

## **EXECUTIVE SUMMARY - FIVE YEAR ENVIRONMENTAL AUDIT FORT KNOX MINE TRUE NORTH MINE AND TWIN CREEK ROAD**

### **ES 1.0 Introduction**

The Alaska Department of Natural Resources (DNR) and the Alaska Department of Conservation (DEC) require Fairbanks Gold Mining Company, Inc. (FGMI) to have third party audits conducted every five years at the Fort Knox Mine in accordance with the issued Millsite Leases (ADL Nos. 414960 and 414961) and the Solid Waste Disposal Permit (No. 0031-BA008). Third-party audits are also required for the True North Mine and issued Millsite Lease (ADL#416509) and the Twin Creek Road. The last Audit was conducted in 1998 by TRC and the report produced in March 1999. In compliance with the regulatory requirements, Golder Associates Inc. (Golder) performed an environmental audit (Audit) of the Fort Knox and True North Mines and the associated haul road (Twin Creek Road) near Fairbanks, Alaska. The Audit included a site visit by three Golder professionals from July 28<sup>th</sup> to July 31<sup>st</sup> 2003, with an additional two days of wetland delineation field work.

The Audit was objective, systematic, and documented review of the conditions, operations, and practices related to environmental requirements and environmental management of the FGMI operations. The objective of this Audit is to assist DNR and DEC in determining if FGMI's environmental management systems and the regulatory controls applicable to the mine provide reasonable assurance that environmental objectives are being met and that the systems and controls are functioning as intended. The Audit results will be used by FGMI and the state of Alaska to assist in updating, renewing, or issuing authorization and permits, in updating policies, plans and procedures, and in determining compliance with permits and authorization.

The recommendations provided in this Audit are our best professional judgment based on the site visit and information review. Due to limitations in time and budget, detailed scientific and engineering analyses are not included. These recommendations, therefore are provided to the Large Mine Permitting Team as suggested solutions (or alternatives) to the potential audit issues or concerns. It is anticipated that FGMI may develop alternative, but acceptable responses to the audit issues or concerns based on more detailed analyses.

This executive summary is a concise discussion of all environmental concerns, recommended mitigation measures and their priority related to the Fort Knox Mine and Milling Operations, the True North Mine and associated haul road.

### **ES 2.0 Audit Procedures and Field Activities**

The audit included the following activities in order to complete the scope of work:

- Review of key project permits and environmental plans.
- Interviews with Agency Personnel.
- Review of agency records.
- Kick-off meeting with FGMI personnel.
- Inspection of mines and processing facilities, access road, hazardous material storage and handling, general waste management areas, environmental controls and waste containment, topsoil stock piles, reclamation trial area, wetlands, fresh water reservoir, interceptor well system, data collection procedures and the environmental files.
- Review of environmental files for monitoring and reporting, environmental compliance, bonding and reclamation costs. This also involved interaction with the FGMI personnel.
- Technical evaluation of key issues and concerns that were identified during the previous audit and new findings from this audit.
- Follow-up telephone conversations with FGMI personnel.
- Preparation of a Draft Audit Report.
- Preparation of a Final Audit Report.

### **ES 3.0 Results of the Audit**

Twelve tasks were completed for this audit and a summary of the results of each task is presented below.

ES 3.1 Task 1. FGMI's Compliance with Federal, State, Local Permits and Authorization

FGMI is in compliance with federal, state, local permits and authorizations. A thorough review of the existing project environmental management systems, key permits, relevant procedures, policies, and guidelines, project commitments to the agencies and federal, state and local regulations was conducted prior to and during the audit. While on site, Golder reviewed those documents for compliance, expiration, and renewal requirements. The implementation of each of the documents' terms were checked during the field audit and found to be in compliance.

ES 3.2 Task 2. FGMI's Compliance with Specialized Environmental Plans

Golder reviewed the specialized environmental plans for the Fort Knox Mine and the True North Mine and determined that FGMI is in compliance with those plans. Golder interviewed FGMI operations personnel on the mining and process operations, permits and regulatory requirements, chemical containment structures, monitoring and environmental controls and procedures, data collection and environmental reporting. The audit team systematically addressed the adequacy of the plans, whether the plans are being followed, and documented the performance of the environmental programs. A tour of the facilities revealed that the site specific environmental systems are being followed. FGMI has implemented sound environmental standards and guidelines that are equal to or above those normally found in the mining industry.

ES 3.3 Task 3. The Reliability and Integrity of Information Relating to Environmental Reporting and Compliance

Direct field observations were completed to determine the reliability of reported information and to verify additional information provided through interviews with key mine personnel. Site observations focused on the environmental controls, reclamation activities, and monitoring systems.

Mine operations and facilities that were inspected include the following:

- Open pit areas at Fort Knox and True North
- Milling and beneficiation facilities
- Processing and maintenance operations

- Waste management and containment facilities, including the tailing storage facility
- Seepage and ground water collection facilities
- Access roads
- Fresh Water Reservoir and water supply facilities
- Overburden, low grade ore, and growth media stockpiles
- Reclamation trail demonstration area
- Wetlands
- Monitoring facilities, and
- File system.

The reliability and integrity of information for reporting and compliance is adequate. FGMI has an environmental management plan which includes protocols for reporting, data QA/QC, instrument calibration, and monitoring requirements in place. The FGMI staff is well organized, knowledgeable, and well-trained on environmental management for mines.

#### ES 3.4 Task 4. The Adequacy of State Oversight to Protect State Resources

In order to determine the adequacy of state oversight to protect state resources Golder interviewed staff from the following agencies:

- Alaska Department of Natural Resources (DNR), Anchorage
- DNR, Fairbanks
- Alaska Department of Environmental Conservation (DEC)
- U.S. Army Corp of Engineers (Corps)
- U.S. Fish and Wildlife Service

- Alaska Department of Fish and Game
- Alaska Mental Health Trust Land Office.

The previous audit recommended several recommendations to facilitate continued communication between agencies and FGMI and to streamline future audits. Golder determined that the recommendations were implemented and have facilitated the communication process. Golder inspected the filing system and reviewed project related files at the DNR. The files were organized in chronological order and fairly easy to review. The regulatory agencies for this project appear knowledgeable and have sufficient understanding of mining practices, environmental mitigation measures and the state and federal regulations.

#### ES 3.5 Task 5. Changes in Tailing Impoundment Geochemistry Due to Processing to True North Ore

Spigotting of a combined Fort Knox and True North tailings has resulted in increases in tailings decant antimony, arsenic, copper, nitrate, phosphate, and selenium concentrations.

The tailings decant concentration plot shows a change in slope, indicative of a decline in the rate of concentration increase, in August 2001. A change in slope for the tailings seepage is observed in May 2002, 9 months following the observed change in tailings decant. Tailings pond water copper concentrations have increased as well, reflecting an increase in copper sulfate use. The gradual rise in tailings decant nitrate concentrations has continued over the life of the operation. Completion of a nitrogen balance of the cyanide and other nitrogen compounds may provide insight on the increasing nitrate trends.

Speciation modeling using PHREEQC identified potential mineral solubility controls on tailings decant water chemistry and indicated a mineral solubility control on arsenic, selenium and antimony in tailings decant waters is unlikely. Adsorption onto ferrihydrite (supersaturated in decant water assuming dissolved iron is present) is a possible attenuation mechanism for arsenic, copper and antimony. Selenium present as selenite ( $\text{Se}^{4+}$ ) may also adsorb to iron oxides.

## **Pond Cyanide and Cyanide Degradation Product Concentrations**

Prior to processing of the True North ore, tailings decant total cyanide concentrations were relatively low with seasonal variability. After the start of the processing of the True North ore, changes in operating practices resulted in a seasonal increase in cyanide concentrations. Concentrations of nitrate, a cyanide degradation product, are expected to continue to increase (Note: please see Task 7 analysis related to cyanide recycling in the process circuit). A better understanding of the various nitrogen species and their longevity/mobility in the tailings water and groundwater system would assist in developing appropriate control features, if needed.

### ES 3.6 Task 6. Changes in Tailing Impoundment Geochemistry Due to the Lead Nitrate Addition to the Milling Circuit

The addition of lead nitrate in tailings processing is intended to remove sulfur from solution through the precipitation of a lead sulfate, thereby preventing the formation of thiocyanate (SCN). The use of lead nitrate in tailings processing since April 2001 has not resulted in significant increases in tailings decant lead concentrations. The increase in peak nitrate levels in 2003 relative to previous years is likely only in part attributable to the use of lead nitrate. Higher cyanide use would also contribute to higher tailings decant nitrate concentrations through natural decay of cyanide.

### ES 3.7 Task 7. Changes in Tailings Impoundment Geochemistry Due to Operation of the New Tailings Thickener

On October 17, 2002 the Fort Knox mill commissioned the operation of the new tailings thickener as part of the ore processing circuit. The changes to tailings impoundment geochemistry are considered to be beneficial due to the reduction of reagent usage (cyanide, ammonium bisulfite, and copper sulfate) and cyanide recycling. Cyanide is recycled as process water is removed directly from the tailings prior to detoxification. The tailings are further diluted with decant water to reduce or eliminate the need for detoxification resulting in significant reduction in the use of ABS and copper sulfate.

Another distinct advantage to the thickener is during the last year of operations, thickened tailings can be spigotted to the tailings impoundment to shape the surface of the impoundment reducing the potential grading requirements for reclamation.

ES 3.8 Task 8. Operation of the Interceptor Well System to Maintain a Zero Discharge from the Tailings Impoundment

The last audit identified water quality changes in a monitoring well located downgradient from the Tailings Storage Facility (TSF). The changes were due to migration of seepage and indicated the well interceptor system may not have been operating effectively. Records from the pump back system, the tailings underdrain seepage and the water quality downgradient from the tailing storage facility were reviewed.

FGMI conducted a drilling program to further characterize the hydrogeology in the area of the interceptor well system, installed additional interceptor wells, and installed additional downgradient monitoring wells. FGMI has increased pumping rates at the seepage interceptor system to improve capture of tailings seepage in bedrock. In order to confirm the operational adequacy of the system, Golder analyzed water quality over time and the results from the hydraulics of the system (i.e., Surfer modeling results). This program has improved the efficiency of the interceptor/pumpback system as evidenced by the monitoring data.

Groundwater elevation contour maps have been developed by FGMI to demonstrate that the pumping wells create a hydraulic barrier or capture zone down gradient of the tailings dam. These contour maps are based on water level measurement from the pumping wells and the groundwater monitoring well network. Golder reviewed the data and parameters used for the model in order to assess the basis for the water contour maps contained in the reports. The water level contour maps presented in various documents show that the draw-down cones from the pumping wells intercept and create a continuous hydraulic barrier across the area of interest below the tailings dam. The water elevation data for the November 2002 and June 2003 maps were reviewed in more detail and were found to be consistent with and support the associated water level contour maps presented in the various reviewed documents.

The second quarter 2003 report in compliance with Solid Waste Permit #0031-BA008, confirmed that the tailings impoundment is operating as a zero discharge facility. The interceptor well system was performing well in the report and a cone of depression was being maintained. The system is being monitored and adjusted to assure proper performance. This monitoring and adjustment will continue as required.

It is Golder's opinion that the Interceptor System is performing adequately and that it should continue to perform well with minor modifications and adjustments as indicated by the monitoring systems in place. With proper attention to the system and any required maintenance, operations as a zero discharge facility should continue.

### ES 3.9 Task 9. Reclamation Plan Alternatives Proposed for the Tailing Impoundment and Critical Areas at Both Fort Knox and True North

The reclamation planning for the Fort Knox and True North Mines is preliminary, as is appropriate for this stage of the mine life. A reclamation schedule is needed to support coordination of future studies and the sequencing of the TSF reclamation in relation to other project components. Based on the review of the reclamation approach and the operating history there are no major concerns related to meeting the reclamation goals for the waste rock dumps, roads, process plant areas, wetlands, and water storage reservoir (WSR). Areas of concern do exist for the demolition, open pit, and TSF and consist of the following:

- Process Plant Demolition: No plans for building and equipment demolition were evaluated for this audit and may not currently exist. It is anticipated by FGMI that equipment and structural steel salvage credits will cover all demolition costs. This analysis needs to be completed and a demolition plan prepared. A plan to deal with mill and process area cleanout and remediation of contaminated soils will be needed for final reclamation.
- Open Pit: The post-reclamation land use objectives for the open pit include a recreational lake. Based on the existing water quality information, this plan should be compatible with a recreational use. However, the pit highwalls will provide a potential long-term rockfall hazard. While the pit highwalls may be stable on the macro-scale, small raveling failures will continue. The pit highwalls have been designed for operational stability in a dewatered condition and are not designed for rising groundwater elevations, which may lead to some larger-scale instability associated with the schist rock slope areas. A stability review of the flooded pit may be warranted to define the long-term stability given the proposed post-mining land use.
- TSF: A consolidation analysis of the tailings is needed to support final design and planning of the post-reclamation topography, surface water management plan and spillway design. Establishment of a final TSF topography during operations that accounts for future consolidation can greatly reduce closure costs but can increase operating costs during the later phases of mill operations. The TSF closure incorporates the use of a large volume of riprap (60,000 cubic yards) that will be sourced from the waste rock dumps. This material will have processed and stockpiled during the later stages of operations or during the waste dump reclamation. Water quality predictions for the reclaimed TSF seepage should be

developed based on the water quality data currently be collected, to determine the potential loading rates to wetland areas and receiving waters.

### **True North**

True North is approximately 15 months from the completion of mining. A detail-level reclamation plan that addresses backfill, grading plans, highwall stability, cover thickness, and surface water drainage is in development by FGMI.

#### ES 3.10 Task 10. Adequacy of the Reclamation Financial Sureties for Both Sites

The reclamation sureties as prepared by FGMI are based on reasonable and proven reclamation concepts and have well documented cost backup. Production rates and equipment selection will be adjusted to be in line with equipment available in Alaska. Unit rates provided by FGMI for the TSF are in line with anticipated third party contractor costs, but the Fort Knox and True North cost estimates will need to be updated with new rates for the next permit renewal. A demolition plan that includes cost estimates and equipment salvage value is lacking and should therefore be completed. The estimated indirect costs are generally consistent with industry standards for Mobilization/Demobilization and Contract Administration costs but are low or not estimated for Engineering, Contractor Profit and Overhead, Performance and Payment Bonds, Contingencies and Inflation costs.

#### ES 3.11 Task 11. Evaluate: the Extent and Functional Value of Developed Wetlands Created by FGMI as Mitigation for Lost Acres Beneath the Tailings Impoundment

Wetlands and other aquatic sites created by FGMI as mitigation for lost acres beneath the tailings impoundment are presently 24.5 acres less than acres prescribed. Wetland and aquatic sites created by FGMI exceed the prescribed amount by 19.3 acres for the water reservoir and associated wetland acres. Lake area within the pit and wetlands on the reclaimed tailings bench as prescribed have not yet been created and are anticipated to be created upon mine closure.

In terms of overall wetlands and other aquatic sites created, FGMI has to date developed a total of 204.8 acres, including wetlands below the tailings dam and the water reservoir and associated wetlands. Wetlands and other aquatic sites created by FGMI below the tailings dam are primarily aquatic (pond) sites surrounded by palustrine scrub-shrub (PSS) wetlands. These presently constitute

20.5 acres (24.5 total acres less than the prescribed amount). The water reservoir and associated wetlands are primarily open water sites surrounded by Palustrine Forested wetlands (PFO) and Palustrine Scrub-shrub wetlands (PSS). The water reservoir and associated sites created by FGMI total 184.3 acres and exceed the prescribed amount of 165 acres by 19.3 acres. Additional habitat enhancement on Last Chance Creek completed by FGMI was non-prescribed. Lake area within the pit (148 acres) and wetlands/ponds/uplands (425/425/365) on the reclaimed tailings impoundment as prescribed have not yet been created and are anticipated to be created upon mine closure

This delineation did not include a functional assessment of created wetlands. A functional assessment is recommended for the Fort Knox Mine site to assess the relationship between wetland areas created and those filled and/or cleared.

#### ES 3.12 Task 12. Compliance with Recommendations Made in the Last Audit

The previous audit made ten recommendations to FGMI. They are summarized below in italics with Golder's audit findings following.

*"...optimize capture of tailings water seepage..."* Response: Since the last audit, the system has been further optimized by a program that included installation of several new interceptor wells and a better understanding of the hydrogeological environment downstream from the tailings impoundment.

*"...consider issues related to tailings water management and disposal at mine closure..."* Response: FGMI has developed a conceptual/preliminary level reclamation and closure plan for the TSF. FGMI is collecting water quality information and has reduced reagent loading coming into the impoundment by the installation of the new thickener.

*"...reclamation cost estimate and closure bond should be updated..."* Response: FGMI has updated them and Golder reviewed them as part of this audit.

*"...FGMI should further evaluate the potential seepage impacts that may occur due to construction of a permanent wetland on the tailings surface following mine closure..."* Response: FGMI is collecting water quality data to support this assessment and have developed water management strategies for seepage treatments should this occur.

*“Update of the reclamation cost estimate and financial sureties should consider...”* Response: FGMI has included the audit recommendation in the reclamation plans reviewed for this audit, with the exception of the development of the demolition plans.

*“...optimization of water quality monitoring is recommended...”* Response: FGMI did not reduce any of the constituents of concern analyses. FGMI did reduce organic testing since it was identified as a non-issue.

*“Further optimization of the monitoring program could be considered....with reduced monitoring frequency...”* FGMI has implemented this where and when it is appropriate and the criteria, based on consistent analysis results below detection limits, is met.

*“Additional recommendation regarding the monitoring program.....include trend plots.... Review lab data for potential reporting errors...Complete the update of the FGMI water quality monitoring plan revision.....Measure surface water flows at wetland monitoring stations and perform annual evaluation of groundwater levels. Include groundwater elevations and surface water flow rates to monitoring reports.”* Response: FGMI has implemented these recommendations.

*“ADF&G should continue monitoring of fish populations and water quality in the water supply reservoir (WSR) ....and consider monitoring of Fish Creek and other tributaries to the WSR to monitor arctic grayling spawning habitat....in evaluation of tailings water disposal and wetland restoration at closure.”* Response: ADF&G has been doing this for the past five years.

*“...recommendations...to facilitate continued communication between the agencies and FGMI...Encourage approaches to improve continuity of ADEC interactions with FGMI...designating one of the current ADEC staff members as coordinator.....Schedule the next ..audit during the summer of 2003....Provide detailed cost estimate backups for the auditors that can be related directly to the bond amount....”* Response: FGMI has implemented all of these recommendations.

## **ES 4.0 Mitigation and Recommendations**

### ES 4.1 Monitoring Optimization

The tailings decant and seepage are sampled quarterly. This frequency of monitoring is considered adequate to characterize tailings water and groundwater quality and capture seasonal trends. Quarterly monitoring should be continued.

Both the tailings decant and seepage samples are collected from areas where the water is in contact with the atmosphere. Tailings decant water is collected from the surface of the tailings pond from a barge, and is therefore representative of near-surface conditions in the tailings pond. Tailings seepage samples are collected from a sump open to the atmosphere. The four trace metals of interest in tailings water (arsenic, copper, selenium, and antimony) are all redox species. As such, redox conditions will influence the mobility of these metals. To characterize tailings water at depth, a pond water sample could be collected from the base of the tailings pond using a depth sampling bomb. This sample is expected to be more representative of pore water conditions within the tailings and therefore more representative of tailings seepage water quality. Comparison of the composition of tailings water at surface and at depth will provide insight into the homogeneity of the tailings pond water (i.e., if the pond water is a well mixed system). Such a comparison will also assist in identifying whether samples collected at surface are representative of the entire pond water chemistry.

Monitoring of the wells should continue. Golder recommends that the monitoring data be presented as Piper Diagrams so that trends and changes of water quality “signatures” can readily be compared to tailings seepage and the IW-series wells to evaluate specific concerns during the future audits or as requested by the agencies.

### ES 4.2 Reclamation

The reclamation planning for Fort Knox and the TSF are at an appropriate level for this stage of the project. Additional design detail will be necessary over the next five years. The True North Project has an immediate need for development of detailed reclamation plans. Specific recommendations for the reclamation plans are to develop:

- Demolition plans for the processing plant and mill.

- A consolidation model for the TSF and finalize the surface water management plan, grading plan, and cover concepts. It is recommended that the TSF reclamation plan include a small surface water pond near the spillway and that surface recontouring occur during the latter stages of operations using thickened tailings. Additional study and documentation of the direct revegetation of the tailings is required to support this concept.
- Detail-level reclamation plans for True North that incorporate the results of the infiltration estimates developed in the lysimeter field studies.
- Project reclamation schedule that considers that the reclamation and closure of the TSF will occur a period of years after the reclamation of the pits, dumps, and mill site demolition.
- A predictive water quality assessment of the TSF to define a long-term tailings seepage management strategy. In addition a site-wide water quality assessment that incorporates the predicted water quality from pit wall and lake, waste rock dumps and TSF pond water should be prepared to assess the long-term water quality associated with the post-closure conditions. The study should also consider the beneficial affects of the wetland and reservoir system downstream of the reclaimed mine facilities.

Additional closure planning and assessment of the water quality data is needed after the completion of the True North ore milling to assess the current concepts.

#### ES 4.3 Reclamation Sureties

The reclamation sureties for the Fort Knox and True North projects are calculated on reasonable assumptions and approaches for FGMI to complete the reclamation. Recommendations for refinement of the reclamation sureties include:

- Prepare a demolition cost estimate that includes time for mill cleanout and contamination soils remediation.
- Refine production rate estimates to reflect third-party contractor rates.
- Update unit rates for equipment in the Fort Knox and True North reclamation plans.
- Review and update indirect costs as needed.
- Re-evaluate riprap processing, stockpiling, hauling, and placement costs and equipment selection.

ES 4.4 Dust Control

FGMI needs to maintain dust control program on the haul road.

ES 4.5 Noise Control

FGMI has implemented noise certification for new trucks as well as operational monitoring. Follow up testing completed by FGMI and reviewed by DEC and residents indicates operational compliance.

FGMI needs to maintain the noise monitoring program and continue to remove trucks which fail the compliance from operation until the trucks meet compliance standards (82 decibels (dBA) at a distance of 50-feet from the roadway).

ES 4.6 Wetlands

FGMI is not yet in full compliance of wetland mitigation with regards to replacement of acres between the tailings dam and the water supply reservoir. Additional wetland acres need to be developed below the tailings dam.

No functional assessment was performed in this wetland evaluation. It would be important to determine the functions and values of the created wetlands with respect to acres lost. A functional assessment of these wetland areas is warranted. It would be most useful if the methodologies utilized in a new functional assessment were comparative to those used in the initial jurisdictional wetland functional assessment.

Detailed hydrological and hydraulic analyses are necessary to determine the capacity of the wetland impoundments and the channels upon mine closure for long term maintenance of the ponds. A review of the ponds vegetation establishment should be conducted prior to mine closure also to determine any long term vegetation maintenance necessary.

Fish habitat monitoring should continue on an annual basis to continue to document Arctic Grayling and burbot uses of the wetlands and reservoir.

Additional shrub habitat could be increased through plantings on Pond C now that it has assumed a riffle/pool form. Additional shrub habitat would provide shade, canopy cover and bank stabilizing effect on this area.

Assorted metal pieces should be removed from the ponded areas. These rusting metals, especially in Pond B may be degrading water quality in some portions of the ponds.

Planting and seedings of the Last Chance Creek enhancement area should be reviewed and supplemented. These areas have experienced 1.5 growing seasons since planting and vegetative cover is currently very low.

**TABLE ES-1 AUDIT ISSUES**

<b>Task</b>	<b>Audit Issue</b>	<b>Recommended Action</b>
• Task 1. FGMI's Compliance with Federal, State, Local Permits and Authorization	In compliance	No action recommended.
• Task 2. FGMI's Compliance with Specialized Environmental Plans	In compliance	No action recommended.
• Task 3. The Reliability and Integrity of Information Relating to Environmental Reporting and Compliance	In compliance	No action recommended.
• Task 4. The Adequacy of State Oversight to Protect State Resources	In compliance	No action recommended.
• Task 5. Changes in Tailing Impoundment Geochemistry Due to Processing to True North Ore	The increased concentrations associated with the True North ore have resulted in short-term, defined changes in the decant and related seepage quality with a known travel time.	The concentration increases may have a longer-term impact on seepage quality than the 9 (or 6)-month travel time, due to dispersion, attenuation and chemical controls as these constituents move from the pond water through the tailings. The time frame for the elevated constituents to migrate through the system or until there is no impact to seepage quality is not well defined and is recommended to be addressed with site specific studies.
• Task 6. Changes in Tailing Impoundment	Changes noted with increasing nitrate	Concentrations of nitrate, a cyanide degradation product, are expected to continue to increase. The

Task	Audit Issue	Recommended Action
Geochemistry Due to the Lead Nitrate Addition to the Milling Circuit	concentration is pond water.	increasing nitrate concentrations may require modification of the water management measures at closure to avoid potential impacts to groundwater. A better understanding of the various nitrogen species and their longevity/mobility in the tailings water and groundwater system would assist in modifying the existing control features, if needed for closure conditions. Completion of a nitrogen balance of the cyanide and other nitrogen compounds may provide insight on the increasing nitrate trends.
<ul style="list-style-type: none"> <li>Task 7. Changes in Tailings Impoundment Geochemistry Due to Operation of the New Tailings Thickener</li> </ul>	Changes noted.	No action recommended.
<ul style="list-style-type: none"> <li>Task 8. Operation of the Interceptor Well System to Maintain a Zero Discharge from the Tailings Impoundment</li> </ul>	Significant improvement from last Audit results.	Continued monitoring and system analysis recommended.
<ul style="list-style-type: none"> <li>Task 9. Reclamation Plan Alternatives Proposed for the Tailing Impoundment and Critical Areas at Both Fort Knox and True North</li> </ul>	Preliminary planning is complete for TSF, waste rock disposal areas, and open pit. Detail-level design is required for True North. Demolition plans for the process area required.	<p>Specific recommendations for the reclamation plans are presented below:</p> <ul style="list-style-type: none"> <li>Develop demolition plans for the processing plant and mill.</li> <li>Develop a consolidation model for the TSF and finalize the surface water management plan, grading plan, and cover concepts. It is recommended that the TSF reclamation plan include a small surface water pond near the spillway and that surface recontouring occur during the latter stages of operations using thickened tailings. Additional study and documentation of the direct revegetation of the tailings is recommended to support this concept.</li> <li>Develop detail-level reclamation plans for True North that incorporate the results of the infiltration studies.</li> <li>Develop a project reclamation schedule that considers that the reclamation and closure of the TSF considering the consolidation duration of the tailings, could occur a period of years after the reclamation of the pits, dumps, and mill site demolition.</li> </ul>
<ul style="list-style-type: none"> <li>Task 10. Adequacy of the Reclamation</li> </ul>	The reclamation sureties as prepared by	Recommendations for refinement of the reclamation sureties include:

Task	Audit Issue	Recommended Action
Financial Sureties for Both Sites	FGMI are based on reasonable and proven reclamation concepts and have well documented cost backup. Future updates are recommended as closure planning advances.	<ul style="list-style-type: none"> <li>• Prepare a demolition cost estimate that includes time for mill cleanout and contamination soils remediation.</li> <li>• Refine production rate estimates.</li> <li>• Update unit rates for equipment in the Fort Knox and True North reclamation plans.</li> <li>• Review and update indirect costs as needed.</li> <li>• Re-evaluate riprap processing, stockpiling hauling and placement costs and equipment selection.</li> </ul>
<ul style="list-style-type: none"> <li>• Task 11. Evaluate: the Extent and Functional Value of Developed Wetlands Created by FGMI as Mitigation for Lost Acres Beneath the Tailings Impoundment</li> </ul>	FGMI is not yet in full compliance of wetland mitigation with regards to replacement of acres between the tailings dam and the water supply reservoir.	A detailed hydrological/engineering analyses will be needed if flow is directed through the created wetlands upon mine closure. If an alternative plan to create a north valley stream/wetlands complex is desired, hydrological/engineering analysis will need to be conducted to determine size and shape of channels to handle flow. Long term monitoring and maintenance of the structural integrity of the dikes on the existing created wetlands is necessary.
<ul style="list-style-type: none"> <li>• Task 12. Compliance with Recommendations Made in the Last Audit</li> </ul>	Audit found compliance with previous Audit Recommendations	No action recommended.

**FINAL**

**FIVE-YEAR ENVIRONMENTAL AUDIT  
FORT KNOX MINE, TRUE NORTH MINE AND TWIN CREEK ROAD**



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State of Alaska, Department of Environmental Conservation*

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