures are described later in this section.

2. Locate sampling site at a point in the stream exhibiting greatest flow and/or highest velocity, if possible.

3. Surface water sample sites may require filling the plastic-bucket by direct submergence.

    a. When submersion is required; submerge plastic-bucket at sampling point such that mouth of container is under water surface at least 2 to 3 inches, if possible. Allow container to fill partially, rinse container by shaking, and then discharge this water. Repeat this procedure three times. Collect sample, and then transfer water from plastic-bucket into the sample bottles with one-liter pitcher.

4. Fill out appropriate field data form(s) see documenting sample location, time, and other pertinent information before leaving sample site.

Surface Water Grab Sampling Through Ice

During winter months when ice cover is present, sample water is accessed with use of a manual handheld ice auger.

Clear snow off ice, an area large enough area for sampling equipment.

Drill sample hole in ice with auger periodically cleaning hole of ice chips.

After breaking through ice, cut a square area with an ax around the ice hole large enough (3-4” deep) to dip sample collection container in.

Purge three hole volumes from the ice hole prior to sampling, trying to remove all ice chips within the hole. This volume can be approximated from the hole-dimensions in the ice.

Follow surface water grab sample procedure steps 3 – 4 Surface Water
Grab Sample Procedure.

Groundwater Sampling

Groundwater sampling procedures are listed below.

The monitoring wells are sampled with a portable submersible Grundfos electric pump. A description of the sampling procedure is given below.

1. Adjust the reel support pins (on bar below roller) so that the roller is centered over the well opening. Lift and hang the REEL E-Z on the well casing by resting the support pins against the inside of the well casing.

2. Unlock the reel by pulling the pin lock mechanism outward and turning.

3. Using the operating handle gently reel down the pump to the necessary level and lock the reel in place. The cable is marked every five feet.

4. **DO NOT power the converter until the extension cord is connected.** Connect the extension cord to the electrical box. Connect the other end of the extension cable to the Grundfos MPI converter.

5. Connect the discharge hose to the discharge port.

6. Power up the MPI converter (220/240 V - 5KW generator), turn the frequency control knob to approximately mid-range (12 o'clock position) and start the pump by moving the start/stop switch to the "start" position. Adjust the speed dial to the desired frequency or flow rate.

7. Purge at least three well casing volumes prior to sampling, taking field parameters (pH, conductivity, and temperature) at each casing volume. After finishing purging and if field parameters were stable, fill sample bottles directly from sample discharge hose. A filter will be used for filling the dissolved metals sample bottle. See Appendix A (Section 5.0) for complete groundwater filtering procedure. If field parameters were unstable during well purging, continue purging well until stable field parameters are achieved. Fill out appropriate field data form(s) documenting sample location, time, and other pertinent information before leaving sample site.

8. When finished pumping, move the start/stop switch to the "stop" position. Turn off the generator. Disconnect the extension cord.

9. Disconnect the discharge hose, unlock the reel, and rewind the hose and pump back onto the reel.

Solids Sampling Procedure

As part of the mining operations, blast hole drills bore 6 3/4-inch diameter holes to a depth of 23 feet into schist bedrock within the open pit prior to blasting and loading operations. The holes are drilled on 16 X 16-foot centers using air rotary drilling methods. Generally 50-200 drill holes are drilled. The holes are loaded with explosives and detonated in one shot or blast pattern.

During drilling operations a device located near the drill steel, holds a sample container and collects approximately 7-15 kilograms of cuttings from the borehole. Each sample represents a block of approximately 440 tons of mine material. The sample is collected in a cloth sack, labeled with a bar code to identify the drill hole where sample was collected. These samples are currently taken to the FGMI assay lab (at Fort Knox) to determine the gold content by classical fire assay techniques. Based on analytical results, the block is zoned, by grade. If the grade of the material is less than 0.0018 oz Au per ton of ore, it is classified as development material and is placed in the appropriate development rock dump.

Tailing Solids

Following the determination of ore/waste for the material, assay laboratory personnel will store an assay pulp sample of development material from each blast pattern for each quarter throughout the calendar year. The Environmental Technician will then form a composite sample using approximately 7 grams from each sample. This composite sample will be forwarded to the contract laboratory for analysis. The remaining samples will be held until the results from the lab are received. Following receipt of the results of analysis the remaining samples will be discarded. If the analytical results vary significantly from previous sampling events, another composite sample will be formed, or samples from individual blast holes will be collected and shipped to the laboratory for analysis.

Annual Waste Rock Composite Sample

The ore control engineer and mine geologist will provide information on a quarterly basis relating to tonnage of development rock mined and placed in dumps over the previous three-month period. The following factors will be considered in collecting a representative sample for the annual composite sample:

- Lithological variation.
- Mineralogical variation.

- Extent of “sulfide” mineralization.
- Color variation.
- Degree of fracturing.
- Degree of oxidation.
- Extent of secondary mineralization.

Collect a representative sample of the material. The minimum sample size for this procedure is 12 pounds (5 kilograms). The maximum particle size for sample material is equal to or less than two inches (5 centimeters). All quarterly samples collected are to be saved and representatively composited during the year for evaluation. A composite sample of the quarterly samples will be composited and submitted to the contract laboratory to evaluate the potential to release pollutants by the Meteoric Water Mobility Procedure and for Acid/base Accounting.

Annual B-Stockpile & Overburden/Topsoil Samples

The same procedure described for the annual waste rock composite sample above, will be followed for sampling of the B-stockpile (low-grade stockpile) and active overburden/topsoil stockpiles. These samples will also be submitted to the contract laboratory to evaluate the potential to release pollutants by the Meteoric Water Mobility Procedure and for Acid/Base Accounting.

Sample Labeling

Labeling. Each sample container will have a waterproof label large enough to contain the information needed to easily identify each sample. The information to be included on each label includes the project name, date, time, preservative (if added), and sampling code. The sample code will be formatted to indicate sample number and date. In the field record book, the sampler identifies each sampling location. Each sample will be identified with a multi-digit number, which includes the date, and identification number of the sample. An example of sample identification is as follows:

0512017777101

Where:

051201 = Date (Dec 1, 2005)
7777 = Employee’s identification number
101 = Sequential sample number recorded in logbook for that date

All blanks and duplicates will be noted on field data sheets. The following designation will be noted where natural samples are identified as 100 series, blanks as 200 series, and duplicates as 300 series.

Packaging

Each analytical sample bottle will be packed to prevent breakage and placed in an iced cooler to keep the samples cooled to 6°C. For hand delivered and shipped samples one copy of the chain-of-custody form will be placed in a sealed plastic bag. Additionally, for shipped samples, the cooler lid will be sealed with fiber tape and at least one chain-of-custody seal will be attached to the outside of the cooler so that this seal(s) must be broken if the cooler is opened. Before sealing coolers, the Environmental Specialist will inspect sample packaging.

Chain-of-Custody

Chain-of-custody forms will be used for all samples. Once collected, the samples will remain within the custody of the sampler or will be locked up until the samples are prepared for shipment. Each time the sample bottle or sample changes hands, both the sender and receiver will sign and date the chain-of-custody form and specify what samples have changed hands. The pink carbon copy of the chain-of-custody form is retained by FGMI and the original (white) and yellow carbon copy is sent to the laboratory. The laboratory will forward the original to FGMI.

The following information is to be included on the chain-of-custody form:

- Sample identification code
- Signature of sampler
- Date and time of collection
- Project name
- Type of sample
- Number and type of containers
- Sample analysis requested (Profile I, II, III, Acid/Base Accounting, etc.)
- Inclusive dates of possession
- Signature of receiver

Other chain-of-custody components will include sample labels, sample seals, field data sheets, sample shipment receipts, and the laboratory logbook noting the Analytical profiles I, II, and/or III.

Shipping

FGMI personnel or courier will deliver samples to the designated laboratory as soon as feasible after collection.

Field Documentation

Field observations, field equipment calibration information, field measurements, and sample documentation, including sample identification, sample duplicates, and date and time the sample was collected, will be the responsibility of the entire sampling team. Field logbooks will consist of waterproof paper.

Proper documentation for sample custody includes keeping records of all materials and procedures involved in sampling. Project notebook and field data sheets will be used to record field data. The Environmental Technician will record all information on the sampling station and respective samples and replicates collected at each site, including the positions of each station. The Environmental Technician will review all data before leaving the sampling station. Completed field logs will be kept on file for any QA/QC checks. Additionally, the Environmental Specialist will inspect field documentation field data sheets regularly.

Corrections to Documentation

Unless weather conditions prevent it, all original data will be recorded using waterproof ink. No accountable documents will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on an accountable document assigned to one person, that person must make corrections by drawing a line through the error, initialing and dating the lined-out item, and entering the correct information. The erroneous information is not to be obliterated but is to remain legible. The person who made the entry will correct any subsequent error discovered on an accountable document. All such subsequent corrections will be initialed and dated.

Field Equipment Calibration

Field equipment used for collection, measurement, and testing is subject to a strict program of control, calibration, adjustment, and maintenance (See Appendix A). Portable water quality instruments will be used for the in situ measurement of pH, temperature, and conductivity. Recorded measurements will not be taken until an agreement of replicate measurements is obtained. Calibrations will be performed daily prior to beginning any sample tasks. The standards of calibration are in accordance with applicable criteria such as the NIST (National Institute of Standards Technology), ASTM standards, or other accepted procedures outlined in the manufacturer's handbook of specifications. All calibration activities will be documented on Field Data Sheets.

The Environmental Technician will review data measured in the field, and final validation will be by the Environmental Specialist. Data validation will be completed by checking procedures used in the field and comparing the data with previous results. Data that cannot be validated will be so documented; corrective action may be required, as discussed later.

Decontamination Procedures

All sample processing equipment, such as buckets and hoses, which come into contact with a sample will be decontaminated by means of the following procedure:

1. Rinse in water
2. Wash with Alconox, or equivalent, in tap water
3. Double rinse in de-ionized water, and, if not to be used right away,
4. Air-dry
5. Place in plastic bag immediately after air-drying

The purpose of the water and Alconox, or equivalent, washes is to remove all visible particulate matter. This is followed by a de-ionized water rinse to remove the detergent. It is not anticipated that high concentrations of TPH will be sampled. If visible contamination is found, a solvent rinse will be added, followed by a de-ionized water rinse.

Field Corrective Action

Field sampling corrective actions includes procedures to follow when field data results are not within the acceptable error tolerance range. These procedures include the following:

- Comparing data readings being measured with readings previously recorded
- Recalibration of equipment (i.e., pH meters)
- Replacing or repairing faulty equipment
- Resampling when feasible

The Environmental Technician is responsible for ordering appropriate field corrective actions when deemed necessary. The Environmental Specialist will be responsible for overseeing these corrections. All field corrective actions will be recorded in the field book.

3.0 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The laboratory QA/QC program is available to all FGMI personnel and a copy is also located in the FGMI library.

Data Quality Assurance/Quality Control Program

The data QA/QC program serves four major functions:

- Maintenance of a duplicate record of all field data
- Sample tracking through laboratory analysis
- Data validation
- Oversight of data management

During field operations, the Environmental Specialist will receive copies of all field data sheets, which will then be filed in the Environmental Department Filing System. These duplicates will serve as a backup file and will be checked against the field data entered into the database management system.

The second major component of the data QA/QC program is sample tracking throughout the laboratory analytical process. The Environmental Specialist will maintain close communication with all analytical laboratories to verify sample receipt, proper sample management, and strict adherence to sample holding times. The laboratories will immediately inform the Environmental Specialist of sample breakages, inadequate sample media to meet QA objectives, and other sample problems. The Environmental Specialist will then notify the Environmental Technician and the Environmental Manager so that corrective action can be implemented as deemed necessary.

Following the receipt of the analytical data package, the Environmental Specialist will verify that all sample parameter data have been received and will compare detection limits and preliminary results with previous results. Should major discrepancies be found, the Environmental Specialist will communicate these to either or both the Environmental Engineer and Environmental Manager. Possible corrective measures will then be evaluated as deemed necessary.

A data review or validation process will also be performed on 20 percent of all analytical data received from the laboratories. Chemical data will be reviewed with regard to the following:

- Analytical methodology
- Detection limits
- Cross-contamination as indicated by blank data

- Accuracy and precision
- Adherence to holding times

Where data do not meet the requirements specified in this QA/QC program, the data will be flagged with qualifiers. These reviews of data will be summarized and included in the report of sampling data.

4.1 Data Reporting

On a quarterly basis, all water quality data will be compiled, reviewed and validated, and a report of results sent to Alaska Department of Environmental Conservation. FGMI QA/QC documents and records are kept onsite and available for inspection upon request by ADEC. Analytica Alaska has on file QC reports for all samples analyzed and these are available for inspection, upon request, by ADEC.

APPENDIX A

Instrument Calibration, Operation, and Maintenance Procedures

TABLE OF CONTENTS

Instrument Calibration, Operation, and Maintenance Procedures

The following sections discuss field sampling procedures and instrument calibration, maintenance, and measurements.

1.0 Electrical Conductance

Instrument Calibration

At the beginning of each day of sampling, check instrument linearity.

1. Rinse probe with deionized water.

2. Measure conductivity of two potassium chloride (KCl) solution standards, which bracket expected sample values.

3. Measure temperature of both KCl solution standards.

Calculate cell constant for each standard to determine if instrument linearity is reasonable. The cell constant is the ratio of the computed conductivity to the measured conductivity of the standard KCl solution.

Maintenance

1. Store meter in its case during transport.

2. Check batteries before taking meter into the field. Carry spare batteries in the field (9 volt).

3. Inspect conductivity probe for cracks or other damage.

Field Measurement Procedures

1. Turn instrument on.

2. Rinse plastic beaker with approximately 50 milliliters of sample water three times.

3. Place water sample in plastic beaker (fill to at least 50 millimeters).

4. Rinse probe with deionized or sample water and place in sample water.

5. Immerse conductivity probe in sample so that vent hole is submerged. Move probe around in sample to displace any air bubbles. Turn instrument on to appropriate scale to measure conductivity. Record conductivity reading after a stable reading is obtained.

6. Remove probe from sample and turn off instrument.

2.0 Field pH

Instrument Calibration

1. Calibrate pH meter at the beginning of each day of fieldwork when pH will be measured, and whenever the standard check is out of acceptable bounds.

2. Rinse pH electrode probe with deionized water.

3. Immerse electrode and temperature probe in beaker of fresh commercial calibration solution of pH 4.0. Calibrate meter to solution.

4. Remove electrode and temperature probe from solution, and then rinse with deionized water.

5. Immerse electrode and temperature probe in fresh pH 10.0 solution. Calibrate meter to solution.

6. Remove electrode and temperature probe from solution, and rinse with deionized water.

7. Measure pH of a third fresh calibration solution at pH 7.0. If measured value differs from expected value by more than 0.1 units, obtain fresh calibration solutions and recalibrate. If discrepancy persists, begin trouble-shooting procedures following meter-operating instructions: check batteries, connections, probe, etc.

Maintenance

1. Store meter in its case with electrode immersed in a pH 7 buffer solution.

2. Inspect electrode prior to use.

3. Check glass electrode for cracks or scratches.

4. Check batteries each time meter is used. Carry a spare battery pack into the field in the pH meter case.

Field Measurement Procedures

1. Rinse decontaminated glass beaker or sample bottle with approximately 50 milliliters of sample water three times.

2. Rinse pH electrode with deionized water.

3. If measurement is read ex situ, fill beaker with sample water.

4. Immerse electrode and temperature probe in sample while swirling the sample to provide thorough mixing. Turn on meter. Read pH to nearest 0.1 until the reading has stabilized (when beaker icon stops flashing).

5. Record sample pH. Note any problems such as erratic readings.

6. Rinse probe with deionized water and store according to manufacturer's directions.

3.0 Water Temperature

Linearity and Field Measurement Procedures

1. Use either a National Institute of Standards and Technology (NIST)-calibrated thermometer or a digital temperature probe calibrated against a NIST-calibrated thermometer to measure temperature.

2. Check thermometers for cracks or gaps in the mercury. Do not use thermometers if either cracks or gaps are visible.

3. When possible, measure temperature of surface water at midstream by submersing the thermometer or electronic temperature probe for approximately 1 minute or until temperature stabilizes.

4. When in situ temperature measurements are not possible, draw sample of at least 200 ml into a decontaminated beaker or sample bottle as soon after sampling as possible.

5. Place thermometer or electronic temperature probe in sample and allow temperature to stabilize.

6. Record temperature to nearest 0.5°C in field logbook or on field data sheet.

7. Rinse thermometer or electronic temperature probe with deionized water.

8. Check field thermometers or digital temperature probes against a NIST-certified laboratory thermometer, on a quarterly basis. Agreement should be within 0.5°C.

4.0 Dissolved Metal Filtration Method for Groundwater

1. Place disposable, high capacity, pre-cleaned, vacuum-type, .45-micron filter in two-way hose fitting/reducer fitting after restricting flow to one outlet.

2. After inserting filter firmly into the two-way hose fitting adjust valves so as to divert flow through the filter.

3. Let at least three filter volumes run through the filter before filling sample bottles.

APPENDIX B

QUANTITATIVE DEFINITIONS OF DATA QUALITY PARAMETERS

Quantitative Definitions of Data Quality Parameters

Precision

If calculated from duplicate measurements:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

RPD = relative percent difference

C_1 = larger of the two observed values
C_2 = smaller of the two observed values

If calculated from three or more replicates, use relative standard (RSD) rather than RPD:

RSD = (s/y) x 100%

RSD = relative standard deviation

s = standard deviation
y = mean of replicate analyses

Standard deviation, s, is defined as follows:

$$S = \sqrt{\frac{\sum (y_I - y)^2}{n - 1}}$$

s = standard deviation
y_i = measured value of tl
y = mean replicate measurements
n = number of replicates

Accuracy

For measurements where matrix spikes are used:

$$\%R = 100\% \times \left[(S - U) / C_{sa} \right]$$

%R	= percent recovery
S	= measured concentration in spiked aliquot
U	= measured concentration in unspiked aliquot
C_{sa}	= actual concentration of spike added

For situations where standard reference material (SRM) is used instead of or in addition to matrix spikes:

$$\%R = 100\% \times (C_m / C_{srm})$$

%R	= percent recovery
C_m	= measured concentration of SRM
C_{srm}	= actual concentration of SRM Accuracy

Completeness (Statistical)

Defined as follows for all measurements:

$$\%C = 100\% \times (V/n)$$

%C	= percent completeness
V	= number of measurements judged valid
n	= total number of measurements to achieve a specified statistical level of confidence in decision making

APPENDIX C

CASING VOLUMES TABLE

Capacity of casing

DIAMETER OF CASING (inches)	GALLONS PER LINEAR FOOT	LINEAR FEET PER GALLON
2.00	0.1632	6.1275
2.50	0.2550	3.9216
3.00	0.3672	2.7233
3.50	0.4998	2.0008
4.00	0.6528	1.5319
4.25	0.7369	1.3570
4.50	0.8362	1.2104
4.75	0.9206	1.0862
5.00	1.0200	0.9804
5.25	1.1246	0.8892
5.50	1.2342	0.8102
5.75	1.3489	0.7413
6.00	1.4688	0.6808
6.25	1.5938	0.6276
6.50	1.7238	0.5801
6.75	1.8590	0.5379
7.00	1.9992	0.5002
7.25	2.1445	0.4663
7.50	2.2950	0.4357
7.75	2.4505	0.4081
8.00	2.6112	0.3830

One Casing Volume = (Well Depth – Depth To Water) x Gallons per Linear Foot
One Purge Volume = One Casing Volume x 3.0

Note: Well Depth and Depth to Water are measured in feet!

Reference: Anderson, Keith E., 1989, "Water Well Handbook", Missouri Water Well & Pump Contractors Assn., Inc.

APPENDIX B

Wildlife Mortality Reporting Form

WILDLIFE MORTALITY REPORT FORM

Fairbanks Gold Mining Inc.
Fort Knox Mine
P.O. Box 73726
Fairbanks, Alaska 99707-3726

Date:____________________

WAD Cyanide:_____________

Identification	Number	Species Identification
Raptors		
Songbird		
Upland Game		
Waterfowl		
Shorebird		
Mammal		
Other		

Reporter:______________________________

Title:_________________________________

Phone:________________________________

Mail To:

U.S. Fish & Wildlife Service
Ecological Service
101-12th Avenue
Fairbanks, Alaska 99701

Alaska Office of Habitat Management & Permitting
1300 College Road
Fairbanks, Alaska 99701-1599

Alaska Department of Environmental Conservation
Northern Regional Office
610 University Avenue
Fairbanks, Alaska 99709