

Environmental Compliance and Management Systems Audit Fort Knox Gold Mine

Report Submitted to

State of Alaska Department of Environmental Conservation

State of Alaska Department of Fish and Game

State of Alaska Department of Natural Resources

State of Alaska Trust Land Office

US Army Corps of Engineers



Report Prepared by



SRK Consulting (U.S.), Inc.

073400.018

February 2019

Environmental Compliance and Management Systems Audit

Fort Knox Gold Mine

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Revised February 2019

December 2018

Executive Summary

SRK Consulting (U.S.), Inc. (SRK) was retained by Fairbanks Gold Mining, Inc. (FGMI) to perform an environmental audit of the Fort Knox Mine located in the Fairbanks North Star Borough, approximately 26 road miles northeast of Fairbanks, Alaska. (Figure 1-1) The Request for Proposal (RFP) for this audit was issued by FGMI in March 2018, in coordination with the State of Alaska Department of Environmental Conservation (ADEC), State of Alaska Department of Natural Resources, Division of Mining, Land, and Water (ADNR), and Mental Health Trust Land Office referred to subsequently as “the agencies”.

The work associated with this environmental compliance and management systems audit was directed by ADNR, in conjunction with ADEC. FGMI was responsible for all financial obligations associated with the audit, in addition to soliciting proposals, hosting site visits, providing reports, answering technical questions, and participating with the agencies in this audit. The agencies and FGMI selected SRK to conduct the audit and prepare a report of the findings.

SRK’s preliminary review of the requirements in the Fort Knox Millsite Lease (ADL 414960 and 414961) Section 12 is indicated below:

- c) The audit will be an objective, systematic, and documented review of the conditions, operations, and practices related to environmental requirements and environmental management of the Millsite Operations conducted under this Lease. The objectives of the audit will be to evaluate:
 - i. FGMI's compliance with all federal, state, and local permits and authorizations;
 - ii. FGMI's compliance with internal environmental policies, plans, and procedures, and established environmental management systems and policies, an initial list of which is attached hereto as Exhibit E and is subject to updating, amending, or revising upon mutual agreement of the parties;
 - iii. the reliability and integrity of information relating to environmental reporting and compliance;
 - iv. the adequacy of state oversight to protect state resources; and
 - v. those conditions, operations, and priorities required by the Department of Fish and Game (ADF&G) permits.
- d) The audit will evaluate, at a minimum and not limited to, all items listed in Section (I.12) 2.8 (March 28, 2014) of the Solid Waste Disposal Permit issued by the ADEC regarding the facility audit required for that permit.

The requirements outlined above expanded the scope of the audit beyond what was presented in the RFP, and additional items were added at the request of FGMI. Additional areas to be included in the audit were ADNR water use authorizations and spill reporting. The expanded scope was agreed to by the agencies and FGMI.

The purpose of the audit is to determine if FGMI's environmental management systems and the regulatory controls in place provide reasonable assurances that the environmental objectives in the Plan of Operations (PoO) and relevant permits and approvals are being met and that the systems and controls are functioning as intended. The audit results will be used by FGMI and the agencies to assist in updating, renewing, or issuing approvals and permits, in updating policies, environmental management plans and procedures, in determining compliance with permits and approvals, and in evaluating the adequacy of the financial assurance.

SRK's role was not to solve issues but to bring them to light. The following sections present SRK's conclusions assessing if these objectives were met. Recommendations are also presented to aid the agencies and FGMI in further attaining their environmental compliance objectives.

Conclusions

The following conclusions and recommendations are based on the site visit for the audit conducted at Fort Knox Mine on July 17, 2018, review of documents, and subsequent meetings, emails, and phone calls with FGMI and the agencies:

Fort Knox Mine

- FGMI is in substantial compliance with those environmental permits and authorizations reviewed as part of this audit and appears to be very diligent in their operations.
- Monitoring and reporting activities are also in substantial compliance for FGMI.
- Tailings Storage Facility (TSF) seepage collection and monitoring systems appear to be functioning according to design based on the currently available data and in compliance with permit conditions.
- A few administrative compliance deadlines, an elevated cyanide level in an Alaska Pollutant Discharge Elimination System (APDES) Outfall 001 sample, and a potable water sample collection was missed, but overall operational compliance is above industry standards.
- Environmental health and safety procedures in place with the environmental management system and International Cyanide Management Code certification demonstrate pro-active management of FGMI.
- The Reclamation and Closure Plan is substantially complete; however, it is lacking a Reclamation Plan showing surface drainage and reclaimed contours for all facilities.
- The Closure Plan needs to be updated to reflect the current dam height, for the Reclamation and Closure Plan as required by the five-year review and update.
- The Closure Plan will be updated and consolidated per regulation, with the anticipated delivery date of March 27, 2019.
- The reclamation cost estimates appear to be adequate to cover surface reclamation as proposed; however, the uncertainties surrounding long-term water quality and management, i.e., treatment, pumping, etc. are not clearly defined and may be underestimated.
- Based on SRK's operational experience, the number of spills reported is not excessive when considering the extreme climate and amount of equipment use in 24-hour operation.
- FGMI and the US Army Corps of Engineers (USACE), and ADEC Spill Prevention and Response (SPAR), have a differing interpretation of regulatory status memorandums and spill quantities reported.

Agencies

Overall permitting and regulatory oversight of the mine and associated activities is reasonable and appropriate.

Recommendations

The scope of the audit required a review of the company's compliance with permits and authorizations including a general overview of the operations. As previously stated, SRK's role was not to solve issues. The following are general recommendations to address some of the issues identified during the audit:

- Complete the column rinsing tests to determine final rinsing or drain down requirements for the Walter Creek Valley and the Barnes Creek heap leach facilities (under construction) to assess long-term water quality and management.
- Only bulk neutralizing potential is measured in the geochemical samples. SRK recommends adding carbonate-NP to the list of geochemical analysis and evaluate for its use as a proxy for effective neutralizing potential to confirm the non-PAG classification of the samples.
- The Reclamation Plan for the Walter Creek Valley heap leach facility (WCVHLF), needs to be reviewed for adequacy of drainage through the perforations proposed in the liner. The proposed closure scenario assumes drainage under the dam structure into the tailings storage facility. Drainage may not occur, and water may continue to be impounded for the short and/or long terms.
- The Closure Plan needs to be updated to reflect the current dam height for the Reclamation and Closure Plan and amendments seem to have overlooked this change.
- The Reclamation and Closure Plan must include a grading plan showing reclamation contours, and drainages, the current plan does not include this detail.
- Update the 2017 Fort Knox Pit Lake Evaluation to include post-mining contributions from the reverse osmosis plant and the Barnes Creek heap leach facility (BCHLF);
- FGMI has numerous inert solid land fill trenches within the Waste Rock Facilities (WRF) and should remain aware of the separation requirements where applicable: 18 AAC 60.217 states: *Separation from groundwater. A new unlined landfill or a lateral expansion of a landfill may not be closer than 10 feet above the highest measured level of an aquifer of resource value unless the landfill is constructed two feet or more above the natural ground surface.*
- FGMI should continue its spill reporting and cleanup per the existing authorizations, procedures, and regulations.
- Work with ADF&G to further enhance the fishery in the Water Supply Reservoir (WSR) and wetlands is ongoing or being considered and includes:
 - Continue development of a second wetland complex along the north side of the Fish Creek valley as previously proposed by ADF&G;
 - Conversion of the existing Gil Sourdough causeway into revegetated islands;
 - Continue maintenance of the road down the valley between the tailings dam and the WSR;
 - Construction of a passive water treatment wetlands below the tailings dam where fish are not present; and
 - Removal of beaver dams to maintain fish passage for Arctic grayling spawning in the developed wetlands.
- FGMI and the agencies need to review wetland mitigation status memorandums and spill reporting quantities to verify that both entities are interpreting and understanding the information and data the same.

Agencies

- Continue improving the computerized document tracking system for document control;
- Facilitate better communication between departments and sections among the state agencies and within the internal divisions of the agencies.

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ACRONYMS

AAC	Alaska Administrative Code
ABA	Acid-Base Accounting
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish & Game
ADNR	Alaska Department of Natural Resources
ADOT	Alaska Department of Transportation
APDES	Alaska Pollutant Discharge Elimination System
AS	Alaska Statute
AWQS	Alaska Water Quality Standards
BCHLF	Barnes Creek heap leach facility
BLM	Bureau of Land Management
BMP	Best Management Practices
CIP	Carbon-In-Pulp
CWA	Clean Water Act
DO	dissolved oxygen
EA	Environmental Assessment
EHSS	Environmental Health and Safety System
EIS	Environmental Impact Statement
EMS	Environmental Management Systems
FCE	Full Compliance Evaluation
FEIS	Final Environmental Impact Statement
FGMI	Fairbanks Gold Mining Inc.
FNSB	Fairbanks North Star Borough
LCRS	Leachate Collection and Recovery System
LMPT	Large Mine Permitting Team

MOU	Memorandum of Understanding
MSGP	Multi-Sector General Permit Activity
MWMP	Meteoric Water Mobility Procedure
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
Non-PAG	non-potentially acid generating
NP	Neutralization Potential
NPDES	National Pollutant Discharge Elimination System
NPR	Neutralization Potential Ratio
POA	Pacific Ocean Alaska (U.S. Army Corps of Engineers – Alaska District)
PoO	Plan of Operations
ROA	results of analysis
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposal
SPAR	Spill Prevention and Response
SPCC	Spill Prevention Control and Countermeasure
SRK	SRK Consulting (U.S.), Inc.
TLO	Alaska Mental Health Trust Land Office
TSF	Tailings Storage Facility
USACE	US Army Corps of Engineers
USDOT	Department of Transportation
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
WAD	Weak Acid Dissocial
WCVHLF	Walter Creek heap leach facility
WMP	Waste Management Plan
WOTUS	Waters of the United States
WSR	Water Supply Reservoir

UNITS OF MEASURE

amsl	above mean sea level
CaCO ₃	calcium carbonate
C°	Celsius
Cy ³	cubic yards
F°	Fahrenheit
ft ³	cubic feet
gpm	gallons per minute
gpm/ft ²	gallons per minute/per square foot
kg	kilogram
kT	kilo tonne
mg/L	million gallons per liter
mm	millimeter
Mt	million tons
ppb	parts per billion
SO ²	sulfur dioxide
st	standard ton

APPENDICES

Appendix A: List of Fort Knox Mine Permits

Appendix B: List of Specialized Environmental Management Plans

1 Introduction

1.1 Background

SRK Consulting (U.S.), Inc. (SRK) was retained by Fairbanks Gold Mining, Inc. (FGMI) to perform an environmental audit of the Fort Knox Mine located in the Fairbanks North Star Borough (FNSB), approximately 26 road miles northeast of Fairbanks, Alaska as shown on Figure 1. The Request for Proposal (RFP) for this audit was issued by FGMI in March 2018 in coordination with ADEC in Fairbanks and ADNR, Division of Mining, Land, and Water in Fairbanks and Anchorage, and the Alaska Mental Health Trust Land Office (TLO), referred to subsequently as “the agencies”.

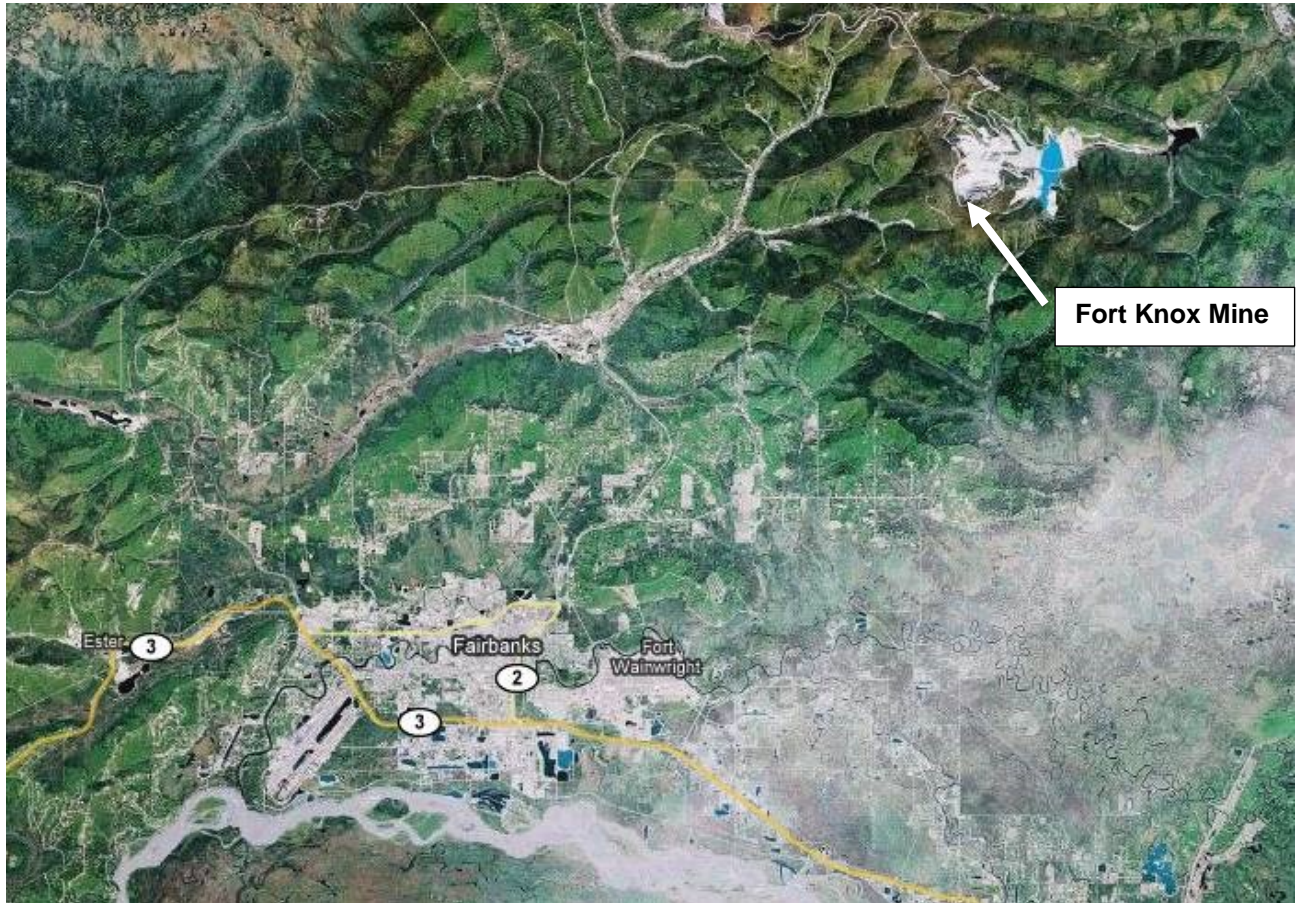


Figure 1-1: Site Location

The work associated with this audit was directed by ADNR, in conjunction with ADEC and TLO. FGMI was responsible for all financial obligations associated with the audit, in addition to soliciting proposals, hosting site visits, providing reports and documentation, responding to technical questions and data requests, and participating with the agencies in the audit of the facilities.

The on-site audit phase of the project was conducted at the Fort Knox Mine and in the offices of ADNR, ADEC, and ADF&G from July 16 to 18, 2018. This document presents the findings of the on-site audit observations as well as subsequent data and document reviews. Additional interviews were conducted with ADNR, Dam Safety Division on August 1, 2018; ADEC Air Quality division on August 10; USACE on August 13; and FNSB on August 16, 2018.

1.2 Limitations

The scope of work requested by the agencies participating in this audit was comprehensive and included areas outside the scope of general regulatory compliance. To evaluate compliance with permits, plans, approvals, and regulations, a sample of documents and procedures was examined, as is the normal practice for an audit. The documents reviewed are referenced in the corresponding sections of this audit report. As a result, SRK does not guarantee the compliance status of all requirements of a given permit, plan or approval.

The findings and recommendations in this report are based on the best professional judgment, and expertise of the auditors. FGMI and/or the participating agencies may develop alternative responses to the audit findings that are equally acceptable.

1.3 Regulatory Purpose of the Audit

The purpose of the audit is to determine if FGMI's environmental management systems and the regulatory controls in place at the Fort Knox Mine provide reasonable assurances that the environmental objectives in the Plan of Operation (PoO) are being met, and that the systems and controls are functioning as intended. The audit results will be used by FGMI and the agencies to assist in updating, renewing, or issuing approvals and permits, in updating policies, environmental management plans and procedures, in determining compliance with permits and approvals, and in evaluating the adequacy of the financial assurances.

Facility audits are required in accordance with FGMI's, Millsite Leases (ADL nos. 414960, 414961) originally issued by ADNR on February 15, 1994 (updated February 15, 2002, July 3, 2007, December 31, 2007, and June 2, 2011), Plan of Operations Approval No. F20149852POO, (March 28, 2014), and Waste Management Permit (WMP) (No. 2014DB0002).

The audit provision from the original Millsite Lease (Permit) has been carried forward in permit renewals, modifications to permits, memorandum of understanding, ADNR's PoO approval, and within ADEC's Waste Management Permit. Although ADNR permits refer to "Environmental Audit" and the ADEC lists the requirement in Section 2.8 as a "Facility Audit," SRK understands these terms have the same regulatory meaning as applied to the Fort Knox Mine.

This audit follows the three previous audits prepared by TRC (1999), Golder Associates (2004), and SRK Consulting, Inc. (2011).

1.4 Scope of the Audit

In accordance with Item 12 of the Millsite Lease, SRK's audit is intended to be an objective, systematic, and documented review of the conditions, operations, and practices related to environmental requirements and environmental management of the facility during the period of time between March 28, 2014 and July 17, 2018. The audit also considers six specific areas of concern that were identified in the RFP. These include:

- FGMI's compliance with the PoO and WMP;
- FGMI's controls provide reasonable assurances that the environmental objectives in the current PoO and WMP are being met;
- That the controls are functioning as intended;
- That the PoO and WMP provide environmental protection as required;
- That both the facility management and regulatory oversight provide reasonable assurances that the facility and controls are functioning as intended; and
- The adequacy of the reclamation financial sureties.

During the Environmental Audit Kick-off Meeting conducted on June 18, 2018, FGMI requested the review of the ADNR water use authorizations be included in the scope. During the site visit on July 17, 2018, review of the ADEC spill reporting and reports was added to the scope of the audit at the request of FGMI.

1.5 Structure of this Report

The report is structured in the following major sections:

- Section 1 provides background on the motivation, requirements and scope of the audit;
- Section 2 describes the audit methods;
- Section 3 summarizes the audit team's understanding of the mine site features obtained from a review of documents and visits to the sites;
- Section 4 provides detailed findings of the audit and recommendations; and
- Section 5 summarizes major findings and recommendations arising from the audit.

1.6 Acknowledgements

SRK acknowledges FGMI and the agencies for their accommodations, time, assistance, and cooperation in conducting this audit. The success of an audit hinges on the cooperation of all participants, which was granted to the SRK team at all times during the audit and in follow-up inquiries.

2 Audit Methods

2.1 Overview

SRK’s approach to environmental audits recognizes the multi-disciplinary character of these types of projects. To that end, the audit team was selected to include a variety of specialties including permitting, impact analyses, geochemistry, engineering, and closure specialists who have the experience to see the “big picture” and specialist consultants who provide highly specific input to the process. SRK recognizes that the overall objective of the audit is to prepare a systematic and documented review of the conditions, operations, and practices related to environmental requirements and environmental management of the operations conducted at the Fort Knox Mine.

2.2 Audit Methodology

The audit broadly followed standard methodology. In general, the major activities of an audit are:

- Initiating the audit;
- Conducting initial document review;
- Preparing for on-site auditing activities;
- Conducting on-site audit activities;
- Preparing, approving, and distributing the audit report;
- Completing the audit; and
- Conducting audit follow-up.

2.3 Audit Team

The State of Alaska’s Large Mine Permitting Team (LMPT) was originally formed specifically for the Fort Knox Mine Project and includes the agencies presented in Table 2-1 as well as Region 10 US Environmental Protection Agency (USEPA) and US Fish and Wildlife Service (USFWS). ADNR was the lead agency for the Large Mine Permitting Team. Individuals involved in the audit included representatives from ADNR, ADEC, ADF&G, USACE, FGMI, FNSB, and SRK. All agency individuals and FGMI staff are very familiar with the mine and provided invaluable expertise.

Table 2-1 Summary of Individuals Involved in the Audit

Name	Responsibility
ADNR	
Kyle Moselle	Intergovernmental coordination of project permitting
Charlie Cobb	Certificate of Approval to Operate a Dam; Dam safety and construction
Brent Martellaro	Plan of Operations Approval, reclamation, mine best management practices, financial assurances
William Groom and Carolyn Curley	Plan of Operations Amendment, reclamation, mine best management practices, financial assurances
Jenny Wynne	Water rights and use authorizations
ADEC	
Allan Nakanishi	Waste management plan, water quality
Tim Pilon	Water quality, waste management plan
Robin Wagner	Title V and minor air permit compliance
Doug Buteyn	Waste Management Plan, solid waste
Ashley Adamczak	Spill Reporting

Name	Responsibility
Tiffany Larson	Enforcement Section Manager Division of Water Compliance & Enforcement Program
AF&G	
Audra Brase	Project-specific biomonitoring; fish habitat, potential construction impacts, mitigation/best management practices
MHTLO	
Mike Franger	Owner of subsurface mineral rights in the pit and other lands purchased by FGMI
USACE	
Ellen Lyons	CWA 404 Wetlands, WOTUS
FNSB	
Bryan Sehmel	Zoning, Flood Plain, and Conditional Use Permits
FGMI	
Bartly Kleven	Environmental Manager
William Collingswood	Water, Inert Solid Waste Landfills
Jennifer Pyecha	Reclamation, Dam Permits, 404 Permits
Mark Huffington	Air, Monitoring, Data Management, Waste Management, Potable Water, Spill Reporting,
SRK	
Valerie Sawyer	Team Leader, Air, Releases, Environmental, Hazardous Materials
Bill Jeffress	Biological, Water Rights, Wastes, CWA 404
Ivan Clark	Reclamation, Closure, Geotechnical
Michael Herrell	Geochemistry

2.4 Site Visit Preparation

Preparations for the site visit included initial document review. Ms. Bartly Kleven, Environmental Manager, and ADNR provided files of relevant reports, plans, and permits from their website (<http://dnr.alaska.gov/mlw/mining/largemine/fortknox/>). Additional information was received from FGMI for review.

2.5 Site Activities

The group visited the Fort Knox Mine on July 17, 2018. FGMI representatives described the mining and reclamation activities at the site. Employees of FGMI accompanied the audit team during the site visit and were kept informed of preliminary results of the audit and assessments by the auditors during the site visit as the information became available. The auditors also met with agency representatives in Fairbanks on July 16, 2018.

- Jennifer Wynne – ADNR, Water Section Specialist II
 - Brent Martellaro – ADNR, Geologist III, Mining Section Large Mine Lead
 - William Groom – ADNR, Geologist II, Mining Section Large Mine
 - Audra Brase – ADF&G, Habitat Division Northern Region Supervisor
- July 18, 2018 with:
- Tim Pilon – ADEC, Environmental Engineer II, Waste Water

- Ashley Adamczak – ADEC, Environmental Program Specialist
- Doug Buteyn – ADEC, Environmental Program Manager I, Solid Waste Program
- Lee Johnson – ADEC, Engineer II, Drinking Water
- Charlie Cobb, P.E. – ADNR Alaska Dam Safety Engineer on August 1, 2018
- Robin Wagner – ADEC Environmental Program Specialist III on August 10, 2018 via phone and email
- Ellen Lyons – USACE Project Manager on August 13, 2018
- Bryan Sehmel – FNSB Planner on August 16, 2018
- Mike Franger – TLO Land Manager on September 4, 2018
- Tiffany Larson – ADEC Enforcement Section Manager on October 4, 2018

2.6 Close-Out Meeting

The close-out meeting was held in Fairbanks on July 18, 2018, at the FGMI office to brief FGMI on the preliminary findings of the audit. SRK presented the initial impressions of the sites, and preliminary findings in the major areas, with the caveat that additional review could change these preliminary findings.

2.7 Reporting

The deliverable for this audit is a Draft Report, issued electronically to ADNR, ADEC, ADF&G, TLO, USACE, and FGMI on September 14, 2018 and a final report will be submitted to ADNR, ADEC, ADF&G, TLO, and FGMI after review and comments are received from the agencies.

The reports include a comprehensive written record of the audit findings, along with conclusions and recommendations of the auditors. Each team member was assigned sections based on their areas of responsibility and expertise, with the report compiled by the Project Manager.

3 Site Description

3.1 Site Location

FGMI, a wholly owned subsidiary of Kinross Gold Corporation (Kinross), operates an open pit gold mine, a heap leach facility, a mill and associated tailings storage facility at its Fairbanks, Alaska property. The Fort Knox Mine complex is located in the Fairbanks North Star Borough, approximately 26 road miles northeast of Fairbanks, Alaska. Access is via the Steese Highway for approximately ten miles to the town of Fox, then northeast on Alaska Highway 2 for approximately ten miles to Cleary Summit and travel southeast on the Twin Creek Road and Fish Creek Road for approximately 6 miles to the site.

The Fort Knox Mine is located in the Little Chena River basin within the Yukon-Tanana Uplands physiographic province. The site is situated within the Fish Creek sub-basin, which is tributary to the Chena River. Ridges with gentle slopes characterize the higher elevations ranging between 1,200 and 1,300 feet above mean sea level (amsl). The ore body is centered on the north flank of Gilmore Dome on a ridge between Melba Creek and Monte Cristo Creek. The WCVHLF is located in the Walter Creek drainage. The BCHLF, which is under construction, is located in the Barnes Creek drainage. The remaining site facilities, including the waste rock dumps, tailings storage facility, water reservoir, mill and plant, are located within the Barnes Creek and Fish Creek drainages. The Barnes, Melba, and Monte Cristo Creeks, as well as the smaller tributaries of Walter, Pearl, Yellow Pup, Solo, and Last Chance all flow to Fish Creek (Schlumberger 2011).

3.2 Fort Knox Mine

The Fort Knox Mine provides ore for the mill, a large modern carbon-in-pulp gold extraction plant that has a capacity to process between 36,000 to 50,000 short tons (st) of ore per day. Heap-grade ore is placed on the WCVHLF, authorized in 2007. The BCHLF, which is under construction, will be operational in 2020. The mill is anticipated to operate through 2020, the open pit through 2021, and heap leaching through 2024 (FGMI 2018a), which includes a period of residual leaching. The major mine components include:

- Fort Knox Pit
- Milling and beneficiation facilities
- WCVHLF
- BCHLF, under construction
- INCO SO₂/Air cyanide destruction process (standby)
- Tailings Storage Facility (TSF)
- Seepage and groundwater collection (interceptor) system
- Alaska Pollutant Discharge Elimination System (APDES) Outfalls 001 and 002
- Twin Creeks access road
- Administration and security buildings
- Maintenance facility
- Fresh water supply reservoir (WSR)
- Overburden/waste rock dumps
- Coarse ore stockpile
- Low-grade ore
- Stockpiled growth media
- Material borrow sites
- Constructed wetlands.

3.2.1 Open Pit Mining

The Fort Knox Mine was permitted in early 1994, and construction began in March 1995; gold has been produced on a continuous basis since 1996. The Pit is currently mined as a conventional truck-and-shovel mine and operates year-round. Ore is processed at the mine's mill complex adjacent to the Fort Knox Pit.

3.2.2 Processing

Processing the ore begins with a one-stage crushing, conveyance to the mill on belt conveyors, grinding by a semi autogenous and two ball mills, ending in a slurry. The slurry passes through a gravity separation circuit, thickened to 55 percent solids and processed through a cyanide leaching circuit. Gold is recovered from a carbon in pulp (CIP) circuit followed by carbon stripping, electrowinning, and refining.

The CIP discharge gravity flows to a tailings thickener, and the warm decant solution is re-introduced into the milling circuit thus recovering residual heat, cyanide, and other mill reagents. The tailings thickener underflow is mixed with decant solution (supernatant) pumped from the TSF. Cyanide is recovered and cycled back into the process, substantially reducing the weak acid dissociable (WAD) concentrations in tailings as well as reducing the amount of cyanide and other reagents required. The patented INCO SO₂/Air process detoxification circuit is held in reserve and activated as necessary to address process fluctuations. FGMI's goal is to maintain a WAD cyanide level less than 10 mg/L in the tailings solution.

The slurry is either pumped or gravity-fed depending on the discharge point to the tailings disposal system with controlled deposition in order to control the size and location of the supernatant pond. Slurried tailings are discharged sub-aerially from pipes located at the upstream margin of the TSF facility. Approximately 39,500 tons per day are processed and deposited in the TSF. A primary decant pond serves as the source of makeup water to the mill. An additional decant pond exists in the Pearl Creek area of the TSF (Schlumberger 2011).

3.2.3 Tailings Storage Facility

The tailings management is a zero-discharge system consisting of a 1,147-acre TSF located 1.5 miles from the Fort Knox Pit. As of December 31, 2017, approximately 304.6 Mt of tailings have been placed in the facility. The tailings dam is an earthen-filled structure designed to contain all process water from the mill, as well as surface water runoff. The dam is designed and maintained to contain the 100-year, 24-hour storm event with three feet of freeboard and the Probable Maximum Precipitation (PMP) event with one foot of freeboard. Impoundment water is not discharged to the environment but is recycled to the mill for reuse in the beneficiation process. To ensure zero discharge, a seepage collection system at the toe of the dam collects and returns seepage to the tailings impoundment. A series of groundwater pump-back (interceptor) wells, just down-gradient of the seepage control system, is designed to intercept groundwater and seepage and pump the water back into the tailings impoundment. Monitoring wells were installed to monitor groundwater quality downstream of the interceptor wells.

3.2.4 Walter Creek Valley Heap Leach Facility

The WCVHLF was authorized in 2007; construction began in 2008, and ore placement and leaching began in 2009. The WCVHLF has a design capacity of 307 Mt and approximately 215 Mt have been placed on the heap leach and another 21.5 million tons will be loaded on the pad in 2018.

Ore is loaded on the pad in incremental lifts at an average rate of 50,000 to 100,000 tons per day. Barren cyanide solution is applied near surface at a rate of approximately 20,000 gallons per minute (gpm) through a network of solution drip emitters as permitted by condition 3.1.3.2 of the WMP. The solution application rate is 0.0024 gpm per square foot of leached area. These emitters are placed on the ore or buried during cold weather months. The barren solution percolates through the heap and is intercepted by an impervious composite liner system and solution collection piping which discharges into a double lined sump located at the base of the heap.

The pregnant solution (containing gold) is collected in the in-heap storage pond and pumped to dedicated heap leach carbon columns in the mill facility for gold recovery. A seepage collection system is monitored to detect potential leaks in the liner system. At any given time, the TSF is capable of storing the operating pond volume, the runoff from the PMP and, in the extremely unlikely event of a catastrophic failure of the heap leach pad embankment dam, the volume of the heap leach pond. Under this worst-case situation, 1 foot of freeboard would remain in the TSF. Beneath the in-heap storage pond, a leachate collection and recovery system (LCRS) was constructed between an overlying primary geomembrane liner and an underlying secondary geomembrane liner, which, in turn, is underlain by a 12-inch-thick layered prepared sub-base. The LCRS consists of a drainage layer that reports to a pump-back system to return any solution passing through the primary liner back to the in-heap storage pond. The LCRS constructed in conjunction with the double liner in the area of the in-heap storage reservoir provides leak monitoring and collection. A process component monitoring system (PCMS) was constructed under the main header lines for the solution collection system outside of the LCRS, providing additional leak detection. An underdrain system consisting of a network of drainage channels containing drain rock routes water from base flow in Walter Creek, and other seeps and springs, under the sub-base to the TSF providing a third level of leak detection (Schlumberger 2011).

3.2.5 Barnes Creek Heap Leach Facility

The BCHLF has a design capacity of 207 Mt. This heap leach facility will extend up the valley from the existing Barnes Creek conveyor causeway and will be comprised of six distinct and progressively developed stages (Stages 1 through 6). Following FGMI's planned removal of the majority of the Barnes Creek stockpile, the maximum relief across the BCHLF footprint is expected to be on the order of 720 feet, from the base of the in-heap storage pond at elevation 1,450 feet amsl, to the crest of the Stage 6 pad area at approximately elevation 2,165 feet amsl. At the final buildout, the BCHLF will disturb about 290 acres (FGMI 2017b).

At its final configuration, through the planned Stage 6 development, the BCHLF will reach a maximum height of approximately 800 ft from toe to crest and will achieve a storage capacity of approximately 125 million cubic yards or 207 Mt. A maximum 500-foot vertical ore thickness over the pad liner system has been adopted to remain consistent with the WCVHLF (FGMI 2017a).

Slope stability analyses of the Stage 6 heap were conducted for both static and seismic loading conditions and provided acceptable results that confirmed the adequacy of the Barnes Creek heap configuration. Settlement analyses, conducted to assess the effect of constructing final heap configuration over the existing waste dumps and small portions of the Barnes Creek stockpile material that is planned to be left in place, suggest that flow reversal and localized low-points are not expected to develop along the pad liner system and that the estimated foundation settlements should not adversely affect the integrity of the proposed BCHLF liner system (FGMI 2017a).

In part, due to the Fort Knox location where cold weather conditions are experienced for significant periods of each year, and to remain consistent with the operational success of the WCVHLF, the BCHLF has been designed with an in-heap pond for storage of process solution and storm water. It will be contained behind an approximate 95-foot high in-heap pond embankment, with a crest elevation of 1,545 amsl that will be developed on the upstream side of the existing Barnes Creek conveyor causeway (FGMI 2017b).

FGMI currently plans to deliver a total solution flow of 16,000 gpm to the heap; however, to allow flexibility for future possible increases the solution collection system has been designed to accommodate a 50 percent increase to 24,000 gpm. The maximum unit rate of solution applied to the heap will be 0.005 gpm/ft². The overliner solution collection system has been designed to collect and convey the process fluid from the base of the heap to the in-heap storage pond while limiting the maximum hydraulic head acting above the leach pad composite liner system to 1 foot (outside the confines of the pond). The leach solution within the in-heap pond will be removed by a series of extraction wells located near the upstream toe of the in-heap storage pond embankment (FGMI 2017b). Similar to the WCVHLF, a LRCS will be installed under the primary liner of the in-heap pond.

3.2.6 Climate

The climate at the site is continental sub-arctic, with the majority of precipitation occurring between the months of May and September. Precipitation has been measured continuously at the mine site and has averaged approximately 18 inches per year, with a low of 10.8 inches in 2006 and a high of 25.51 inches in 2015. The precipitation station at the mine is located in the main parking lot, on the east side of the administration building, at an approximate elevation of 1,640 feet amsl. The temperatures on site range from highs above 90° Fahrenheit (F) to lows of minus 50°F (Schlumberger 2011).

3.2.7 Geology

The Fort Knox Mine is located within the Fairbanks Mining District, a southwest–northeast trending belt of lode and placer gold deposits that comprise one of the largest gold producing areas in the state of Alaska. The Fairbanks district is situated in the northwestern part of the Yukon–Tanana Uplands. The Yukon–Tanana terrane consists of a thick sequence of polymetamorphic rocks that range from Precambrian to upper Paleozoic in age. The protoliths were comprised primarily of sedimentary and volcanic units, with only minor rocks of plutonic origin. The region has undergone at least two periods of dynamic and thermal metamorphism, an early prograde amphibolite event, and a later, retrograde, greenschist facies event (FGMI 2003).

The dominant rock unit in the district is the Fairbanks Schist which is comprised of gray to brown fine-grained micaceous schist and micaceous quartzite. Interlayered with the Fairbanks Schist is the Cleary Sequence, a varied assemblage of metamorphic lithologies. In the northern part of the district highly metamorphosed rocks of the Chatanika terrane have been identified. These rocks, which are in fault contact with the Fairbanks Schist and Cleary Sequence, are thought to be Devonian to Mississippian in age, and have been metamorphosed to eclogite facies (FGMI 2003).

The dominant structural trend of the district is expressed by numerous northeast trending faults and shear zones. These structures, which were important to the localization of gold mineralization, show a dominant strike-slip movement (FGMI 2003).

3.3 Geochemistry

The *Fort Knox Gold Mine Monitoring Plan* (FGMI 2017) stipulates which mine materials require sampling for geochemical testing and the sampling frequencies as follows:

- Annual sampling of overburden/topsoil, B-stockpile, waste rock, and ore; and
- Quarterly sampling of tailings solids from the Fort Knox mill.

All samples are submitted for Meteoric Water Mobility Procedure (MWMP) analysis and Acid-Base Accounting (ABA).

The Monitoring Plan (FGMI 2017) states that if ABA results have a neutralization potential ratio (NPR), defined as the ratio of neutralization potential (NP) to acid potential (AP) of less than 3, a 12-week humidity cell test will be completed. Tailings samples MWMP leachates are analyzed for the Profile II water quality constituents, defined in the monitoring plan. Screening criteria for MWMP leachates is not stipulated in the Monitoring Plan.

Table 3-1: Profile II Water Quality Constituents (after FGMI 2017)

Major Ion Chemistry	Minor Ion Chemistry	Trace Ion Chemistry
Lab pH	Aresnic ¹	Antimony ¹
Lab Conductivity	Cyanide	Aluminum ¹
Temperature (field)	Total	Barium ¹
Turbidity	WAD	Bismuth ¹
Total Suspended Solids	Fluoride	Cadmium ¹

Major Ion Chemistry	Minor Ion Chemistry	Trace Ion Chemistry
Total Dissolved Solids	Iron ¹	Chromium ¹
Calcium ¹	Magnanese ¹	Copper ¹
Magnesium ¹	Nitrogen, Ammonia ¹	Lead ¹
Potassium ¹	Nitrate as Nitrogen	Mercury ¹
Silicon ¹	Nitrite as Nitrogen	Nickel ¹
Sodium ¹	Total Phosphorus	Selenium ¹
Chloride	Sulfide	Silver ¹
Sulfate		Zinc ¹
Alkalinity (as CaCO ₃)		
Bicarbonate		
Total Hardness		

¹Dissolved

3.4 Regulatory Setting

The Fort Knox Mine is located on a combination of Alaska state and private land. Currently, there are 72 separate permits, licenses, certificates and authorizations covering activities in and around the mine, issued by various federal, state, and local agencies. Development, operation, and reclamation activities are authorized in part under a series of leases and other land use authorizations from ADNR, TLO, and FNSB. Only a brief discussion of the primary agencies and permits is practical in describing the fundamental regulatory setting for FGMI. The primary permits and authorizations are:

- Millsite leases ADL No. 414960 and 414961 issued by ADNR;
- ADNR Plan of Operations approval and amendments;
- Waste Management Permit 2014DB0002, Modification #2 (which succeeds Waste Management Permit 2006DB0043);
- Alaska Pollutant Discharge Elimination System Permit (AK0053643) Wastewater Discharge (Point Source)
- Alaska Pollutant Discharge Elimination System Storm Water Discharge Permit (AKR06AB17);
- 404 Permit Issued by the USACE; and
- FNSB - Zoning, Flood Plain, and Conditional Use Permits

A list of the permits, authorizations, and certificates are presented in Appendix A.

3.5 Jurisdictional Agencies

USACE is the primary federal agency administering Section 404 (Dredge and Fill) provisions of the Clean Water Act (CWA) for activities affecting wetlands (waters of the U.S.). The USACE issued the original permit (Pacific Ocean Alaska [POA]-1992-574 – Fish Creek 23) for the Fort Knox project in May 1994 and has since reviewed, extended, or modified the permit 26 times.

The ADEC regulates air quality, solid waste, storm water, potable water and other aspects of the operations primarily through Title 18 of the Administrative Code (AAC) Chapters 50, 60, 70, 72, 75, 80 and 83. Several certificates, authorizations, and permits are issued by the ADEC, including, but not limited to the Air Quality Control Minor Permit No. AQ0053MSS04 and Air Quality Operating Permit No. AQ0053TVP03, Waste Management Permit 2014DB0002, and Certificates of Reasonable Assurance (CWA 401). The ADEC authorizes air sources, tailings and other solid waste disposal, prescribes monitoring, reporting, closure, post-closure and financial responsibility requirements. ADEC also issues APDES permits for stormwater and point source discharges.

ADNR issues certain land and water use authorizations, dam safety certificates, and is the primary agency implementing reclamation/closure planning and bonding primarily through Title 11 of AAC Chapters 27, 38, 86, 93, 96, and 97.

3.6 Fort Knox Land Use Authorizations

The project area encompasses approximately 8,691 acres. The project area includes the Amended and Restated Millsite Lease, the Upland Mining Lease, and private land. The Amended and Restated Millsite Lease (amending and restating the Millsite Lease effective as of February 15, 1994, ADL no. 414960, 414961) contains approximately 5,832 acres of state land and 121 acres of private land. Further, 63 acres of land were purchased/deeded (2008) as part of the Phase 7 expansion. An additional 1,790 acres within the Upland Mining Lease and Millsite Lease were purchased in 2008 by FGMI from TLO. An additional 709 acres (Gilmore/Parcel G) were added to the lease in 2018.

FGMI submitted an application for an Upland Mining Lease (ADL 535408) covering tentatively approved lands on December 4, 1992. These lands include 48 state mining claims owned by Melba Creek Mining, Inc., an Alaska corporation, and FGMI, a Delaware corporation. FGMI, on December 4, 1992, applied for two surface leases; the Surface Lease A (ADL 414960) and Surface Lease B (ADL 414961) were tentatively approved in the vicinity of the Fort Knox lode gold deposit. The ADNR issued a Millsite Lease (ADL no. 414960, 414961) and Upland Mining Lease (ADL 535408) on February 15, 1994.

On July 8, 2002 the Amended and Restated Millsite Lease (amending and restating the Millsite Lease effective as of February 15, 1994, ADL no. 414960, 414961) became effective and authorized gold-bearing ores derived from outside the Millsite Lease area to be processed through the Fort Knox mill and tailings facilities.

Private land included within the Fort Knox project area consists of 121.2 acres of patented claims purchased by FGMI. The narrow block of patented claims adjacent to, but not included in, the Upland Mining Lease or the Millsite Lease, were conveyed to FGMI and Melba Creek Mining, Inc. via warranty deed in August 1993. (Figure 3-1)

An agreement was reached with the National Oceanic and Atmospheric Administration (NOAA) and the Bureau of Land Management (BLM) to release 63 acres from the NOAA withdrawal for expansion of the Fort Knox Pit. The land was conveyed to the State of Alaska who in turn conveyed it to TLO. As part of this agreement, a 19-acre easement was established at the ridgeline to prevent any activity that could impact the activities of NOAA. In 2008, FGMI reached an agreement with TLO to purchase their surface interest within the Millsite Lease area. The purchase was finalized in May 2008.

No federally administered land is located within the project boundaries. The closest residence to the project area is approximately 2.5 miles from the project boundary on Cleary Summit.

The ore body and the majority of the project area are located on land belonging to the State of Alaska. Private land and mineral rights in the project area along Fish Creek, originally patented to placer miners under the General Mining Act of 1872, have been purchased by FGMI. The patented private lands along Fish Creek were conveyed to the State of Alaska, at the time the Millsite Lease was issued.

FGMI operates under Plan of Operations Approval F20149852POO, last amended in March 28, 2014, and effective until March 27, 2019. This authorization is granted by the ADNR in accordance with and subject to Alaska Statutes (AS) 27.19 (Reclamation) and 38.05 (Alaska Land Act) and the AAC Title 11 and chapters 86.800 (Plan of Operations), 96 (Miscellaneous Land Use), and 97 (Mining Reclamation). The Plan of Operations Approval authorizes activities upon state lands encompassed by the previously mentioned Amended and Restated Millsite Lease and Uplands Mining Lease. The Reclamation Plan Approval authorizes activities on certain private lands. The Plan of Operations Approval contains general, project-specific, and standard stipulations for environmental protection, monitoring, reporting, and reclamation and closure.

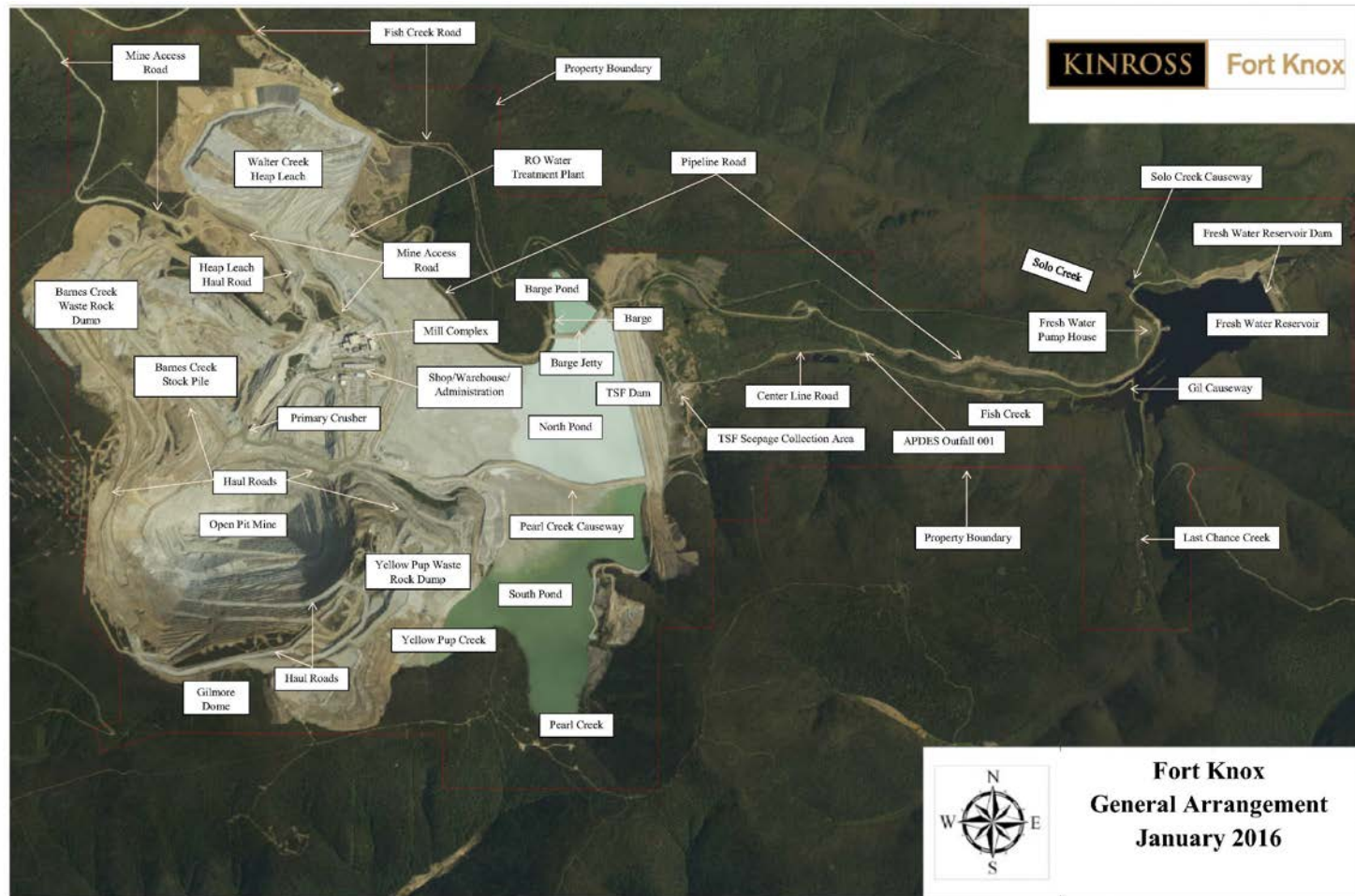


Figure 3-1: Mine Facilities

4 Audit Findings

The following sections document the findings by the auditors and, in some cases, include recommendations to address the findings. The sections are organized in a similar fashion to the Detailed Scope of Work provided in the RFP.

4.1 Areas Addressed by the Audit

The audit team identified and focused on the following areas to evaluate if the Fort Knox Mine’s environmental management systems and the regulatory controls in place provide reasonable assurances that the environmental objectives in the Plan of Operations and relevant permits and approvals are being met and that the systems and controls are functioning as intended:

- Federal, state, and local permits, authorizations, certifications;
- Releases to the environment;
- Geochemistry;
- Reclamation and closure;
- Reclamation cost estimate;
- Physical stability;
- Biological resources;
- Environmental management plans;
- Waste management; and
- Obligations and reclamation awards.

4.2 Summary of Federal, State, Local Permits, and Other Commitments

The Fort Knox Mine maintains 80 individual permits and authorizations issued by federal, state, and local agencies. Table 4-1 presents a summary of the permits and authorizations, and Appendix A presents a list of the current permits. The specific documents and permits reviewed are referenced in the corresponding sections of this audit report. The audit included all aspects of the mine including access roads, material sites, waste rock dumps, the open pit, the mill, the heap leach facility, the TSF, the constructed wetlands, and the water storage reservoir.

Table 4-1: Summary of Major Fort Knox Permits and Authorizations

Agency	Permit/Authorization
Federal	
USACE	<ul style="list-style-type: none"> • 404 Permits • Jurisdictional Determinations
Federal Communication Commission	<ul style="list-style-type: none"> • Radio Station Authorizations
Bureau of Alcohol, Tobacco, Firearms, and Explosives	<ul style="list-style-type: none"> • License for Use of Explosives
Nuclear Regulatory Commission	<ul style="list-style-type: none"> • Radioactive Materials License
US Department of Transportation	<ul style="list-style-type: none"> • Hazardous Materials Certificate of Registration
State	
ADEC	<ul style="list-style-type: none"> • Alaska Pollutant Discharge Elimination System (APDES) • Storm Water MSGP • Air Quality Permit • Waste Management Permit

Agency	Permit/Authorization
	<ul style="list-style-type: none"> • Certificate of Reasonable Assurance (401 certification) • Non-transient Non-Community Class A Drinking Water Permit
ADF&G	<ul style="list-style-type: none"> • Fish Habitat Permits
ADNR	<ul style="list-style-type: none"> • Millsite Leases • Hardrock Exploration Permit • Lease of Water Rights • Permits to Appropriate • Certificate of Approval to Operate a Dam • Certificate of Approval to Modify a Dam • Upland Mining Lease • Millsite Permit • Amended and Restated Millsite Permit • Final Plan of Operations Approval • Reclamation Plan Approvals • Land Use Permits
ADOT	<ul style="list-style-type: none"> • Compliance with 17 AAC 25.200
Local	
Fairbanks North Star Borough	<ul style="list-style-type: none"> • Floodplain Permit • Conditional Use Permits for tailings disposal and solid waste landfills • Zoning Permit

Table 4-2 presents a summary of the monitoring and reporting conditions required by the 80 permits, plans, and approvals which results in about 5,663 conditions to meet.

Table 4-2: Summary of Monitoring and Reporting Conditions

Frequency	Number of Conditions
Daily	3 to 6
Weekly	15 to 20
Monthly	104
Quarterly	156
Annually	1,027

Source: FGMI, ADEC Spill Meeting 3-29-17.pptx

The Fort Knox Mine is in substantial compliance with those permits and authorizations reviewed during the audit. Non-compliances identified by agencies, or discrepancies noted during the 2018 audit are described in the respective sections.

4.2.1 APDES Discharge Permits

Fort Knox applied to ADEC in early 2012 for an APDES permit to discharge non-process and non-contact groundwater from pit dewatering wells. ADEC granted FGMI an APDES permit in August 2012 and effective October 2012 to the Old Fish Creek Channel (Outfall 001) from which it flows to the Water Supply Reservoir (WSR). Since receiving the APDES Permit AK0053643 and until March 3, 2015, there had been no discharge of dewatering well water. Discharge of dewatering well water that did not require treatment began on March 4, 2015.

The APDES permit was re-issued by ADEC on April 30, 2018 and became effective on June 1, 2018. The re-issued permit allows discharge to the Old Fish Creek Channel (Outfall 001) and in the North Channel (Outfall 002). Seepage from the TSF will be treated in a newly constructed reverse osmosis treatment facility prior to discharge (Outfall 002) into the North Channel into Pond B of the wetland complex.

Outfall 001 – Reverse Osmosis Water Treatment Plant (RO1)

On June 24, 2016, the reverse osmosis water treatment system for the dewatering well groundwater that requires treatment before discharge to Outfall 001 became operational. Discharge monitoring at Outfall 001 demonstrated compliance with all permit effluent limits throughout 2017.

The total dewatering well groundwater (treated and non-treated) discharged to Outfall 001 was 618 acre-feet in 2017.

A single discharge monitoring report showed non-compliance for cyanide, weak acid, dissociable on July 20, 2016 (reported from the laboratory results of analysis [ROA]). Another sample was immediately submitted for analysis, and the analytical results showed compliance with the effluent standard. The USEPA ECHO Detailed Facility Reporting system shows three quarters of non-compliance for Outfall 001.



Outfall 001 – Reverse Osmosis Water Treatment Plant (RO1)

The ADEC, Division of Water Compliance & Enforcement Program conducted a site inspection on September 27, 2016 as follow up to the non-compliance report noted above. After receiving a Compliance Letter from ADEC, dated October 19, 2016, FGMI responded with a letter, dated October 24, 2016, to correct some factual errors in the Compliance Letter. The ADEC acknowledged the factual corrections in the letter and entered it into the public record.

On June 21, 2018 USEPA Region and the ADEC Division of Water Compliance & Enforcement Program performed a compliance evaluation on the APDES Point Source and Stormwater Discharge permits. A trip/inspection report has not been issued as of this date.

Outfall 002 – Reverse Osmosis Water Treatment Plant (RO2)

Seepage from the TSF will be treated in a newly constructed reverse osmosis treatment facility prior to discharge into the North Channel into Pond B of the wetland complex. The RO2 water treatment plant was still going through commissioning during the site visit and was not fully operational.

During the early stages of commissioning on May 22, 2018 a thermal-fused weld failed and an estimated 6,000 gallons of untreated TSF seepage water escaped containment of the catchment basin Pond 801 for approximately two hours. The flow was stopped by closing a valve. The untreated seepage water flowed to Pond 801 prior to overtopping, and the 6,000 gallons flowed into the North Channel. Water from Pond 801 was pumped back into the seepage collection basin. Monitoring the downgradient wetlands complex did not indicate any adverse environmental impacts. Verbal notification was provided to ADEC within 24 hours of the incident on May 22, 2018. ADF&G performed a site inspection on May 23, 2018 and did not observe any adverse impacts to the fisheries in the wetlands area (ADF&G Trip Report 2018). FGMI followed up with a written a Noncompliance Notification to ADEC detailing the incident on May 25, 2018. FGMI repaired the pipe and performed corrective action to prevent a re-occurrence of the incident.



Reverse Osmosis Water Treatment Plant (RO2)

SRK Recommendation: Continue updating and upgrading monitoring system and check valves to initiate alarms and shutdown procedure during upset events.

4.2.2 APDES Stormwater Permit

Following prior coverage under USEPA's NPDES Stormwater Construction Permit No. AKR10BR49, ADEC issued APDES General Permit for Storm Water Discharges for Multi-Sector General Permit Activity (MSGP) on July 9, 2015. MSGP Permits No. AKR06AB17 and AKR06AB19 became effective seven-days after issuance. FGMI updated the Stormwater Pollutant Prevention Plan (SWPPP) for Permit No. AKR06AB17 on June 19, 2015 and SWPPP figure was updated in 2017.

Site inspection of best management practices (BMPs), identified in the SWPPP and implemented along the access and service roads, demonstrated effective control structures, innovative techniques (i.e., brush berms, rock check dams, velocity reducing structures, stilling basins, etc.), and obvious maintenance of the structure as shown on the photographs below.



SRK Recommendation: None. Continue current level of monitoring and maintenance

4.2.3 ADEC Air Quality Operation Permits

The Fort Knox Mine is authorized to operate under two air quality permits for stationary sources issued by the ADEC – Division of Air Quality, Air Permits Program. These permits regulate gaseous (sulfur compounds nitrogen compounds, visible, fugitive emissions, and mercury. The permits include the Title V Air Quality Operating Permit No. AQ0053TVP03 issued on May 31, 2017 and the Title I Air Quality Control Minor Permit No. AQ0053MSS04 issued on December 17, 2012.

Air permits require a variety of parameters be collected such as differential pressure drops across baghouses, opacity from emission units and fugitive dust, fuel deliveries and usage, sulfur content, and hours of operation. In addition, source testing is required for some stationery sources to verify the source is operating correctly. In addition, FGMI submits an estimate of particulate matter ten microns or less, oxides of nitrogen, oxides of sulfur, and carbon monoxide. FGMI submits compliance reports with the required information every six months to the Division of Air Quality.

A review conducted by ADEC of the permit files and full compliance evaluations (FCE) between April 19, 2000 and December 15, 2015 indicates the stationary source generally operates in compliance with its minor permit and operating permit (ADEC 2017a).

Title V Air Quality Operating Permit No. AQ0053TVP03

On February 23, 2017, FGMI submitted an application to renew Operating Permit No. AQ0053TVP02 Revision 1. Activities are now authorized under Operating Permit No. AQ0053TVP03. The application did not request any change in the authorized operating permit. The mine operates only carbon processes without mercury retorts and does not have any other ore pretreatment processes, pregnant solution tanks, or non-carbon concentrate processes requiring a Title V permit.

The mine's potential emissions for criteria pollutants are less than the thresholds for a Title V major source. However, the existing gold mine ore processing and production facility at the mine meets the applicability criteria for the National Standards for Hazardous Air Pollutants (NESHAP), Subpart EEEEEEE for an area source of hazardous air pollutants emissions, namely mercury. The affected emission units at the Fort Knox Mine are four 125 ft³-electrowinning cells, one 75 ft³-electrowinning cell, one induction furnace, one carbon regeneration kiln, and two activated carbon bed adsorption vessels. Activated carbon beds control mercury emissions from the carbon regeneration kiln and the combined exhaust of the induction furnace and the electrowinning cells.

The *Statement of Basis for the Terms and Conditions of Permit No. AQ0053TVP03* (ADEC 2017) indicated that the Fort Knox Mine's potential to emit is 0.0003 tons per year of mercury and 0.56 tons per year of particulate matter. Potential mercury emissions are based on source tests performed between June 2012 and August 2016 (ADEC 2017).

Title I Air Quality Control Minor Permit No. AQ0053MSS04

FGMI also operates under a Title I Air Quality Control Minor Permit No. AQ0053MSS04 which addresses the primary and cone crushers, the reclaim tunnel, lime silos, the induction furnace, the carbon regeneration kiln, generators, boilers, and heaters. This permit regulates gaseous (sulfur compounds), particulate matter, visible emissions, and fugitive emissions.

2015 Full Compliance Evaluation and FGMI Responses

The Division of Air Quality conducted an FCE (ADEC 2015) for Permit No. AQ0053TVP02Rev1, AQ0053MSS01 (rescinded December 17, 2012), and AQ0053MSS04 for the period covering March 22, 2011 and June 30, 2015. Because this FCE goes outside of the audit period which spans March 28, 2014 to July 17, 2018, only those items identified as non-compliances within the audit time period are discussed.

The main non-compliance issues associated with the 2015 FCE were generally with regard to the new mercury rule, some procedural errors, and a new rule and confusion with its interpretation and implementation (R. Wagner, personal communication, August 29, 2018). Non-compliance findings identified in this FCE included:

- NESHAP Subpart EEEEEEE (7E) notification requirements per Condition 7 of Permit No. AQ0053TVP02. ADEC finding stated that the notifications of compliance status were submitted late. FGMI responded in December 2015 disputing this finding believing that ADEC was misapplying the governing regulations and the notification was timely for initial notification;
- NESHAP Subpart EEEEEEE (7E) reporting requirements per Condition 9.3 of Permit No. AQ0053TVP02. ADEC finding stated that the mercury source test data were reported outside of the 60-day window after test completion, and FGMI was one day late in reporting. FGMI's position was that the compliance demonstration activity was not completed until laboratory results were reported', the data analyzed, and documented by the source test report, which was provided to FGMI on May 18, 2015.
- Compliance Evaluation Report Section XIII, Condition 30.1c(i) Summary. ADEC findings stated that FGMI failed to submit permit deviation reports after violating conditions 7 and 9.3 of Permit No. AQ0053TVPP02Rev1. FGMI responded that permit deviations were not required to be submitted to ADEC as FGMI was not out of compliance.
- Title I permit limits for Permit No. AQ0053MSS04 per conditions 7.2, 8.2, and 9.2 which requires monthly and 12 consecutive months of operating hours, fuel oil consumption, and used oil consumption. Only 12-month totals were provided in 2014, and no permit limits were exceeded. FGMI provided the missing information;

ADEC findings stated that FGMI failed to use USEPA Reference Method 3/3A/3B to determine the dry molecular weight of stack gas per Permit No. AQ0053TVP02. Instead, FGMI had a minor deviation from the approved source test plan and calculated the effluent molecular weight using assumed ambient air concentrations for oxygen and carbon dioxide. On August 27, 2015, FGMI retroactively applied for a waiver from USEPA but was denied. FGMI retested in December 2015 and again in June 2016 as corrective actions. The ADEC issued an acceptance letter of the June 2016 source test on October 26, 2016, and the case was subsequently closed (ADEC 2016).

SRK Recommendation: None. According to Ms. Wagner, there are no violations or unresolved cases (R. Wagner, personal communication, August 29, 2018).

4.2.4 Amended Plan of Operations

The terms and conditions contained within the documents above and environmental management plans are considered stipulations of the PoO authorization. Changes to these documents and plans must be approved by ADNR if they affect the PoO. If approved by ADNR, the stipulations become part of the PoO.

SRK Recommendation: As the specialized environmental plans are updated, ADNR should acknowledge the latest version via letter or email to reflect the approval or concurrence with any modification to the plans and incorporation into the PoO.

4.2.5 Dam Safety

Water Supply Dam and Reservoir NID ID#AK00211

The water supply dam has been in operation since 1996 and will continue after reclamation and closure of the mine. Currently, the dam is in full compliance and all certificates are current. Longitudinal cracks were observed during the 2015 annual dam inspection. An intensive monitoring program was initiated and determined the cracks were superficial, likely to due to freeze/thaw movement. Corrective action included scarifying and recompacting the area where the cracks were observed (KP 2015a).

Fort Knox Tailings Dam NID ID#AK00212

The tailings dam has been in operation since 1996. Throughout its life, the dam has been raised six times, including the last and final raise completed in 2017. The modifications were a result of planned raises to accommodate mining operations and maintain adequate storage capacity of water and milled tailings.

Prior to completion of the final raise on the tailings dam and during construction of an interim raise of the tailings dam, the Pearl Creek Causeway was temporarily classified as a jurisdictional dam. This classification was a result of the structure impounding water to an elevation above the designed operating elevations of the tailings dam. Upon completion of the final raise on the dam, the Pearl Creek Causeway is no longer regulated as a dam structure because the crest elevations is lower than the tailings dam. The causeway returned to its intended purpose as an access and operations road and is no longer classified as a dam structure.

During the 2015 Periodic Safety Inspection a new seep was detected adjacent to Site 501, and two small seeps were detected on the north abutment just upstream of the existing seepage collection system. The two new seeps on the north abutment were running clear and seeping approximately 20 gpm. The water was tested and confirmed to be supernatant water from the tailings. Corrective action included extending the drain system in intercept the seepage. (KP 2015a and KP 2016). The seepage adjacent to Site 501 appeared to be a continuation of the existing known seep and is actively collected in the existing collection and pump-back system.

The tailings dam is in full compliance of all certificates are current. No structural issues have been observed, and no corrective actions were required per the last dam inspection.

Walter Creek Valley Heap Leach Dam NID ID#AK00310

The WCVHLF was commissioned for construction in 2007 and has been in operation since 2009. The facility consists of an ore stockpile on an impervious liner and a collection pond located at the base of the ore stockpile. The collection pond and heap leach pad itself is a regulated dam structure. The dam structure has remained in the current configuration since commissioning of the heap leach facility.

The heap leach facilities expand as mining advances, and ore is deposited for leaching. As the heap expands in either height, width, or both reaching capacity, a "stage" is constructed, and the pad footprint expands. Generally, the stages are constructed at intervals slightly advanced to mined ore placement to minimize runoff catchment areas, and to minimize liability for closure activities.

The WCVHLF is presently at Stage 8 of 10 stages. Final construction of the remaining stages will commence in the coming years, with ultimate expected loading to occur sometime in the year 2020.

In 2017, FGMI requested approval to construct, place ore, and leach Stage 8 Area A of the WCVHLF, and approval to construct through Stage 10. The ADNR issued a letter (ADNR 2017) noting that the most current design report in their records (Knight Piésold 2015) did not support construction to Stage

10 and required additional engineering investigation before the remaining stages could be constructed. In addition, the certificate to operate did not support construction above Stage 7.

FGMI responded quickly to ADNR's comment and determined that the design on record did not match the current construction documents. In addition, the engineering and construction was consistent with the design intent. The engineering and specifications had been updated to address the concerns the engineering report stated for construction above Stage 7.

FGMI issued a revision and updated the operations and maintenance manual to address the discrepancies and concerns highlighted by ADNR. ADNR ultimately issued their Certificate of Approval to Operate a Dam, and that the engineering design had been updated to reflect changes in construction conditions and footprint boundary changes due to construction.

The WCVHLF is in full compliance, and all dam certificates are current. No structural issues have been observed, and no corrective actions were required per the last dam inspection.

4.2.6 Hazardous Waste Management

FGMI is a small quantity generator under the Resource Conservation and Recovery Act (RCRA), and ships limited quantities of hazardous wastes off site to a permitted treatment, storage, and disposal facility. As such, FGMI maintains a hazardous materials registration (Reg. No: 050718550102AC) with the US Department of Transportation (USDOT) as required by 49 CFR Part 107, Subpart G.

As a small quantity generator, FGMI generates between 100 and 1,000 kg of hazardous waste per month and is required to comply with the RCRA regulations in 40 CFR, including:

- 262.11 – Requirement to make a hazardous waste determination on all wastes
- 262.12 – Requirements for obtaining an USEPA identification number
- 262 Subpart B – Requirement for manifests for shipments of hazardous waste
- 262 Subpart C – Pre-transport requirements, including packaging, labeling, marking, placarding and accumulation time
- 262 Subpart D – Requirements for record keeping and reporting
- Part 266 – Standards for the management of specific hazardous wastes
- Part 268 – Land Disposal Restrictions
- Part 273 – Universal Waste standards
- Part 279 – Used Oil standards.

Hazardous waste management practices were reviewed broadly during the 2018 environmental audit. SRK found no obvious issues with hazardous waste management at the mine site.

SRK Recommendation: None – The lined storage facility was well organized and barrels containing wastes (hazardous and non-hazardous) were labeled and dated.

4.2.7 Solid Waste Management

Solid wastes are managed under Waste Management Permit No. 2014DB0002, which covers disposal of mine waste to the TSF, inert solid waste landfill facilities, the WCVHLF, BCHLF, the mine pit, and groundwater and surface water monitoring systems. The permit is issued under the provisions of AS 46.03, and 18 AAC 15, 18 AAC 60, 18 AAC 70, and 18 AAC 72 and other applicable state laws and regulations.

The operation of the TSF as a zero-discharge facility is stipulated under this permit. The evaluation of that compliance item is discussed elsewhere in this audit report.

Non-hazardous inert wastes are placed in permitted facilities within the waste rock dumps in appropriate trenches. Solid waste management practices were reviewed broadly during the 2018 environmental audit. SRK found no obvious issues with solid waste management.

SRK Recommendation: FGMI has numerous inert solid land fill trenches within the waste rock facilities and should remain aware of the separation requirements where applicable:

18 AAC 60.217. Separation from groundwater. *A new unlined landfill or a lateral expansion of a landfill may not be closer than 10 feet above the highest measured level of an aquifer of resource value unless the landfill is constructed two feet or more above the natural ground surface.*

4.2.8 Safe Drinking Water

The Fort Knox facility has potable water delivered by Pioneer Wells and performs additional disinfection. Drinking water samples from the delivered water are collected and analyzed for *E. Coli* and chlorine. Results of analyses for the Fort Knox potable water system are submitted electronically and monitored for compliance. The ADEC's Fairbanks office program supervisor noted two non-compliance incidents when required samples for December 2016 were not collected and submitted for analysis. The two non-compliance incidents were rescinded in a letter from ADEC dated November 27, 2018 (attached)

A Sanitary Survey for Fort Knox Mine –PWSID No: AK2314093 was conducted on December 4, 2015, and the final Sanitary Survey Follow-Up was sent to the mine on January 25, 2016. The one minor deficiency noted in the survey report was the presence of an air pressure hose connected to the water supply. The air hose was used to periodically blow out the pipelines and needed to be disconnected when not in use. The minor deficiency was corrected, and documentation submitted to ADEC on May 10, 2016.

SRK Recommendation: None.

4.2.9 Releases to the Environment

FGMI has six permits and approved plans that provide conditions for spill management at the site and assure full compliance with all Spill Prevention and Response (SPAR) obligations:

- Waste Management Permit No. 2014DB0002, issued by ADEC in March 2014 and Modification #1 issued in May 2017;
- Fort Knox Mine Plan of Operations F2014852POO, approved by ADNR in March 2014;
- Fort Knox Mine Reclamation and Closure Plan Approval No. 20149852RCP, approved by the ADNR in March 2014;
- Alternative Cleanup Plan at Fort Knox Gold Mine approved by ADEC in October 1997;
- Fort Knox Mine Solid Waste Management Plan dated April 2016; and
- Fort Knox Spill Reporting Procedures and Waste Disposal dated August 2017.

Per the *FGMI Spill Reporting Procedures and Waste Disposal* (FGMI 2017), releases of hydrocarbons and hazardous materials *which enter the environment* are reported to ADEC Division of Spill Prevention and Response and are remediated. Since 2014, FGMI has reported releases consisting of brake fluid, hydraulic oil, coolant, compressor oil, automatic transmission fluid, engine oil, ethylene glycol, propylene glycol, process solution, ammonium nitrate, diesel fuel, and gear oil. A spot check of online records (<https://dec.alaska.gov/Applications/SPAR/PublicMVC/PERP/FacilityDetails?FacilityID=85173>) indicates these incidents appear to have been adequately addressed and closed by SPAR. Some of the data on the SPAR site does not match what was reported by FGMI.

According to FGMI, reportable releases have been decreasing at a steady rate (M. Huffington, personal communication, July 17, 2018). Much of the decrease can be attributed to FGMI identifying equipment parts failures and working with the manufacturer to reduce the frequency of failure. A review of the 142 out-of-pit spills reported by FGMI since 2012 indicated:

- 9% of the spills were less than one gallon;
- 68% of the spills ranged between one and ten gallons;
- 14% of the spills ranged between 11 and 54 gallons; and
- 9% of the spills were greater than 55 gallons.

Based on SRK’s operational experience, the number of spills reported is not excessive when considering the extreme climate and amount of equipment in 24-hour operation.

On October 7, 2015, a 1,500-gallon diesel spill occurred at the Fort Knox fuel island located at the northeast corner of the Barnes Creek Waste Rock Dump. The fuel island equipment and fuel loading/offloading area is fully contained with an engineered secondary containment that uses an 80-mill LLDPE impermeable geomembrane liner. Of the 1,500-gallons that was spilled within the containment area, 1,200 gallons were contained within the pump building’s metal containment, and 300 gallons spilled onto rock material (material that provides protection of the geomembrane) of the secondary containment area, which eventually drained through the rock material and into the designed containment’s sump system (within the engineered secondary containment system), pumped out an undetermined amount of fuel, and the off-specification diesel placed in the mine’s used oil tanks.

Per 18 AAC 75.300-396, the SPAR included this incident in the contaminated sites database under ID number 26832 and listed the status as ‘open’. FGMI disputed including this incident in the contaminated sites database namely because the diesel fuel release was within containment (no release to the environment) and cleanup and reporting was consistent with the aforementioned documents and past practice. This incident has not yet been resolved.

It appears that the trigger for SPAR on this incident was the volume of diesel fuel that was spilled regardless if the spill was in containment or not. FGMI’s response to the spill was based on the knowledge that the spill was within containment and the cleanup followed past approved practices. The key factor is that the spill was immediately reported and cleaned up without an impact to the environment, and the spilled and clean-up materials were disposed of appropriately.

SRK Recommendation: The future reporting and of spill responses at the mine should be consistent with the authorizing permits and plans as well as Alaska regulations. FGMI should continue its spill reporting and cleanup per the existing authorizations, procedures, and regulations.

4.2.10 Geochemistry

Compliance with Geochemical Monitoring Requirements

Table 4-3 provides a summary of the samples collected from each material type during the audit period (i.e., 2014 to 2018).

Table 4-3: Summary of Fort Knox Geochemical Samples

Mine Material	Year/Quarter	Q1	Q2	Q3	Q4
Tailings	2014	X	x	X	X
	2015	X	X	X	X
	2016	X	X	X	X
	2017	X	X	X	X
	2014	-	-	-	X

Mine Material	Year/Quarter	Q1	Q2	Q3	Q4
Overburden Topsoil	2015	-	-	-	X
	2016	-	-	-	X
	2017	-	-	-	X
Waste Rock	2014	-	-	-	X
	2015	-	-	-	X
	2016	-	-	-	X
	2017	-	-	-	X
Ore	2014	-	-	-	X
	2015	-	-	-	X
	2016	-	-	-	X
	2017	-	-	-	X
Low-grade Ore Stockpile	2014	-	-	-	X
	2015	-	-	-	X
	2016	-	-	-	X
	2017	-	-	-	X

X=sample collected

FGMI is in compliance with the geochemical sampling requirements set out in the monitoring plan (FGMI 2012). All samples that were collected were submitted for the MWMP analysis and ABA. The following is a summary of the results:

- All samples had NPR values greater than 3 and were therefore characterized as non-potentially acid generating (non-PAG);
- Based on the non-PAG classification, humidity cell testing is not required on the samples collected between 2014 and 2018;
- The following Profile II constituents were not included in the following MWMP leachate analyses on tailings samples:
 - pH, total suspended solids, turbidity, weak acid dissociable cyanide and silver;
 - temperature (except in the 2016Q2 sample); and,
 - in samples from 2014 to 2017Q2 (inclusive): silica, chloride, alkalinity, bicarbonate, total cyanide (except in the 2014Q1 sample), fluoride, ammonia, nitrate, nitrite, total phosphorus and sulfide.
- The Monitoring Plan does not stipulate a list of analyses for MWMP leachates on overburden/topsoil, B-stockpile, waste rock and ore samples.

Not measuring total suspended solids and turbidity in tailings MWMP samples is reasonable since particulate concentrations in the samples will not be representative since the column effluent sample is filtered prior to analysis. However, pH should be analyzed as required by the MWMP procedure in future tailings sample leachates.

Although some of the Profile II constituents were not analyzed in the MWMP tailings samples, FGMI has developed a robust monitoring program (FGMI 2012) to identify if seepage from the TSF is daylighting. Seepage is detected using indicator parameters in samples collected downstream of the tailings dam. Therefore, the gap in the MWMP analyses is not considered to be critical to the overall compliance of the Fort Knox Mine operation.

The Waste Management Permit No. 2014DB0002 Modification #2, Fort Knox Mine, Section 2.3.1.5 stipulates that FGMI conduct geochemical monitoring of overburden, development rock, run-of-mine ore

placed on the heap leach pads (WCVHLF and BCRLF) and tailings samples from the Fort Knox mill to ensure that there is a low potential for the production of leachate that is acidic or contains levels of metals that would contaminate surface or groundwater.

The monitoring requirements as described in the FGMI Monitoring Plan (FGMI 2017b) include:

- Water quality sampling procedures and analytical profiles and sampling schedules;
- Characterization of acid rock drainage and processed tailings;
- Monitoring of inert solid waste landfills;
- Potable water monitoring requirements;
- Wildlife mortality reporting procedures;
- Documentation, record keeping and reporting requirements; and
- Quality assurance/quality control manual.

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 reclamation and closure, and post-closure phases based on observed improvements in water quality.

SRK Recommendation: Only bulk neutralizing potential is measured in the geochemical samples. SRK recommends adding carbonate-NP to the list of geochemical analysis and evaluated for its use as a proxy for effective neutralizing potential to confirm the non-PAG classification of the samples.

Post-Mining Pit Lake

The technical memorandum "Fort Knox Pit Lake Evaluation, 2017 Update" from WSP/Parsons Brinkerhoff to FGMI dated February 07, 2017(WSP 2017) was used as the basis for the review. The original methods for the pit lake model were described in the technical memorandum "Fort Knox pit lake evaluation" from Water Management Consultants (WMC) to FGMI dated December 28, 2006." Additional updates to the water management of the pit lake were prepared by WMC and Schlumberger Water Services between 2006 and 2013 to accommodate changes to the mine plan. The audit team did not review the model in detail but performed a first principle check on the physical and chemical inputs to the model.

The Fort Knox Pit will be used as a water management facility at closure. Following completion of mining in the pit, TSF decant water will be pumped to the pit for a period estimated to be 7 years post closure, and TSF seepage water will be pumped until it meets WQ standards. Heap leach draindown, rinse water, and reverse osmosis brine will also be pumped to the pit later in this period. The modeling has indicated water chemistry will meet applicable water quality standards approximately 22 years prior to water outflowing the pit at year 72 post mining.

The pit lake model is a coupled fully-mixed physical and chemical model. The water balance indicates the dominant flow entering the pit will be groundwater followed eventually by direct precipitation and pit wall runoff. While TSF water represents a relatively important inflow from years 0 to 7 of post-mining, the current prediction indicates that pump-back will end long before the pit discharges limiting its significance to the overall pit lake water balance. Inflow from rinsing the heap leach pads dominate the constituent loading early on in the model, but WQ is expected to improve once rinsing is complete, before outflow from the pit.

SRK Recommendation: None.

4.2.11 Reclamation and Closure

As part of the 2018 environmental audit, SRK was requested to review (for evaluation of compliance purposes only) the following approved Reclamation and Closure Plan and Amendments: The Plans were reviewed for compliance with current State regulations, and PoO amendments:

- *Fort Knox Mine Reclamation and Closure Plan Rev2* (November 2013) F20149852RCP
- *Fort Knox Mine Permit Amendment - Construction* (May 26, 2017) F20149852RCP Amendment 1
- *Fort Knox Mine Reclamation Plan Approval Amendment 2 - Gilmore Phase 2 Expansion* (January 26, 2018) F20149852RCP Amendment 2
- *Fort Knox Mine Plan of Operations Amendment 12 Approval F20149852POOA.12 and Reclamation Plan Approval Amendment 3 F20149852RCPA.3 for Additional Acres of Disturbance associated with the Phase 9 Expansion* (June 25, 2018) F20149852RCP Amendment 3.

Amendments 1 and 3 are minor amendments to current Plans resulting in minor changes to both cost and scope to the Reclamation Plan. Amendment 2 is a major amendment to the Reclamation Plan with specific details to major facility improvements and reclamation activities.

Table 4-4 details the compliance with current State regulations for both the Reclamation Plan and Amendments.

Table 4-4: Comparison of Fort Knox Reclamation and Closure Plans with Alaskan Administrative Regulation (2014) Chapter 097 Mining Reclamation¹

Note: The requirements listed under each regulation sub-part are not copied in entirety but summarized to highlight the main requirements of each part. The regulations should be referenced directly for specific detail.

Regulation	Reclamation and Closure Plan (2013 R2)	Reclamation Plan Approval Amendment 2 Gilmore Phase 9 Expansion (2018)
ARTICLE 02: RECLAMATION PERFORMANCE STANDARDS		
<p>11 AAC 97.200 LAND RECLAMATION PERFORMANCE STANDARDS</p> <p>(a) Any surface that will not have a stream flowing over it is left in a stable condition.</p> <p>(1) For the purposes of AS 27.19.100(6) and this section, a stable condition that "allows for the reestablishment of renewable resources on the site within a reasonable period of time by natural processes" means a condition that can reasonably be expected to return waterborne soil erosion to pre-mining levels within one year after the reclamation is completed that it can reasonably be expected to achieve revegetation, where feasible, within five years after the reclamation is completed, without the need for fertilization or reseeding.</p> <p>(2) If topsoil from an area disturbed by mining is not promptly redistributed, a miner shall segregate it, protect it from erosion and from contamination by acidic or toxic materials and preserve it in a condition suitable for later use.</p> <p>(3) If the natural composition, texture or porosity of the surface materials is not conducive to natural revegetation, a miner shall take measures to promote natural revegetation, including redistribution of topsoil, where available.</p> <p>(b) Surface contours after reclamation should be conducive to natural revegetation or are consistent with an alternate approved post-mining land use. A miner need not restore the sites approximate original contours but shall stabilize the reclaimed site to a condition that will retain sufficient moisture for natural</p>	<p>Consolidation of tailings and timing for cover and growth media placement may not be attainable. The schedule calls for cover placement to begin immediately post milling.</p> <p>Topsoil/growth media requirements and current stockpiled volumes appear to comply with the requirements and a surplus of growth media is calculated; however calculated volumes by disturbance areas Table 4-1 do not match areas identified for cover with growth media in table 5-1. The table excludes many facilities that should be covered with growth media. Consider updating tables to for better accounting of volumes.</p> <p>(a)3(b) No surface contours or reclamation grading plan is included in the Plan. Detailed surface drainage controls are not identified. The plan includes a description of slopes and practices employed, however how the drainage all ties together is not clear in the plan.</p>	<p>Growth Media placement volumes are not clearly identified.</p> <p>A reclamation grading plan is not provided</p>

Regulation	Reclamation and Closure Plan (2013 R2)	Reclamation Plan Approval Amendment 2 Gilmore Phase 9 Expansion (2018)
<p>revegetation or approved alternate post-mining land use.</p> <p>(c) A pit wall, subsidence feature, or quarry wall is exempt from the requirements of (a) and (b) if the steepness of the wall makes them impractical or impossible to accomplish.</p> <p>(d) If a mining operation diverts a stream channel or modifies a flood plain to the extent that the stream channel is no longer stable, a miner shall re-establish the stream in a stable location. Settling basins may not be placed in the way of the re-established channel location unless fines are properly removed or protected from erosion.</p>	<p>(a)3(b) Surface drainage on large recontoured dump and heap leach pads faces may need to be controlled to reduce erosion potential. The plan notes BMPs will be employed, to reduce or prevent erosion, but none are specified, or included in the Financial Assurance.</p>	
<p>11 AAC 97.210 DISPOSAL OF BUILDINGS, STRUCTURES, AND DEBRIS ON STATE LAND A miner shall remove, dismantle, or otherwise properly dispose of buildings and structures constructed, used, or improved on state land unless the surface owner or manager authorizes otherwise. Scrap iron, equipment, tools, piping, hardware, <u>chemicals, fuels, waste</u>, and general construction debris on state land should also be removed or properly disposed of.</p>	<p>Table 6-3 includes buildings identified to remain or for removal. Suggest updating Figure 6.10 to clarify buildings which remain.</p> <p>Also, not clear what happens to onsite chemicals, fuels and oil waste disposal from demolished buildings or stored on-site.</p>	
<p>11 AAC 97.230 HEAP LEACH OPERATIONS After neutralization of heaps, pads, ponds, and other facilities has been approved by the appropriate regulatory authority, a miner shall reclaim the site of a heap leach operation to the standards of AS 27.19 and these regulations.</p>	<p>Unclear how much water will be able to drain through perforations in liner.</p> <p>Unclear how the water draining through the HLP perforations will bypass the Tailings dam seal, or if they will actually drain through the soils below the tailings. Does the seal at the tailings dam prevent movement of water downstream from the HLP?</p> <p>Plan lacks final grading and surface water control design.</p>	<p>Unclear how much water will be able to drain through perforations in liner.</p> <p>Unclear how the water draining through the HLP perforations will bypass the Tailings dam seal, or if they will actually drain through the soils below the tailings. Does the seal at the tailings dam prevent movement of water downstream from the HLP?</p> <p>Plan lacks final grading and surface water control design.</p>
<p>11 AAC 97.240 ACID ROCK DRAINAGE A miner shall reclaim a mined area that has the potential to generate acid rock drainage (acid mine drainage) in a manner that prevents the generation of acid rock drainage or prevents the offsite discharge of acid rock drainage.</p>	<p>N/A</p>	<p>N/A</p>
<p>11 AAC 97.250 MATERIAL SITES (a) For continuous use or intermittent use of a material site, a miner shall reclaim a material site in accordance with AS27.19.020, 11 AAC 97.200, 11 AAC 97.210, and this section as contemporaneously as practicable with the mining. (1) If conditions permit a miner shall proceed cell by cell so that reclamation can and will occur immediately after each cell is mined. (2) If site conditions require the entire material site to be mined continuously, a miner shall reclaim the site as soon as the mining is completed. (b) Extraction of materials from river beds (gravel bailing operations). If a miner extracts material from the bed of a water course, the miner shall re-establish a</p>	<p>(a) (2) Borrow/material sites are not clearly identified for reclamation, nor are grading details included.</p>	<p>Borrow/material sites are not clearly identified for reclamation, nor are grading details included.</p>

Regulation	Reclamation and Closure Plan (2013 R2)	Reclamation Plan Approval Amendment 2 Gilmore Phase 9 Expansion (2018)
<p>stable bed and bank profile as contemporaneously as practicable with the extraction.</p> <p>(c) Peat and topsoil mines. At least two inches of a suitable growing medium will be left or replaced on the mined land.</p> <p>(d) Materials used for other mines. If the primary use of the extracted materials is to assist another mining operation regulated under this chapter, the miner must include the reclamation plan or letter of intent for the material site operation as part of the reclamation plan or letter of intent for the primary mine.</p> <p>(e) Exempt excavations. If materials are extracted primarily for a non-mining purpose.</p> <p>(f) Stockpiles. Requirements do not apply to materials stockpiled at a distribution point other than the mined area, nor to minerals stockpiled at a mined area where no mining has taken place after October 14, 1991. A stockpile is a storage pile of materials segregated as a commercial product for sale or distribution elsewhere and does not include non-commercial waste rock, overburden or tailings. A stockpile associated with a mining operation other than for materials is not exempt from this chapter.</p> <p>(g) Material used for logging (detail not included herein).</p>		
<p>11 AAC 97.310 RECLAMATION PLAN</p> <p>(a) The miner must submit a proposed reclamation plan before starting a mining operation.</p> <p>(b) A reclamation not submitted on a form provided by the commissioner must include the following:</p> <p>(1) Name, address, and telephone number of the miner who will serve as agent to receive any notice that is required under this chapter, and the names, addresses and telephone numbers of all other owners, operators, or leaseholders of the mining operations.</p> <p>(2) List of all properties, mining locations, or leases on which the mining operation is to be conducted.</p> <p>(3) A map at a scale no smaller than 1:63,360 (inch to the mile) showing the general vicinity of the mining operation and the specific property to be worked</p> <p>(4) A general description and diagram of the mining operation and the mined area that shows and states the number of acres to be mined <u>during each year</u> covered by the plan and that shows the location corners or property boundaries and their relationship to the reclamation work, the tailings or spoil disposal areas, and the areas otherwise affected by the operation.</p> <p>(5) The estimated number of yards or tons of overburden or waste and ore or materials to be mined during each year covered by the plan.</p> <p>(6) A description of the reclamation measures that will be taken to comply with AS 27.19.020 and 11 AAC 97.200 – 11 AAC 97.250, including the equipment to be used; a time schedule; and, if the miner proposes to reclaim the land to an alternate post-mining land use, a statement of that proposed or intended use; the description must include:</p> <p>(A) Measures for topsoil removal, storage, protection and replacement;</p> <p>(B) Measures for reclamation of tailings impoundments, settling ponds, reservoirs,</p>	<p>(b) (4) and (5), Volumes are not clearly defined by year.</p> <p>(6) (C) Reclamation plan is lacking details for surface drainage (re)establishment.</p>	

Regulation	Reclamation and Closure Plan (2013 R2)	Reclamation Plan Approval Amendment 2 Gilmore Phase 9 Expansion (2018)
heaps, open pits and cuts, shafts, adits, tunnels, portals, overburden, waste rock storage areas, and all other affected areas; (C) Measures for stream placement and reclamation at the end of mining; and (D) A proposal for reclamation or post-mining conversion of access roads leading to the mining operation, airstrips, and other associated facilities.		

The Reclamation and Closure Plan is substantially in compliance with the minor items identified in the table above. This Plan will be updated in early 2019 and presumed that all amendments for the Gilmore Phase 9 addition, the tailings dam raise, and BCHLF will be consolidated into one plan.

SRK Recommendation: Providing a simple grading plan identifying drainage patterns and reclaimed slopes would be helpful in identifying potential areas where best management practices may be needed and the extent at which they may be employed. The plan specifies that all drainage will report to the TSF, but nowhere in the plan does it illustrate how the drainage will happen. While the plan is generally complete, the size and complexity of the facilities being reclaimed may result in challenges managing surface and sub-surface waters post-closure. An investigation of post-closure surface and sub-surface water management may be beneficial for generation of the final closure design.

Review the Reclamation Plan for the WCVHLF for adequacy of drainage through the perforations proposed in the liner. The proposed closure scenario assumes drainage under the dam structure into the tailings storage facility. Drainage may not occur, and water may continue to be impounded for the short and/or long terms.

4.2.12 Reclamation Cost Estimates

Financial Assurance

In accordance with 11 AAC 97.400, FGMI is required to post a reclamation performance bond with ADNR’s Commissioner to ensure complete compliance with relevant Alaskan statues, regulations, and the approved reclamation plan. FGMI prepared a Standardized Reclamation and Closure Estimate (SRCE) model to calculate the estimated financial assurance required for reclamation. SRK did not perform an in-depth audit of the closure estimate quantities or methods but provided a high-level review of major cost items included in the Reclamation and Closure Plan.

An examination of the proposed labor and equipment rates found that FGMI rates were within industry standards and comparable to recent reclamation bonding costs within the state. No major physical reclamation items (i.e. earthworks) were identified as being insufficiently bonded.

SRK Recommendation: The Reclamation and Closure Plan assumes the life of mine closure scenario. This should be reviewed for the future closure plan and financial assurance model. The premature closure scenario may require relocating additional tailings to facilitate drainage through the TSF to achieve the proposed drainage design. A review of the tailings deposition plan and other potential scenarios which may impact bonding costs or closure in a premature closure scenario should be incorporated into the next closure plan to ensure planning and bonding for the highest cost scenario.

Water Management Trust Funds

A mine reclamation trust fund may be established per AS 37.14.800 and used for long-term site management, including protection and treatment of surface water and groundwater, per AS 37.14.820 and AS 46.03.100. At the Fort Knox Mine, ADEC acts as the jurisdictional agency over long-term water quality issues and has provision for financial surety under statute and regulations (18 AAC 60.265).

SRK Recommendation: Given the uncertainty surrounding the complex closure program being proposed at the mine, FGMI would be advised to investigate this option, in addition to the standard surface reclamation sureties required by ADNR and ADEC.

4.2.13 Biological Resources

FGMI's practice of concurrent reclamation of inactive areas continues, and the biological diversity (aquatic, wildlife, and vegetation) present at the wetlands complex, WSR, and even within some of the stormwater collection basins is dramatic. Again, in 2018, as during the 2011 site visit, multiple species were present on the sites including, waterfowl, passerines, raptors, moose, squirrels, hoary marmot, and scat evidence of wolf and bear using the site.

The latest Technical Report 17-10, *Fish and Water Quality Monitoring at the Fort Knox Mine, 2017* prepared by ADF&G, Division of Habitat, on the mine's aquatic system provides the most recent record of the biological status of the system:

Water Quality

- Dissolved oxygen (DO) concentrations were measured in mid-April 2017 and for the third consecutive year DO concentrations were some of the highest seen since sampling began in 1998. Higher DO concentrations appear to be directly related to the discharge of non-contact mine water to the WSR.

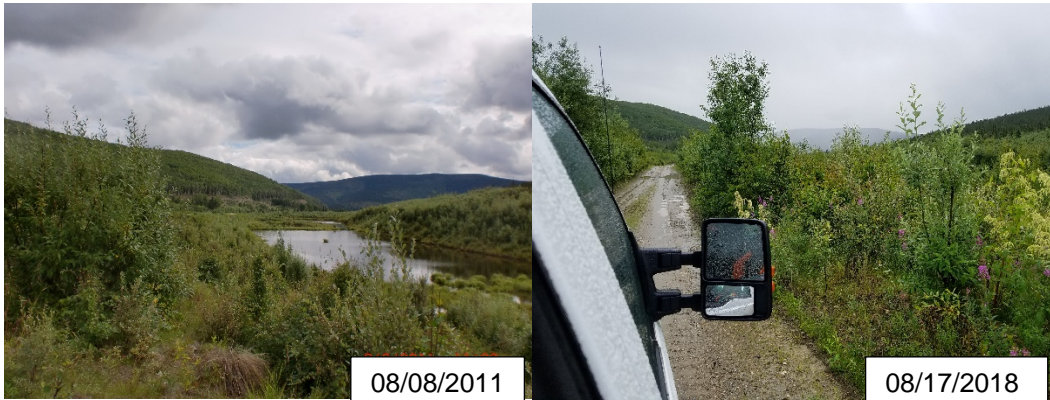
Arctic Grayling in the WSR

- Sampling for Arctic grayling was conducted from May 1-18, 2017 as the fish moved from the WSR to the developed wetlands. Spawning began around May 11 when peak water temperature reached 3.9°C (Celsius) and by May 16, 96% of the females handled were spent. Ripe females continued to enter the wetland complex from the WSR at the close of the sampling event.
- Substantial recruitment of the Arctic grayling was observed in spring 2017, 406 fish between 200 and 245 mm were newly captured and tagged.
- The spring 2016 population estimate for Arctic grayling ≥ 200 mm fork length was 4,396 fish (95% Confidence Interval (CI) 3,912 to 4,880 fish).

Burbot in the WSR

- Sampling for burbot was conducted during the Arctic grayling sampling event (May 1 to 18, 2017) and again from September 26 to October 2. During the two sampling events, 120 burbot were captured in the developed wetlands and WSR. These fish ranged in size from 135 to 900 mm. Thirty-five of the captured burbot were > 400 mm and eight had been previously captured in the 2017 sampling events.
- The spring /fall 2017 population estimate of burbot (≥ 400 mm total length) was 119 fish (5% CI 65-173)

Vegetation growth in the reclaimed areas is apparent in the following dated photographs:



SRK Recommendation: None

4.2.14 Environmental Management Systems

FGMI established an Environmental Management System during initial permitting in 1994 that consisted of the:

- Project Description
- Water Resources Management Plan
- Reclamation Plan
- Monitoring Plan
- Solid Waste Management Plan
- TSF and WSR Operating & Maintenance Manuals
- Emergency Response Manual
- Spill Prevention Control and Countermeasure Plan (SPCC).

The combination of all these plans formed the approved Plan of Operations for the Fort Knox Mine. Kinross and FGMI have further augmented the Environmental Management System with a more comprehensive Environmental, Health and Safety System (EHSS). As plans have been updated and revised, additional plans have been added while others such as the Water Resources Management Plan and SPCC have been omitted due to the content being further augmented and incorporated into other plans or the regulatory requirement being dropped respectively. FGMI Environmental Management System plans are comprehensive, well implemented, and incorporated into ADNR and ADEC permit approvals. A comprehensive list of FGMI's specialized environmental plans is contained in Appendix B.

SRK Recommendation: As the specialized environmental plans are updated, the agencies should acknowledge the latest version via letter or email to reflect the approval or concurrence with any modification to the plans and incorporation into the PoO or Waste Management Permit.

4.2.15 Other Commitments

The Fort Knox Mine is signatory to *the International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold* (Cyanide Code) since 2007. The Cyanide Code is a voluntary industry program for the gold mining industry to promote:

- Responsible management of cyanide used in gold mining;
- Enhance the protection of human health; and

- Reduce the potential for environmental impacts.

The Cyanide Code is intended to complement an operation's existing regulatory requirements. Compliance with the rules, regulations, and laws of the applicable political jurisdiction is necessary; this Code is not intended to contravene such laws. The Code focuses exclusively on the safe management of cyanide that is produced, transported, and used for the recovery of gold, and on cyanidation mill tailings and leach solutions. The Code originally was developed for gold mining operations, and addresses production, transport, storage, and use of cyanide and the decommissioning of cyanide facilities. It also includes requirements related to financial assurance, accident prevention, emergency response, training, public reporting, stakeholder involvement and verification procedures. The Code does not address all safety or environmental activities that may be present at gold mining operations such as the design and construction of tailings impoundments or long-term closure and rehabilitation of mining operations.

Companies that become signatories to the code must have their operations audited by an independent third party to demonstrate compliance with the code. Audit results are made public on <http://www.cyanidecode.org> to inform stake holders of the status of cyanide management practices at the certified operations.

Auditors in 2008, 2011, 2015, and 2018 mine audits found the facility to be in full compliance with the standards and practices of the Cyanide Management Code. An audit was conducted in March 2018 and the report submitted to the International Cyanide Management Institute; the recertification for full compliance was issued on August 9, 2018.

4.2.16 Reclamation Awards

FGMI won an Honorable Mention award from the Interstate Mining Compact Commission in April 2015 for the reclamation of the True North Mine in the non-coal category. ADNR recommended that FGMI apply for this award.

4.3 Audit of the Agencies

4.3.1 Introduction

SRK communicated with personnel from the ADNR, ADEC, ADF&G, USACE, TLO, and FNSB during the audit as presented in Table 2-1.

4.3.2 ADNR

Mining, Land, and Water

The experienced staff at ADNR Division of Mining, Land, and Water is familiar with day-to-day mining operations, which adds to their efficacy as regulators and allows this agency to work closely with the FGMI in their roles as permit writers and inspectors. In the case of FGMI's Mine, the inspections continue to appear to be supportive and genuinely cooperative. This has led to an amicable working relationship that has resulted in FGMI frequently correcting potential or regulatory issues before the ADNR even leaves the site following inspections.

Mr. Brent Martellaro, ADNR – Large Mine Supervisor and William Groom exhibited a good understanding of the currently approved Plan of Operations and associated obligations by FGMI and the ADNR's oversight. ADNR is presently working on developing a file guide for the mine to provide an updated list of approvals (Plan of Operations and amendments, Reclamation Plan, Quarterly Monitoring Reports, and Inspection Reports).

The file guide will significantly improve the record keeping at the agency and makes future data requests and regulatory audits easier which was greatly appreciated by the SRK team. An opportunity also exists for the agency to move toward a more formal document management program in which all documents

are scanned, inventoried to the appropriate project, and made available from any computer terminal within ADNR for instant access.

SRK Recommendation: Complete the development of the file guide.

Dam Safety Officer

On August 1, 2018, a meeting was held with Charles (Charlie) Cobb, P.E., ADNR State Dam Safety Engineer to review oversight and compliance of the regulated dam structures at Fort Knox. ADNR maintains a high-level of interest in the dams at the mine due to their high hazard classification, location in Fairbanks, and the magnitude of the structures. The tailings dam and Walter Creek Valley heap leach dam are the two largest dam structures currently in operation in the state. Thorough review of operations and design changes are paramount to maintaining safe and working structures.

FGMI maintains and regularly updates operating and maintenance manuals and emergency action plans for the dams described in Section 4.2.5. The Dam Safety Officer has comprehensive records and a very proactive approach to oversight of the mine site.

SRK Recommendation: Remain diligent in record keeping and tracking documents. Verify all documents used for construction are current with ADNR records and review certificates to operate, construct, and modify a dam structure prior to construction.

Water Resources Section – Water Use Authorizations

On July 16, 2018 a meeting was held with Ms. Jennifer Wynne, ADNR Water Specialist, to review the status of water use authorizations at the mine. Ms. Wynne provided an update of the Water certificates of appropriation that have been reviewed and issued since the 2011 Environmental Audit:

WSR (Freshwater Reservoir)

- ADL47229 – Certificate of Appropriation (Water Right) issued 03/08/2012
- LAS 13986 - Certificate of Appropriation (Water Right) issued 01/29/2018

Interceptor Wells

- LAS 13987 - Certificate of Appropriation (Water Right) issued 05/15/2015
- LAS 28160 – Permit to Appropriate Water (Water Use Authorization) 09/21/2017

Pit Dewatering

- LAS 21760 - Certificate of Appropriation (Water Right) issued 12/18/2015
- LAS 28158 - Permit to Appropriate Water (Water Use Authorization) 09/21/2017

TSF (includes Heap Leach)

- LAS 13988 - Certificate of Appropriation (Water Right) issued 12/23/2011
- LAS 28161 - Permit to Appropriate Water (Water Use Authorization) 12/28/2017

The ADNR, Water Section and FGMI have collaborated since the Statement of Beneficial Use for LAS 13988 was submitted on September 21, 2011 to continue working toward adjudication of the permits toward issuance of certificates. The certificate of appropriation is a “property right” that is associated with the Millsite Lease (Permit) and the private property and provides certainty for the Fort Knox operation.

As of the date of this audit, all water use activities at the Fort Knox Mine are authorized.

SRK Recommendation: Continue working with the FGMI to update permits to appropriate water to certificates of appropriation when statements of beneficial use are received.

4.3.3 ADEC

Division of Air Quality, Air Permits Program

The Division of Air Quality is familiar with the Fort Knox mining operations, which adds to their efficiency as regulators and allows this agency to work closely with the FGMI. In the case of Fort Knox Mine, the inspections appear to be cooperative. Ms. Robin Wagner, Environmental Program Specialist, was very knowledgeable about the Fort Knox Mine air permits and provided focused and timely responses to questions.

SRK Recommendation: None.

Spill Prevention and Response (SPAR)

The SPAR has a thankless but critical job of overseeing spill prevention and response throughout a large state with an extreme climate. Much of the reporting and response is likely based on reports with minimal and incomplete background from which they have to make their regulatory decisions. Ms. Ashley Adamczek, Environmental Program Specialist, was knowledgeable about the Fort Knox Mine and the spill history. She noted that the Division of SPAR has to work within the existing permits and authorizations.

SRK Recommendation: Continue to work with FGMI to resolve the ongoing issue regarding the October 2015 containment diesel spill. In the approved Reclamation and Closure Plan, FGMI plans an onsite assessment and mitigation of areas with potential contamination is part of the final closure procedures. With the location of the mill and process components upgradient of the TSF (approved solid waste facility), extensive site investigations during operations would only serve to complicate current operations and potentially be disruptive if buried electrical or water lines were to be compromised.

Division of Environmental Health – Drinking Water Program

The ADEC, Fairbanks office confirmed that the Fort Knox facility has potable water delivered by Pioneer Wells and the facility performs additional disinfection (compliance samples for *E. Coli* and chlorine). ROA results of analyses for the Fort Knox potable water system are submitted electronically and monitored for compliance. ADEC provided compliance records for the period March 1, 2014 to August 16, 2018. The ADEC's Fairbanks office program supervisor noted two non-compliance when required samples for December 2016 were not collected and submitted for analysis. The two non-compliance incidents were rescinded in a letter from ADEC dated November 27, 2018 (attached)

SRK Recommendation: None.

Division of Water, Wastewater Discharge (Storm Water and Point Source)

Following prior coverage under USEPA's NPDES Stormwater Construction Permit No. AKR10BR49, ADEC issued APDES General Permit for Storm Water Discharges for Multi-Sector General Permit Activity (MSGP) on July 9, 2015. MSGP Permits No. AKR06AB17 and AKR06AB19 became effective seven-days after issuance. FGMI updated the SWPPP for Permit No. AKR06AB17 on June 19, 2015 and its figure was updated in 2017.

SRK Recommendation: None.

4.3.4 ADF&G, Division of Habitat

Interview of Ms. Audra Brase, Northern Region Supervisor and Mr. Alvin Ott, Operations Manager for the Division of Habitat, were conducted on July 16, 2018. Cooperation between ADF&G and FGMI continues as the developed wetlands and fisheries systems evolve and become more mature. Mr.

Ott, has been involved in the Fort Knox project since environmental baselines studies were initiated and has worked constructively to resolve issues and optimize the wetlands and WSR.

Audra Brase continues to monitor and conduct the fish counts at the wetlands and WSR. Ms. Brase provided copies of the most recent Fish Habitat Permits related to operations on the mine site:

- FH18-III-0039. Culvert Installation Outfall 002 Channel
- FH17-III-0181. Beaver Dam Removals in Fish Creek

ADF&G again noted the importance of beaver dam removal to maintain fish passage for Arctic grayling spawning in the developed wetlands.

SRK Recommendation: Continue to notify FGMI when beaver dams and lodges become impediments to fish movement.

4.3.5 USACE

An extensive telephone review of the Fort Knox files located at the USACE office in Fairbanks was conducted on August 13, 2018, with Ms. Ellen Lyons, Corps Project Manager. Ms. Lyons has maintained a log of permit modification, continues the process of consolidating the Fort Knox files, and reconciling the disturbed wetland acres associated with 26 permit issuances and modifications. Ms. Lyons plans on meeting with FGMI to reconcile mitigation requirements with the updated permit modification document and the proposed mitigation in the current Fort Knox Reclamation and Closure Plan.

Since the initial permit was issued in 1994, there have been six different USACE Project Managers involved with the mine. Ms. Lyons has compiled the files since 2014 and provided additional insight into the USACE role in the project. The fact that there have been several different project managers, and a new one taking over for Ms. Lyons, highlights the potential for the omission of facts and transfer of historical information documented by Ms. Lyons that is important to USACE's oversight of the project.

SRK Recommendation: Periodic meetings with FGMI to review regulatory status and mitigations measure. Meetings will serve to verify similar understanding by both parties regarding mitigation measured currently accepted and credited to the project and future requirements scheduled to be completed at final reclamation and closure.

4.3.6 Fairbanks North Star Borough (FNSB)

Bryan Sehmel, FNSB Planning Department, confirmed the current validity of zoning and permits issued by the Borough:

- Flood Plain Permit
- Zoning Permit No. 12441
- Conditional Use Permit CU-013-94 Disposal of Mine Tailings
- Conditional Use Permit CU-014-94 Inert Landfill Trenches

SRK Recommendation: FNSB has experienced many staff changes recently resulting in limited knowledge and understanding of the permits and authorizations issues to FGMI. It would serve both entities to facilitate improved communication to advance a better understanding of the operation by FNSB staff.

5 Conclusions

As previously stated, the audit was to determine if FGMI's environmental management systems and the regulatory controls in place provide reasonable assurances that the environmental objectives of the Plan of Operations and relevant permits and approvals are being met and that the controls are functioning as needed. SRK's role was not to solve issues but to bring them to light. The following presents SRK's conclusions assessing if these objectives were met.

The following conclusions and recommendations are based on the site visit for the audit conducted at the Fort Knox Mine on July 17, 2018, review of documents, and subsequent meetings, emails, and phone calls with FGMI and the agencies.

5.1 Fort Knox Mine

Based on this audit, SRK concluded:

- FGMI is in substantial compliance with those environmental permits and authorizations reviewed as part of this audit and appears to be very diligent in their operations.
- Monitoring and reporting activities are also in substantial compliance for the Fort Knox Mine.
- TSF seepage collection and monitoring systems appear to be functioning according to design based on the currently available data and in compliance with permit conditions.
- A few administrative compliance deadlines, an elevated cyanide level in an Alaska Pollutant Discharge Elimination System (APDES) Outfall 001 sample, and a potable water sample collection were missed, but overall operational compliance is above industry standards.
- Environmental health and safety procedures in place with the environmental management system and International Cyanide Code certification demonstrate pro-active management of the Fort Knox Mine.
- The Reclamation and Closure Plan is substantially complete; however, it is lacking a reclamation plan showing surface drainage and reclaimed contours for all facilities.
- The Closure Plan amendments did not include the most recent tailings dam raise and consequential changes to the spillway. While these changes are minor in both scope and cost impacts, they are inconsistent with the scope of the amendments to the closure plan submitted during the current 5-year permit cycle.
- The reclamation cost estimates appear to be adequate to cover surface reclamation as proposed; however, the uncertainties surrounding long-term water quality and management, i.e., treatment, pumping, etc. are not clearly defined and may be underestimated.
- Based on SRK operational experience, the number of spills reported is not excessive when considering the extreme climate and amount of equipment in 24-hour operation.
- FGMI and the USACE, and ADEC SPAR, have differing interpretation of regulatory status memorandums and spill quantities reported.

5.1.1 Agencies

Overall permitting and regulatory oversight of the mine and associated activities is reasonable and appropriate.

5.2 Recommendations

The following sections present general recommendations to aid the FGMI and agencies in further attaining their environmental compliance objectives.

5.2.1 FGMI

The following are general recommendations for FGMI to address for issues identified during the audit:

- Complete the column rinsing tests to determine final rinsing or drain down requirements for the Walter Creek and the BCHLF to assess long-term water quality and management.
- Only bulk neutralizing potential is measured in the geochemical samples. SRK recommends adding carbonate-NP to the list of geochemical analysis and evaluated for its use as a proxy for effective neutralizing potential to confirm the non-PAG classification of the samples.
- Review the Reclamation Plan for the WCVHLF for adequacy of drainage through the perforations proposed in the liner. The proposed closure scenario assumes drainage under the dam structure into the tailings storage facility. Drainage may not occur, and water may continue to be impounded for the short and/or long terms.
- FGMI has numerous inert solid land fill trenches within the waste rock facilities and should remain aware of the separation requirements where applicable: 18 AAC 60.217 states: *Separation from groundwater. A new unlined landfill or a lateral expansion of a landfill may not be closer than 10 feet above the highest measured level of an aquifer of resource value unless the landfill is constructed two feet or more above the natural ground surface.*
- Classifying a remediated release site within engineered containment that does not pose a potential or imminent threat as a 'contaminated site' appears to be contrary to established and authorized procedure and regulation. FGMI should continue its spill reporting and cleanup per the existing authorizations and procedures.
- Work with ADF&G to further enhance the fishery in the WSR and wetlands is ongoing or being considered and includes:
 - Continue development of a second wetland complex along the north side of the Fish Creek valley;
 - Conversion of the existing Gil causeway into revegetated islands;
 - Continued maintenance of the road down the valley between the tailings dam and the Water Supply Reservoir;
 - Construction of a passive water treatment wetlands below the tailing dam were fish are not present; and
 - Removal of beaver dams to maintain fish passage for Arctic grayling spawning in the developed wetlands.
- FGMI and the agencies need to review wetland mitigation status memorandums and spill reporting quantities to verify that both entities are interpreting and understanding the information and data the same.

5.2.2 Agencies

The following are general recommendations for the state, federal, and local agencies to address for issues identified during the audit:

- Continue improving the computerized document tracking system for document control;
- Facilitate better communication between departments and sections among the state agencies and within the internal divisions of the agencies.

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7 Disclaimer

The opinions expressed in this report have been based on the information supplied to SRK Consulting (U.S.), Inc. (SRK) by Fairbanks Gold Mining Inc. (FGMI) as well as the Alaska Department of Natural Resources, the Alaska Department of Conservation, the Alaska Department of Fish and Game, and the U.S. Army Corps of Engineers. These opinions are provided in response to a specific request from the agencies and FGMI to do so. SRK has exercised all due care in reviewing the supplied information. While SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report.

Appendix A: List of Fort Knox Mine Permits

Source, FGMI, June 26, 2018

**Fairbanks Gold Mining, Inc.
Environmental, Health, and Safety Management System**

	Permits, Licenses, Certificates and Authorizations	Original Date: May 15, 2002
Reviewed: June 26, 2018	Revision Number: 50	Revision Date: June 26, 2018

PERMITS, LICENSES, CERTIFICATES AND AUTHORIZATIONS

AGENCY	PERMIT #	DESCRIPTION	DATE ISSUED	EXPIRATION/ RENEWAL DUE	LOCATION OF DOCUMENT
<u>FEDERAL</u>					
EPA	AKR000002352	RCRA Small Quantity Generator	1/26/2012	No Expiration Date – Notification is status changes	Laserfiche - Environmental Volume
EPA, Region 10	Facility # 12779	UIC Class V Closure Plan (Facility #12779) at the Fort Knox Mine	8/21/2006	No Expiration Date	Laserfiche - Environmental Volume
FCC	WPRW650	Radio Station Authorization	6/14/2011	3/2/2021	Laserfiche - Environmental Volume
FCC	WPSH854	Radio Station Authorization	6/14/2011	5/2/2021	Laserfiche - Environmental Volume
Nuclear Regulatory Commission	50-29098-01	Radio Active Materials License	7/12/2011	12/31/2021	Laserfiche - Environmental Volume
Bureau of Alcohol, Tobacco, Firearms and Explosives	9-AK-090-22-5A-12031	Federal Explosives License / Permit	8/25/2015	1/1/2018 In process by BATFE	H.R. Bulletin Board Hall to Admin Break Room
US Dept of Transportation & Public Safety	050718550102AC	Hazardous Materials Certificate of Registration Year(s) 2018 – 2021	Effective 7/1/2018	6/30/2021	Laserfiche - Environmental Volume
Corps of Engineers Fort Knox Mine Environmental Assessment	N/A	Fort Knox Environmental Assessment for the Initial ACOE permitting process	8/1993	Life of the Project	Laserfiche - Environmental Volume

**Fairbanks Gold Mining, Inc. (FGMI)
Environmental, Health, and Safety Management System**

	Permits, Licenses, Certificates and Authorizations	Original Date: May 15, 2002
Reviewed: June 26, 2018	Revision Number: 50	Revision Date: June 26, 2018

PERMITS, LICENSES, CERTIFICATES AND AUTHORIZATIONS

AGENCY	PERMIT #	DESCRIPTION	DATE ISSUED	EXPIRATION/ RENEWAL DUE	LOCATION OF DOCUMENT
BLM	Authorization Letter	Casual Use Letter authorizing to conduct surface and groundwater monitoring on NOAA property	1/19/2018	1/31/2021	Laserfiche - Environmental Volume
Corps of Engineers	POA-1992-574-M19	Fish Creek TSF Dam Raise	3/4/2011	4/30/2021	Laserfiche - Environmental Volume
Corps of Engineers	POA-1992-574-M24	Fill into 2 acres of wetlands for expansion of the Yellow Pup Waste Rock Dump	5/2/2014	4/30/2021	Laserfiche – Environmental Volume
Corps of Engineers	POA-1992-574-M25	Mechanical clearing of 10.4 acres of a borrow source and filling 0.85-acre of wetlands for construction of an access road.	7/2/2014	4/30/2021	Laserfiche – Environmental Volume
Corps of Engineers	POA-1992-574-M26	Authorization of a time extension for POA-1992-574 (M19, M24, and M25)	4/8/2016	4/30/2021	Laserfiche – Environmental Volume
<u>STATE</u>					
ADEC - APDES	AKR06AB17	MSGP Industrial Storm Water Discharge Monitoring – Fort Knox	4/1/2015	3/31/2020	Laserfiche - Environmental Volume
ADEC - APDES	AKR06AB39	MSGP Industrial Storm Water Discharge Monitoring – Gil Exploration Site	4/1/2015	3/31/2020	Laserfiche - Environmental Volume

Fairbanks Gold Mining, Inc. (FGMI)
Environmental, Health, and Safety Management System

	Permits, Licenses, Certificates and Authorizations	Original Date: May 15, 2002
Reviewed: June 26, 2018	Revision Number: 50	Revision Date: June 26, 2018

PERMITS, LICENSES, CERTIFICATES AND AUTHORIZATIONS

AGENCY	PERMIT #	DESCRIPTION	DATE ISSUED	EXPIRATION/ RENEWAL DUE	LOCATION OF DOCUMENT
ADEC - APDES	AKR06AB18	MSGP Industrial Storm Water Discharge Monitoring – True North	4/1/2015	3/31/2020	Laserfiche - Environmental Volume
ADEC - APDES	AKR06AB19	MSGP Industrial Storm Water Discharge Monitoring – Gilmore Exploration Site	4/1/2015	3/31/2020	Laserfiche - Environmental Volume
ADEC - APDES	AK0053643	Wastewater Discharge Authorization Program for Fort Knox Mine Facility	4/30/2018	5/31/2023	Laserfiche - Environmental Volume
ADEC	AQ0053MSS04	Title 1 Air Quality Control Minor Permit	12/17/2012	No Expiration Date	Laserfiche - Environmental Volume
ADEC	AQ0053TVP03	Title V Air Quality Control Operating Permit	5/31/2017	5/31/2022	Laserfiche – Environmental Volume
ADEC	2014-DB0002 Modification 1	Waste Management Permit for Fort Knox Mine	5/26/2017	3/27/2019	Laserfiche - Environmental Volume
ADEC Drinking Water Program Office	PWSID: 314093 Source ID: WL001	New Well & Water Softener Class: Non-Transient Non-Community (NTNC), Class A; Source: Groundwater	3/4/2009	No Expiration Date	Laserfiche - Environmental Volume
ADEC Drinking Water Program Office	ID #AK2314093	Sanitary Survey Fort Knox Drinking Water	12/18/2015	12/31/2020	Laserfiche - Environmental Volume

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AGENCY	PERMIT #	DESCRIPTION	DATE ISSUED	EXPIRATION/ RENEWAL DUE	LOCATION OF DOCUMENT
ADEC Drinking Water Program Office	PWSID #AK2314093	Fort Knox Priority Measures Plan (PMP) Biennial Update Compliance Certification	12/18/2017	12/31/2019	Laserfiche - Environmental Volume
ADEC Division of Water, Wastewater Discharge Program	File No. 104.45.002	Ft. Knox Mine-ALPM Maintenance Shop Septic System Final Approval to Operate	12/1/2009	No Expiration Date	Laserfiche - Environmental Volume
ADEC Division of Water, Wastewater Discharge Program	File No. 104.45.001	Ft. Knox Gold Mine-Replacement Leachfield, Two New Standard Manholes, Final Approval to Operate	1/19/2007	No Expiration Date	Laserfiche - Environmental Volume
Dept of Fish & Game	FG93-III-0202	Fish Habitat Permit Solo Creek Culvert	2/15/1994	Upon Third Party Transfer	Laserfiche - Environmental Volume
Dept of Fish & Game	FG99-III-0097, 0098, 0099, 0100, 0101	Fish Habitat Permit Wetlands Channel #1, #2, #3, #4, #5	5/14/1999, 5/15/1999, 6/1/99,6/9/99	Upon Closure of Mine	Laserfiche - Environmental Volume
Dept of Fish & Game	FH14-III-0026	Fish Habitat Permit Fish Creek, Nugget Creek, APMA 9156	2/24/2014	12/31/2018	Laserfiche - Environmental Volume
ADNR	ADL 414960 ADL 414961	Second Amendment to Millsite Lease ADL 414960 & 414961	6/1/2011	Mine Life	Laserfiche - Environmental Volume
ADNR	LAS 13988	Certificate of Appropriation Fish Creek for Mining, Milling, Heap Leach 5,245 acre-feet/year Priority date 12/11/1992	12/21/2011	No Expiration Date	Laserfiche - Environmental Volume

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AGENCY	PERMIT #	DESCRIPTION	DATE ISSUED	EXPIRATION/ RENEWAL DUE	LOCATION OF DOCUMENT
ADNR	LAS 13987	Water Right - Certificate of Appropriation Interceptor Wells for Mining and Milling 724 acre-feet/year Priority date 12/11/1992	4/22/2015	No Expiration Date	Laserfiche - Environmental Volume
ADNR	LAS 13986	Water Right - Certificate of Appropriation Fish Creek for Freshwater Reservoir impoundment for Mining and Milling 5,350 acre-feet/year Fish Creek for Mining and Milling 456.57 acre-feet/year Priority date 12/11/1992	11/22/2017	No Expiration Date	Laserfiche - Environmental Volume
ADNR	LAS 21760	Water Right - Certificate of Appropriation Dewatering Well Field 1,600 acre-feet/year Priority date 2/3/1998	11/14/2015	No Expiration Date	Laserfiche - Environmental Volume
ADNR	LAS 28161	Permit to Appropriate Water TSF & HL for Mining, Milling, and Heap Leach 13,255 acre-feet/year Priority date 7/20/2010	12/28/2017	12/27/2027	Laserfiche - Environmental Volume
ADNR	LAS 28160	Permit to Appropriate Water Drilled wells for Mining and Milling 3,000 acre-feet/year Priority date 7/20/2010	8/24/2017	8/23/2027	Laserfiche - Environmental Volume

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ADNR	LAS 28158	Permit to Appropriate Water Dewatering Wells for Mining and Milling 4,043 acre-feet/year Priority date 7/20/2010	8/24/2017	8/23/2027	Laserfiche - Environmental Volume
ADNR	AK00211	Certificate of Approval to Operate a Dam (Fort Knox Water Dam)	12/24/2015	9/16/2019	Laserfiche - Environmental Volume
ANDR	AK00310	Certificate of Approval to Operate a Dam (Walter Creek Heap Leach Pad Dam)	2/28/2018	8/5/2018	Laserfiche - Environmental Volume
ADNR	AK00310	Certificate of Approval to Modify a Dam (Walter Creek Heap Leach Pad Dam)	11/8/2017	Through Stage 10	Laserfiche - Environmental Volume
ADNR	AK00310	Certificate of Approval to Operate a Dam (Walter Creek Heap Leach Pad Dam) for increasing solution recirculation rate to 20,000gpm (FY2018-24-AK00310)	6/22/2018	8/5/2018	Laserfiche - Environmental Volume
ADNR	AK00212	Certificate of Approval to Operate a Dam (Fort Knox Tailings Dam)	6/22/2017	9/23/2018	Laserfiche - Environmental Volume
ADNR	AK00315	Certificate of Approval to Construct a Dam (Barnes Creek Heap Leach Pad Dam)	7/19/2017	Stage 2 Completion	Laserfiche - Environmental Volume
ADNR	ADL 47229	Modified Lease Certificate – Fish Creek	2/15/1994	2/15/2019	Laserfiche - Environmental Volume

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ADNR	ADL 535408	Fort Knox Upland Mining Lease	2/15/2014	2/14/2034	Laserfiche - Environmental Volume
ADNR	ADL 414960 ADL 414961	Fort Knox Millsite Permit	2/15/1994	Mine Life	Laserfiche - Environmental Volume
ADNR	ADL 414960 & 414961 Addendum	Amended and Restated Millsite Lease	7/3/2007	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852	Final Plan of Operations Amendment Approval	3/28/2014	3/27/2019	Laserfiche - Environmental Volume
ADNR	Plan of Operations Amendment	Re-routing segment of Fish Creek Road powerline & clearing of a 43-acre area to the N & E of topsoil stockpile for a sub-base material source	4/7/2011	Mine Life	Laserfiche - Environmental Volume
ADNR	Plan of Operations Amendment	2015 Fuel Island Relocation	6/24/2015	Mine Life	Laserfiche - Environmental Volume
ADNR	Plan of Operations Amendment	Plan of Operation Modification - Carbon in Column Plan #2 Construction amendment and design details approved	7/3/2012	Mine Life	Laserfiche - Environmental Volume
ADNR	Plan of Operations Amendment	Plan of Operation Modification - Proposed Growth Media Stockpile (West of YP WRD) Approval	9/10/2012	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852RCP.1	Barnes Creek Heap Leach Construction	5/26/2017	Mine Life	Laserfiche - Environmental Volume

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AGENCY	PERMIT #	DESCRIPTION	DATE ISSUED	EXPIRATION/ RENEWAL DUE	LOCATION OF DOCUMENT
ADNR	F20149852RCP.2	Reclamation & Closure Plan Approval	1/26/2018	3/28/2019	Laserfiche - Environmental Volume
ADNR	F20149852POO.4	Clearing & Grubbing for Filter and Seal Material	4/13/2016	Mine Life	Laserfiche - Environmental Volume
ADNR	F2014852POO.5	Install Light Duty Vehicle Spur Road for Fish Creek Road	5/12/2016	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852POO.6	Heap Leach Expressway	1/26/2017	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852POO.7	2017 Drill Pad Construction for Monitoring Wells	4/4/2017	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852POO.8	2018 Powder Magazine Relocation	11/20/2017	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852POO.9	Phase 9 Pit Expansion & Fish Creek East Waste Rock Expansion	1/26/2018	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852POO.10	Parcel G Powerline Trail Replacement	3/14/2018	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852POO.11	Clearing & Grubbing for Subbase Material and Re-establishing Light Duty Vehicle Spur Road for Fish Creek Road	4/4/2018	Mine Life	Laserfiche - Environmental Volume
ADNR	F20149852POOA.12	Phase 9 Pit Expansion Additional 10.57 Acres	6/25/2018	Mine Life	Laserfiche - Environmental Volume
ADNR	ADL 528271	In the name of Melba Creek Mining, Inc. lease renewed until August 31, 2019	8/31/2009	8/31/2019	Laserfiche - Environmental Volume

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AGENCY	PERMIT #	DESCRIPTION	DATE ISSUED	EXPIRATION/ RENEWAL DUE	LOCATION OF DOCUMENT
ADNR	ADL 415405	Land Use Permit Fish Creek and Fairbanks Creek Road Right of Way	3/7/1996	Mine Life	Laserfiche - Environmental Volume
ADNR	APMA 9736	Miscellaneous Land Use Permit for Hardrock Exploration Permit #9736	4/30/2014	12/31/2018	Laserfiche - Environmental Volume
ADNR	APMA 9156	Miscellaneous Land Use Permit for Hardrock Exploration Permit #9156 – Gil	4/15/2015	12/31/2019	Laserfiche - Environmental Volume
ADNR	ADL 419213	TSF Jetty Pipeline Road & Re-Alignment of Portion of Fish Creek Road	4/14/2011	Mine Life	Laserfiche - Environmental Volume
ADNR – Division of Forestry	96283	Fort Knox Burn Pit Permit (no permit needed from 9/1 – 3/31)	4/18/2018	8/31/2018	Laserfiche - Environmental Volume
Dept. of Public Safety	N/A	Life and Fire Safety Plan Check	6/29/1999	Construction Approval Archived	Laserfiche - Environmental Volume
Dept. of Public Safety	N/A	Tank Installation Plan Review	1/31/2014	Construction Approval Archived	Laserfiche - Environmental Volume
Dept of Labor	SEE FILES	Certificate of Inspection for Fired and Unfired Pressure Vessel	See Files 9/7/2011	As Required	Laserfiche - Environmental Volume
Dept of Labor	EIN 061325565	Employer Identification	9/1991	Mine Life	Laserfiche - Environmental Volume

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Dept of Labor	BL 1011245	Business License	10/10/2016	12/31/2018	H.R. Bulletin Board Hall to Admin Break Room
Dept of Revenue	100051	FGMI Mining License	5/1/2017	4/30/2018	H.R. Bulletin Board Hall to Admin Break Room
Dept of Revenue	99110	Melba Creek Mining License	5/1/2016	4/30/2017 Renewal Submitted	H.R. Bulletin Board Hall to Admin Break Room
<u>LOCAL</u>					
FNSB	NA	FNSB Floodplain Permit	4/28/1994	NA	Laserfiche - Environmental Volume
FNSB	CUO13-94	Conditional Use Permit (Tailing Disposal)	3/1/1994	NA	Laserfiche - Environmental Volume
FNSB	CUO14-94	Conditional Use Permit (Solid Waste Landfill)	3/1/1994	NA	Laserfiche - Environmental Volume
FNSB	12441	Zoning Permit	4/21/1994	NA	Laserfiche - Environmental Volume

**Appendix B: Fort Knox Specialized Environmental
Management Plans**

APPENDIX B: LIST OF FORT KNOX SPECIALIZED ENVIRONMENTAL PLANS

The following table lists the various environmental management plans that are on file at the Fort Knox Mine.

<i>FGMI LIST OF FORT KNOX SPECIALIZED ENVIRONMENTAL PLANS</i>			
Plan	Description	Latest Revision	Expiration / Renewal
Emergency Response Plan	Includes emergency response procedures and contact lists for the site.	February 2018	As Needed
Solid Waste Management Plan	Landfill design, construction, operation, and closure along with waste management procedures.	April 2016	As Needed
Dam Emergency Action Plan	Describes actions to be taken in the event of an embankment failure at the Water Storage Reservoir.	January 2017	As Needed
Water Balance	Site water balance includes mill, tailing impoundment, water reservoir, dewatering, and runoff.	Updated Monthly	N/A
Tailing Dam Operation and Maintenance Manual	Includes operation, maintenance, inspection, and record keeping procedures along with contingency plans for the tailing impoundment.	January 2018	As Needed
Water Dam Operation and Maintenance Manual	Includes inspection, monitoring, operating, and maintenance procedures along with contingency plans and an overview of the water dam.	March 2015	As Needed
Pearl Creek Causeway Operation and Maintenance Manual	Includes operation, maintenance, inspection, and record keeping procedures along with contingency plans for the causeway.	January 2010	As Needed
Heap Leach Operation and Maintenance Manual	Includes operation, maintenance, inspection, and record keeping procedures along with contingency plans for the heap leach.	May 2018	As Needed
PM10 Sampling & Meteorological Monitoring Plan	Utilized for PM ₁₀ monitoring during the first year of operation of the Fort Knox Mine.	April 1997	N/A
Fort Knox Mine Monitoring Plan	Describes monitoring procedures, analytes, and locations monitoring is completed for the entire site.	November 2017	As Needed
Fort Knox Mine Quality Assurance/Quality Control and Field Procedures Manual	Includes field and laboratory QA/QC procedures for environmental sample collection, chain-of-custody, shipment, and analysis.	July 2018	As Needed
Fort Knox Project Description	Integral part of the Plan of Operations for the site.	July 1997	N/A
Fort Knox Project Reclamation and Closure Plan	Includes the reclamation and closure plans for the entire site.	March 2017	March 2019
Fort Knox Pit Lake Model	Includes the reclamation and closure plans for pit.	February 2017	Annually
Fort Knox Storm Water Pollution Prevention Plan	Requirements to meet conditions of the Multi-Sector General Permit	June 2015 (figure updated 2017)	As Needed