

TRUE NORTH

**PROJECT
MONITORING
PLAN**

Prepared By

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A Subsidiary of Kinross Gold Corporation
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December 2001

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1.0 INTRODUCTION

1.1 Overview

Fairbanks Gold Mining, Inc. (FGMI), a wholly owned subsidiary of Kinross Gold Corporation (KGC), has prepared this monitoring plan for the amended True North Project. The plan is designed to address the objectives and goals of the Federal and State resource management agencies: U.S. Army Corps of Engineers (COE), and Alaska Departments of Natural Resources (ADNR), Environmental Conservation (ADEC), and Fish & Game (ADF&G).

It is the goal of FGMI to operate the True North Project in a manner that will ensure the protection and, where possible, the enhancement of surface and groundwater quality. This baseline and operational monitoring plan will assist FGMI in the establishment and refinement of operating procedures to identify pre-development natural water quality conditions and ensure the long-term protection of State of Alaska land, wildlife, and water resources. Periodic updates of the monitoring plan will coincide with regulatory changes, annual reviews, process modifications, or anomalies noted as a result of monitoring and sampling.

This monitoring plan is an intricate part of the Project Management System (PMS) for the True North Project.

Access by Federal and State regulatory personnel to the True North Project facilities for the purpose of inspecting for reclamation, wildlife mortalities, or other appropriate compliance areas are statutory/regulatory mandates and will be adhered to by FGMI, with the request that agents contact mine management to gain access. The health and safety of FGMI employees and that of regulatory personnel is the rationale for this request. Mining is regulated under the Mine Safety and Health Administration (MSHA) and their regulations require minimum training for employees and visitors for Hazard Recognition and Safety. Visitors as well as employees must wear safety equipment, approved by MSHA.

FGMI requests consideration by the regulatory agencies to conduct routine inspections during weekdays when administration and site managers are available to answer questions and, if necessary, accompany agents to different site components.

1.2 General Information

Date: December 2001

Name of Facility: Fairbanks Gold Mining, Inc. – True North Project

Type of Facility: Gold Mine and Operation

Location: The True North Project is within the Chatanika River watershed located on the northwest flank of Pedro Dome approximately 25 miles northeast of Fairbanks. The ridgelines drain into Murray Creek, a tributary of Dome Creek to the south; and Louis Creek, Whiskey Gulch, and Spruce Creek, tributaries of Little Eldorado Creek to the north. More specifically, the Millsite Lease boundary is located in portions of Sections 21, 27, 28, 29, 32, & 33, Township 3N, Range 1E, Fairbanks Meridian (Appendix A). The project site is located entirely on State and University of Alaska land. There is no federal land involved within the project boundaries and the closest residence is approximately one mile from the project boundary.

Corporate Information:

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General Manager: Rick Baker

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1.3 Site Description

The True North Project (exploration area and mine site) is within the Chatanika River watershed located on the northwest flank of Pedro Dome approximately 25 miles northeast of Fairbanks. The ridgelines drain into Murray Creek, a tributary of Dome Creek to the south; and Louis Creek, Whiskey Gulch, and Spruce Creek, tributaries of Little Eldorado Creek to the north.

Even though a mineable reserve has been identified in the Hindenburg, East, Central, Shepard, and Zeppelin Pits, FGMI will continue to explore the mineralized areas in the immediate vicinity. Environmental baseline water quality and quantity monitoring will continue until FGMI determines the potential of the area.

The mine, as currently identified, will operate year-around with conventional open pit mining averaging 52,000 tons per day, at a 4.2:1 strip ratio, and producing approximately 150,000 ounces of gold annually. Approximately 10,000 tons of ore per day will be trucked to the Fort Knox mill for processing. Amended mine life is approximately three-years.

No process components will be present at the property; therefore mining will be similar to a gravel pit or rock quarry operation.

1.4 Objectives

The objectives of baseline surface and ground water monitoring are:

- To collect data that describe the pre-mining surface water and groundwater hydrology;
- Determine pre-development natural water quality conditions in the project area; and
- To determine possible post mining land uses that are consistent with the Tanana Basin Area Plan.

The objectives of operational monitoring are:

- To verify data collected during baseline water quality sampling;
- Determine percolation rates and runoff coefficients;
- Characterize storm water runoff after contact with rock development dumps and pit walls;
- Track both surface and ground water quality trends during operations; and
- Assess monitoring data to determine impacts to surface and ground water quality during operations and after closure.

The objective for closure as agreed to by the Alaska State Project Team:

- Meet applicable surface and ground water quality standards (natural background conditions);
- If required the growth medium caps on the waste rock dumps and Hindenburg Pit bottom are in place; and
- The 70% vegetative cover criteria has been achieved or the area is stabilized in a manner acceptable to ADNR.

FGMI will continue monitoring and sampling through development, operation, reclamation, final closure, and post closure.

2.0 BASELINE MONITORING AND SAMPLING

2.1 Baseline Groundwater

Nine environmental baseline groundwater monitoring wells were drilled and constructed during December of 1999 and have been used to determine pre-mining baseline water quality. The wells were sited in strategic locations to depict existing conditions within the mineralized trend and in specific instances up gradient and down gradient of proposed mining activities. FGMI will continue to evaluate the hydrogeologic features and mineral potential of the True North Project area and determine if additional monitoring wells are necessary.

2.2 Baseline Surface Water

Baseline surface water samples will continue in the area of exploration and potential development (Appendix C). All surface water monitoring locations (baseline and operations) are listed in Table 2-1. The present number of monitoring sites has been reduced since FGMI narrowed the area of activities to the Millsite Lease area, but the numbers may increase dependent on future exploration. All surface water samples are initially analyzed using Profiles I and III (Table 4-1 and Table 4-3). Subsequent samples are analyzed using just Profile I.

**Table 2-1
Summary of Surface Water Sites by Drainages**

Drainage	Location	Comment
Little Eldorado Creek	Lower Louis Creek	Location consistent with 1999 sampling location
	Whiskey Gulch	Location consistent with 1999 sampling location
	Little Eldorado Creek	1999 location unknown, sample at point downstream of Marshall Gulch
Dome Creek	Upper Dome Creek	New location – try and sample above tailings (where old bus is located), upstream of Murray Creek
	Murray Creek	Location consistent with 1999 sampling location
	Lower Dome Creek	Location where Dome Creek flows under the Elliott Highway
Spruce Creek	Spruce Creek	Sample main channel of Spruce Creek down gradient and west of MW-05

3.0 OPERATION AND CLOSURE MONITORING

3.1 Groundwater Monitoring Wells

Mining operations and specific components of the operation are monitored to track water quality trends and identify impacts associated with the construction, excavation of pits, placement of development rock, and closure of the True North Project.

The groundwater associated with the main Hindenburg, East, Central, Shepard, and Zeppelin Pits will be monitored using TMW-1, TMW-4, TMW-6, TMW-7, TMW-8, TMW-9, and TMW-13.

Groundwater associated with the Mobile Maintenance Facilities, the Shop Rock Dump, and Growth Medium Stockpile will be monitored using TMW-2, TMW-3, TMW-8, and TMW-10.

Groundwater associated with the Spruce Rock Dump will be monitored using TMW-11 and TMW-12.

Groundwater associated with the North Rock Dump will be monitored using TMW-5 (when groundwater is present)

These wells (APPENDIX B) will be sampled quarterly and water samples are initially analyzed using Profiles II and III (Table 4-2 and Table 4-3). Subsequent samples are analyzed using just Profile II (Table 4-2).

3.2 Surface Water Monitoring

Surface monitoring during operations will focus on those drainages that are down gradient from mining activities. Murray Creek, Lower Dome Creek, Spruce Creek, Louis Creek, and Whiskey Gulch will monitor potential impacts from operations in the areas of the Hindenburg, East, Central, Shepard, and Zeppelin Pits, development rock dumps, and haul roads.

When present in the pits, surface water samples will be collected and submitted for analysis. Surface water samples day lighting (seeping through) from waste rock dumps will be collected when present and submitted for analysis.

All surface water samples collected on a quarterly bases are initially analyzed using Profiles I and III (Table 4-1 and Table 4-3). Subsequent samples are analyzed using just Profile I.

3.3 Characterization for Acid Rock Drainage

Quarterly characterization of development rock and ore will continue over the life of the mine. Sampling for representative samples will be based on annual operational and geological records identifying materials mined. Acid/base accounting will be performed on the samples. If static evaluations show less than a 3 to 1 ratio of

net neutralization potential to net acid generation, kinetic testing (26-week Humidity Cell Testing) will be performed. A detailed explanation of sample collection and analysis is located in Appendix D: Section 2.3.4.

After mining 300 feet below original ground level, a composite blast hole chip sample (ore and waste) will be sampled and tested monthly using the Static Net Acid Generating (NAG) Procedure (Appendix E). In the event the analytical results indicate a potential for acid generating rock, FGMI will develop a waste rock management plan for submittal to ADNR for approval that will incorporate several management options, i.e. mix or cover potential acid generating rock with oxide material. FGMI will continue to investigate better options to manage and minimize impacts from potential acid rock drainage.

3.4 Waste Rock and Overburden Evaluation

The purpose of the annual characterization of development rock and overburden is to evaluate the potential for dissolution and mobility of certain constituents from mine rock samples using the Meteoric Water Mobility Procedure (MWMP). The procedure consists of a single-pass column leach over a 24-hour period using a mine rock sample to extraction fluid (effluent) ration of 1:1. The extraction fluid will have a pH representative of precipitation in this geographic region.

The annual sample submitted for MWMP testing will consist of a composite of representative samples collected over four quarters. A detailed explanation of sample collection analysis is located in Appendix D: Section 2.3.4.

3.5 Waste Rock Dump Water Quality Monitoring

The Spruce Creek Dump, Shop Dump, Louis Creek Dump, East Pit Dump, and North Dump will each have 2-lysimeters installed to determine potential impacts from soluble constituents as a result of precipitation percolating through the waste rock. During operations waste rock dump lysimeters will be sampled on a quarterly basis when solution is present. The sample analysis will use Profile II (Table 4-2).

3.6 Water Quality Monitoring and Sampling Schedule

**Table 3-1
Monitoring Sites, Sampling Parameters, and Frequency**

LOCATION	PARAMETERS	FREQUENCY
<u>Baseline Surface Water</u> Upper Dome and Little Eldorado creeks	Profile I* (Initial Samples – Profile III)	Semi-Annual
<u>Non-Compliance Monitoring Ground Water Wells</u>	Static Water Levels	Monthly
<u>Operational Surface Water</u> Spruce Creek, Murray Creek, Lower Dome Creek, Louis Creek, and Whiskey Gulch	Profile I* (Initial Samples – Profile III)	Quarterly
<u>Operational Surface Water</u> Pit and Waste Rock Dumps	Profile I*	Quarterly (When Present)
<u>Operational Groundwater Wells</u> TMWs –1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, & 13	Profile II* (Initial Samples – Profile III)	Quarterly
<u>Waste Rock Dump Lysimeters</u> Spruce Dump, Shop Dump, Louis Dump, East Pit Dump, and North Dump	Profile II*	Quarterly (When Present)

* After two (2) years of monitoring and sampling the analytical profiles for three of the quarters may be reduced to the following with the concurrence of the state project team: pH, conductivity, arsenic, antimony, sulfate, selenium, total dissolved solids, and alkalinity (as CaCO₃) bicarbonate and total. Any results of analysis from the reduced sample parameters inconsistent with previous water quality analyses will require re-sampling and either Profile I or Profile II analysis. Third quarter sample analytical parameters will be Profile I or Profile II. The annual full parameter analysis will provide a database for comparison and enable the water quality trends to be tracked over the life of the operation.

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

A complete analytical list for Profile I, Profile II, and Profile III can be found in Section 4.0.

Table 3-2
Post-Closure Monitoring of Surface and Ground Water

MONITORING YEARS AFTER CLOSURE	PARAMETERS	FREQUENCY
Up to two continuous years of meeting the water quality standards	pH, conductivity, arsenic, antimony, sulfate, selenium, total dissolved solids, and alkalinity (as CaCO ₃) bicarbonate and total / Profile I or Profile II	Quarterly / Yearly
From after meeting the water quality standards for two years, through the following eight years	Profile I or Profile II	Yearly
After ten continuous years of meeting the water quality standards, to year 30 following closure	Profile I or Profile II	Once every five years

Compliance history will be evaluated in determining if the duration of post-closure monitoring will be reduced.

4.0 ANALYTICAL PROFILES FOR LIQUID SAMPLES

**Table 4-1
Analytical Profile I -- Surface Water Inorganic Parameters**

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

*Total & Dissolved

Table 4-2
Analytical Profile II -- Groundwater Inorganic Parameters

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

*Total & Dissolved

Table 4-3
Analytical Profiles III – Organic Parameters

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

5.0 MONITORING, SAMPLE RECORDS, AND REPORTING

5.1 Documentation of Measurements, Sampling, and Inspections

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

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

5.2 Retention of Records

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

5.3 Monitoring Reports and Submission Schedules

Monitoring results will be submitted quarterly to ADNR, ADEC, ADF&G, and COE. All quarterly reports will be submitted on or before the 15th day of the month following the quarter. An annual report through December 31st of each year, including raw data if required, will be presented to the ADNR, ADEC, ADF&G, and COE two weeks prior to the annual meeting.

6.0 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The True North Project Quality Assurance / Quality Control and Field Procedures Manual has been designed to reflect current baseline and compliance monitoring at the True North Project (Appendix D). The analytical QA/QC program for FGMI's contract laboratory, incorporated into the above referenced document, will be updated routinely or whenever a different laboratory is used.

7.0 POTABLE WATER MONITORING PUBLIC WATERSYSTEM

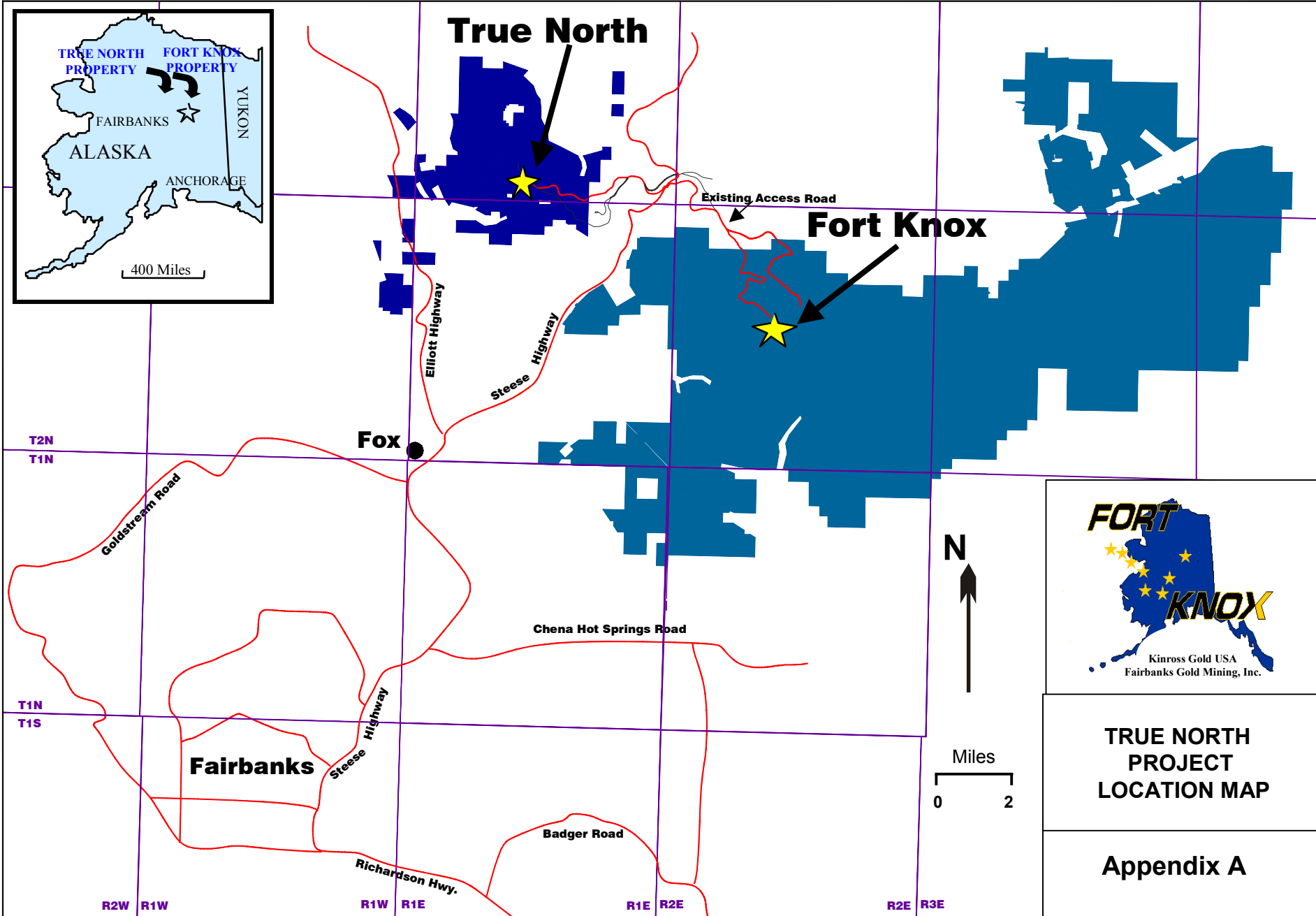
Water will be trucked to the True North Project on a weekly basis. Routine sampling and analysis of water from the system at appropriate points and appropriate times will be in accordance with the intervals set out in Tables B and C of 18 AAC 80.200. Reporting requirements will conform to 18 AAC 80.260.

8.0 IMPACTS TO AVIAN AND TERRESTRIAL WILDLIFE

Wildlife mortalities occurring within the Millsite Lease boundary and along the access/haul road will be reported to the ADF&G. Moose mortalities will be report to Alaska Fish and Wildlife Troopers so charitable organizations can be contacted to salvage useable meat.

APPENDIX A

TRUE NORTH PROJECT SITE LOCATION MAP

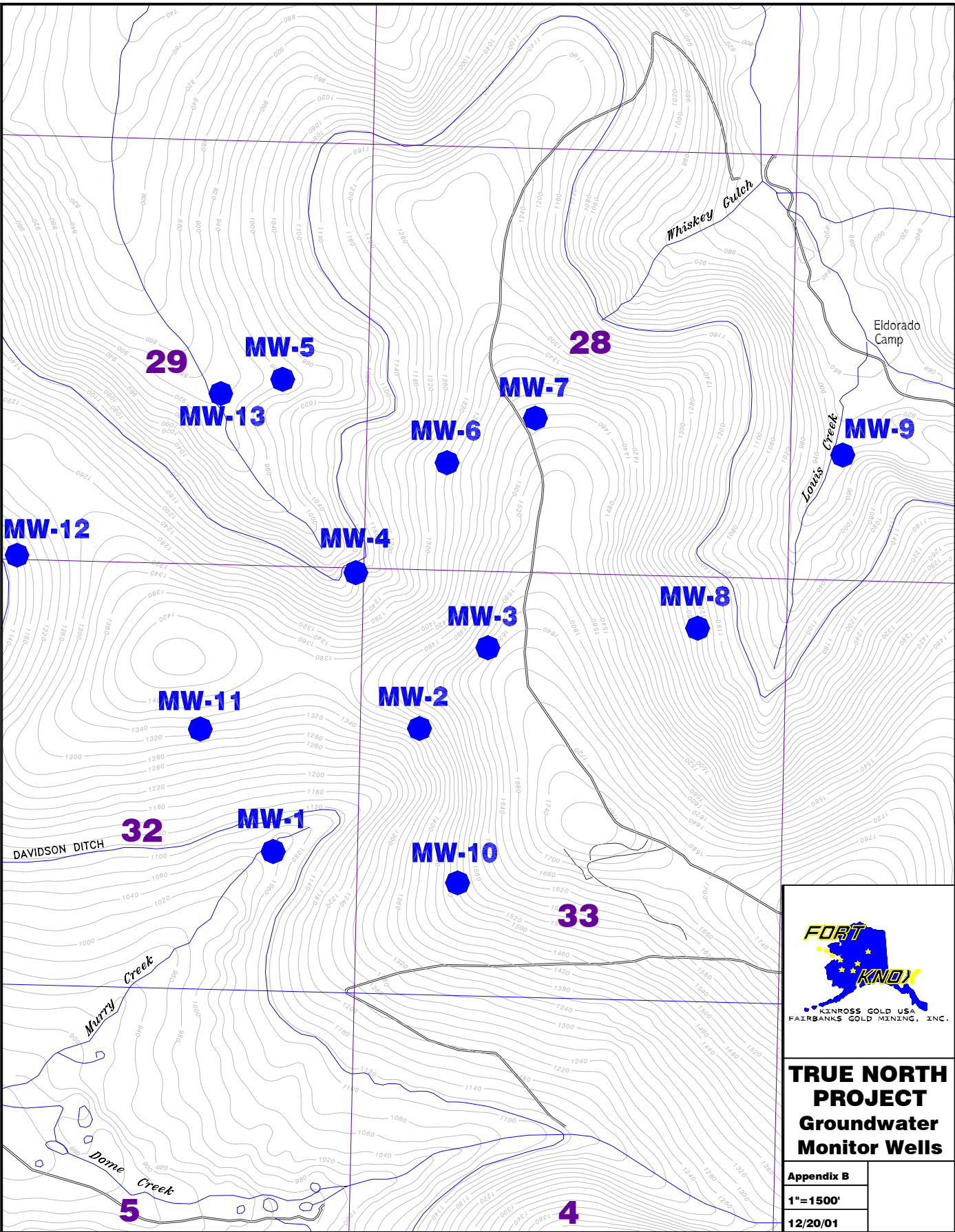


**TRUE NORTH
PROJECT
LOCATION MAP**

Appendix A

APPENDIX B

TRUE NORTH PROJECT
GROUNDWATER WELL LOCATIONS

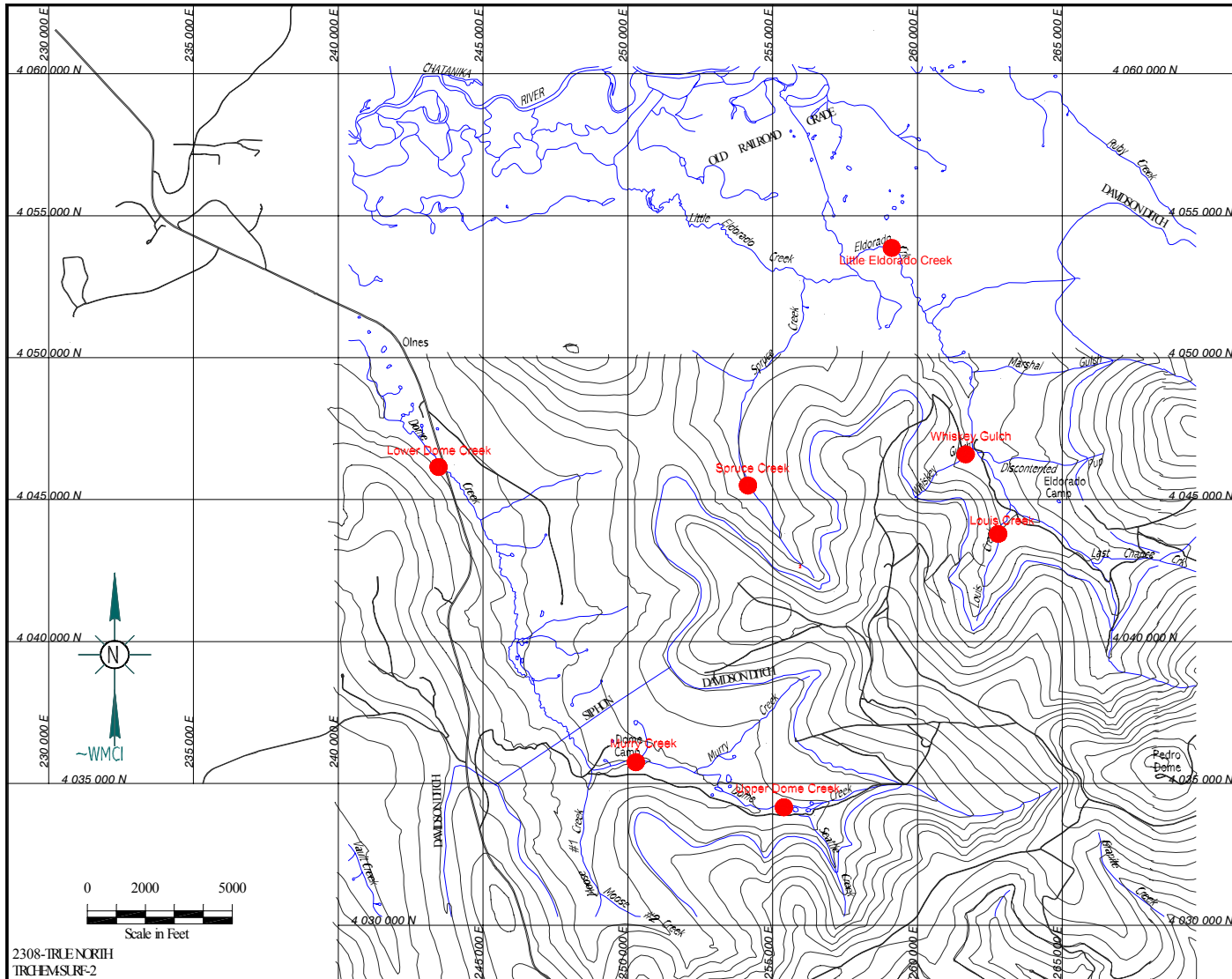


TRUE NORTH PROJECT
Groundwater Monitor Wells

Appendix B	
1"=1500'	
12/20/01	

APPENDIX C

TRUE NORTH PROJECT SURFACE WATER SAMPLING LOCATIONS



2308-TRUE NORTH
TRCHEVSURF-2



Appendix C
TRUE NORTH
PROJECT
Surface Water
Location Map
12/20/01

APPENDIX D

TRUE NORTH PROJECT QA/QC & Field Procedures Manual

**TRUE NORTH PROJECT
QUALITY ASSURANCE/QUALITY
CONTROL
AND
FIELD PROCEDURES MANUAL**

December 2000

**True North Project
Fairbanks, Alaska
Quality Assurance/Quality Control and Field Procedures Manual**

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1.0 INTRODUCTION

1.1 Objectives

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

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

1.2 Quality Assurance/Quality Control Program

The QA/QC program consists of three components:

- **Field QA/QC** identifies the procedures to be used in the field to verify that water samples and field monitoring data are collected according to the requirements of the project. The objective of field QA/QC is to assure that both field measurements and samples collected for laboratory analyses can be demonstrated to be representative of the environment sampled and are of known and acceptable quality.
- **Laboratory QA/QC** identifies the protocols to be used by the laboratories to demonstrate that project data are analyzed according to U.S. Environmental Protection Agency (EPA)-acceptable methodologies, and that reported values are accurate. The objective of the laboratory QA/QC program is to produce data that will meet state and federal analytical requirements.
- **Data QA/QC** identifies the protocols to be used to verify that laboratory and field data have been reported accurately. The objective of the data QA/QC program is to demonstrate that the data reported meet the specified requirements, including comparability with data from previous years.

1.3 Data Uses and Data Quality Objectives

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

Federal and state levels of concern (i.e. ambient water quality criteria or maximum contaminant levels) exist for many of the parameters being analyzed in the water monitoring program. To the extent possible, analytical methods have been specified that will allow detection of chemical constituents at or below levels of concern.

1.4 Data Quality Parameters

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

Precision

Precision is a qualitative measure of the reproducibility of a measurement under a given set of conditions. For duplicate measurements, analytical precision can be expressed as the relative percent difference. A quantitative definition of the relative percent difference is included in Appendix A. The level of effort for precision measurement will be at a minimum frequency of one in 20 (5 percent), or one per batch, whichever is more frequent.

Accuracy

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

Representativeness, Precision and Accuracy

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the soil and water sampled. Sampling plan design, sampling techniques, and sample handling protocols (e.g., storage, preservation, and transportation) have been developed and are discussed in other sections of this document. Proposed documentation will establish that protocols have been followed and sample

Identification and integrity assured. Field blanks (Profile III only) and field duplicates obtained at a minimum frequency of 5 percent or one per Sample event will be used to assess field and transport contamination and method variation. Laboratory sample retrieval, storage, and handling procedures have also been developed and are discussed in other sections of this document. Laboratory method blanks will be run at the minimum frequency of 5 percent or one per set to assess laboratory contamination.

Comparability

Comparability is the level of confidence with which one data set can be compared with another. Comparability of the data will be maintained by using EPA-defined procedures, where available and appropriate. Comparability will also be maintained by the use of consistent units.

Completeness

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

2.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

2.1 Purpose

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

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

Each task sampler is responsible for implementing these components in the field. However, the field QA/QC leader will oversee each aspect of field operations to verify that these components are accomplished within the strict requirements of the project.

2.2 Quality Control Samples

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

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

2.3 Sample Collection, Labeling, and Handling Procedures

Sample collection, labeling, and handling procedures are periodically checked by the QA/QC leader (Environmental Engineer) to verify that the following conditions are being met:

- Collection -- Samples are collected according to approved sampling methods.
- Labeling -- Samples are uniquely labeled using a code that prohibits unauthorized personnel from knowing the sampling locations.
- Packaging -- Samples are correctly packaged to prevent leakage or cross-contamination; Sample containers with proper preservatives are used; Amber sample bottles for UV protection are used when necessary.
- Chain-of-custody forms -- Chain-of-custody forms are properly completed to assure sample custody can be adequately documented.
- Shipping -- Samples are hand delivered to the laboratory or proper shipping procedures are used, including maintenance of proper temperatures and specified holding times.

Each task leader is responsible for implementing the proper sample collection, labeling, and handling procedures. The field QA/QC leader will oversee these activities.

2.3.1 Surface Water Grab Sampling

Surface water samples are collected in the following order:

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

Below, the surface water grab sampling procedure and sampling sites are listed.

1. Decontaminate compositing container (plastic bucket) and one-liter pitcher. See section 2.3.12 for decontamination procedures.
2. Locate sampling site at a point in the stream exhibiting greatest flow and/or highest velocity, if possible.
3. Surface water sample sites at the True North Project require filling the plastic-bucket by direct submergence.
When submersion is required: submerge plastic-bucket at sampling point such that mouth of container is under water surface at least 2 to 3 inches, if possible. Allow container to fill partially, rinse container by shaking, and then discharge this water. Repeat this procedure three times. Collect sample, and then transfer water from plastic-bucket into the sample bottles with one-liter pitcher.
Dissolved metal bottles are field filtered with a 0.45 μm filter. See Appendix A (Section 2.1.1) for complete surface water field filtering procedure.
Note that when sampling TPH (amber glass bottle), the sample bottle must be submerged in the plastic bucket so that its mouth is half out of the water when filling. Alternatively the sample bottle may be filled by submersion directly into the sample water, provided the mouth of the sample bottle isn't fully submersed.
4. Fill out appropriate field data form(s) see documenting sample location, time, and other pertinent information before leaving sample site.

2.3.2 Surface Water Grab Sampling Through Ice

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

1. Clear snow off ice, an area large enough area for sampling equipment.
2. Drill sample hole in ice with auger periodically cleaning hole of ice chips.
3. After breaking through ice, cut a square area with an ax around the ice hole large enough (3-4" deep) to dip sample collection container in.
4. Purge three hole volumes from the ice hole prior to sampling, trying to remove all ice chips within the hole. This volume can be approximated from the hole-dimensions in the ice.
5. Follow surface water grab sample procedure steps 3 –4 Surface Water Grab Sample Procedure.

2.3.3 Groundwater Sampling

Groundwater sampling procedures are listed below.

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

1. Measure and record the static water level in the well then determine the well casing volume to be purged:
(0.37 gal/ft for 2" well) =
(0.65 gal/ft for 4" well) =
(1.04 gal/ft for 5" well) =
(1.47 gal/ft for 6" well) =
2. If not sampling at a well with a dedicated pump then on the portable pump adjust the reel support pins (on bar below roller) so that the roller is centered over the well opening. Lift and hang the REEL E-Z on the well casing by resting the support pins against the inside of the well casing.
3. Unlock the reel by pulling the pin lock mechanism outward and turning.
4. Using the operating handle gently reel down the pump to the necessary level and lock the reel in place. The cable is marked every five feet.
5. DO NOT power the converter until the extension cord is connected. Connect the extension cord to the electrical box. Connect the other end of the extension cable to the Grundfos MPI converter.
6. Connect the discharge hose to the discharge port.
7. Power up the MPI converter (220/240 V - 5KW generator), turn the frequency control knob to approximately mid-range (12 o'clock position) and start the pump by moving the start/stop switch to the "start" position. Adjust the speed dial to the desired frequency or flow rate.
8. Purge at least three well casing volumes prior to sampling, taking field parameters (pH, conductivity, and temperature) at each casing volume. After finishing purging and if field parameters were stable, fill sample bottles directly from sample discharge hose. If field parameters were unstable during well purging, continue purging well until stable field parameters are achieved. Fill out appropriate field data form(s) documenting sample location, time, and other pertinent information before leaving sample site.
9. When finished pumping, move the start/stop switch to the "stop" position. Turn off the generator. Disconnect the extension cord.

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

2.3.4 Solids Sampling Procedure

Quarterly Development Rock Acid/Base Accounting

As part of the mining operation, blast hole drills bore 63/4-inch diameter holes to a depth of 23 feet into schist and granite bedrock within the open pit prior to blasting and loading operations. The holes are drilled on 17-foot centers using air rotary drilling methods. Generally 50-200 drill holes are drilled. The holes are loaded with explosives and detonated in one shot or blast pattern.

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

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

Annual Meteoric Water Mobility

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

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

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

2.3.5 Sample Labeling

Labeling. Each sample container will have a waterproof label large enough to contain the information needed to easily identify each sample. The information to be included on each label includes the project name, date, time, preservative (if added), and sampling code. The sample code will be formatted to indicate sample number and date. In the field record book, the sampler identifies each sampling location. Each sample will be identified with a 12-digit number, which includes the date, and identification number of the sample. An example of sample identification is as follows:

990506038101

Where:

990506 = Date (May 6, 1999)

038 = Employee’s identification number

101 = Sequential sample number recorded in logbook for that date

All blanks and duplicates will be noted in the field notebook. The following designation will be noted where natural samples are identified as 100 series, blanks as 200 series, and duplicates as 300 series.

2.3.6 Packaging

Each analytical sample bottle will be packed to prevent breakage and placed in an iced cooler to keep the samples cooled to 4°C. For hand delivered and shipped samples one copy of the chain-of-custody form will be placed in a sealed plastic bag. Additionally, for shipped samples, the cooler lid will be sealed with fiber tape and at least one chain-of-custody seal will be attached to the outside of the cooler so that this seal(s) must be broken if the cooler is opened. Before sealing coolers, the field QA/QC leader (Senior Environmental Engineer) will inspect sample packaging.

2.3.7 Chain-of-Custody

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

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

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

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

2.3.8 Shipping

FGMI personnel or courier will deliver samples to the designated laboratory as soon as feasible after collection. If a courier is used, a signed receipt from the courier acknowledging receipt of the samples will be attached to the FGMI's copy of the chain-of-custody form.

2.3.9 Field Documentation

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

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

2.3.10 Corrections to Documentation

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

2.3.11 Field Equipment Calibration

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

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

2.3.12 Decontamination Procedures

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

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

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

2.3.13 Field Corrective Action

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

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

The field team leader is responsible for ordering appropriate field corrective actions when deemed necessary. All field corrective actions will be recorded in the field book.

3.0 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

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

4.0 DATA QUALITY ASSURANCE/QUALITY/QUALITY CONTROL PROGRAM

The data QA/QC program serves four major functions:

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

During field operations, the field QA leader will receive copies of all field data and will file these in a project notebook. These duplicates will serve as a backup file and will be checked against the field data entered into the database management system.

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

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

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

- Analytical methodology
- Detection limits
- Cross-contamination as indicated by blank data
- Accuracy and precision
- Adherence to holding times

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

APPENDIX A

TRUE NORTH PROJECT QUALITY ASSURANCE/QUALITY CONTROL AND FIELD PROCEDURES MANUAL

Instrument Calibration, Operation, and Maintenance Procedures

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

1.1.1 Electrical Conductance

Instrument Calibration

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

1. Rinse probe with deionized water.
2. Measure conductivity of two potassium chloride (KCl) solution standards, which bracket expected sample values.
3. Measure temperature of both KCl solution standards.
4. Calculate cell constant for each standard to determine if instrument linearity is reasonable. The cell constant is the ratio of the computed conductivity to the measured conductivity of the standard KCl solution.

Maintenance

1. Store meter in its case during transport.
2. Check batteries before taking meter into the field. Carry spare batteries in the field (9 volt).
3. Inspect conductivity probe for cracks or other damage.

Field Measurement Procedures

1. Turn instrument on.
2. Rinse plastic beaker with approximately 50 milliliters of sample water three times.
3. Place water sample in plastic beaker (fill to at least 50 millimeters).
4. Rinse probe with deionized or sample water and place in sample water.
5. Immerse conductivity probe in sample so that vent hole is submerged. Move probe around in sample to displace any air bubbles. Turn instrument on to appropriate scale to measure conductivity. Record conductivity reading after a stable reading is obtained.
6. Remove probe from sample and turn off instrument.

1.1.2 Field pH

Instrument Calibration

1. Calibrate pH meter at the beginning of each day of fieldwork when pH will be measured, and whenever the standard check is out of acceptable bounds.
2. Rinse pH electrode probe with deionized water.
3. Immerse electrode and temperature probe in beaker of fresh commercial calibration solution of pH 4.0. Calibrate meter to solution.
4. Remove electrode and temperature probe from solution, and then rinse with deionized water.
5. Immerse electrode and temperature probe in fresh pH 10.0 solution. Calibrate meter to solution.
6. Remove electrode and temperature probe from solution, and rinse with deionized water.
7. Measure pH of a third fresh calibration solution at pH 7.0. If measured value differs from expected value by more than 0.1 units, obtain fresh calibration solutions and recalibrate. If discrepancy persists, begin trouble-shooting procedures following meter operating instructions: check batteries, connections, probe, etc.

Maintenance

1. Store meter in its case with electrode immersed in a pH 7 buffer solution.
2. Inspect electrode prior to use.
3. Filler hole plug should be firmly seated when meter is stored for a week or more.
4. Check glass electrode for cracks or scratches.
5. Check batteries each time meter is used. Carry a spare battery pack into the field in the pH meter case.

Field Measurement Procedures

1. Rinse decontaminated glass beaker or sample bottle with approximately 50 milliliters of sample water three times.
2. Rinse pH electrode with deionized water.
3. Rinse pH electrode with deionized water.
4. If measurement is read ex situ, fill beaker with sample water.
5. Immerse electrode and temperature probe in sample while swirling the sample to provide thorough mixing. Turn on meter. Read pH to nearest 0.1 until the reading has stabilized (when beaker icon stops flashing).
6. Record sample pH. Note any problems such as erratic readings.
7. Rinse probe with deionized water and store according to manufacturer's directions.

1.1.3 Water Temperature

1. Linearity and Field Measurement Procedures
2. Use either a National Institute of Standards and Technology (NIST)-calibrated thermometer or a digital temperature probe calibrated against a NIST-calibrated thermometer to measure temperature.
3. Check thermometers for cracks or gaps in the mercury. Do not use thermometers if either cracks or gaps are visible.
4. When possible, measure temperature of surface water at midstream by submersing the thermometer or electronic temperature probe for approximately 1 minute or until temperature stabilizes.
5. When in situ temperature measurements are not possible, draw sample of at least 200 ml into a decontaminated beaker or sample bottle as soon after sampling as possible.
6. Place thermometer or electronic temperature probe in sample and allow temperature to stabilize.
7. Record temperature to nearest 0.5°C in field logbook or on field data sheet.
8. Rinse thermometer or electronic temperature probe with deionized water.
9. Check field thermometers or digital temperature probes against a NIST-certified laboratory thermometer, on a quarterly basis. Agreement should be within 0.5°C.

1.1.4 Dissolved Oxygen

Instrument Calibration

Calibrate probe and dissolved oxygen meter in accordance with manufacturers instrument operating procedures, as follows:

1. Switch instrument to OFF and adjust meter to mechanical zero.
2. Switch to red line and adjust.
3. Prepare probe for operation (keep in moist paper towel **taking care that paper towel doesn't touch membrane**), plug into instrument, turn ON and **wait 15 minutes for probe to stabilize** (temperature).
4. Switch to ZERO and adjust.
5. Adjust salinity knob to FRESH.
6. Switch to TEMP and read.
7. Use probe and true local atmospheric pressure (feet above MSL) to determine correct calibration values from Table I and II (see instrument back panel) for example calculation.
8. Switch to desired dissolved oxygen range 0-5, 0-10, 0-20 and with calibrate control adjust meter to correct calibration value determined in step 7.
9. **It is important that the instrument not be turned off between measurements, as it will then need to be recalibrated if turned off.**

Maintenance

The probe membrane must be replaced prior to sampling. There should be no cracks, tears, or wrinkles in the membrane as well as no air bubbles in the KCL solution filled probe tip. Also any extra membrane should be cut to avoid covering the stainless steel temperature sensor. Store the probe in a saturated piece of cloth or paper towel.

Field Measurement Procedures

1. When possible, place probe directly into the stream or water to be measured. If this is not possible, place probe into Teflon sample container filled with sample. Manually raise and lower probe through sample about 1 foot per second. Allow sufficient time for probe to stabilize to sample temperature and dissolved oxygen concentration.
2. Read dissolved oxygen value. Record appropriate data on field forms.

2.1.1 Dissolved Metal Field Filtration Method

Surface Water:

1. Use a disposable, high capacity, pre-cleaned, vacuum-type, .45-micron filter for each sample.
2. Visually inspect funnel, filter, and plastic hose for damage. Replace parts or repair equipment as necessary.
3. Attach a section of plastic hose on both the inlet and outlet of the filter. Insert funnel into end of plastic hose (pre-filter end). Fill funnel and let approximately 3 volumes of sample water pass through hose and filter.
4. If sample water is extremely turbid use the same procedure but pre-filter the water (usually with a 3-micron filter) and then use the .45-micron filter.
5. Fill sample container to appropriate level with filtered sample.
6. Repeat step 6 until all sample bottles are filled.
7. If sample water is extremely turbid use the same procedure but pre-filter the water (usually with a 3-micron filter) and then use the .45-micron filter.

Decontaminate all non-disposable equipment following use.

Groundwater:

1. Place disposable, high capacity, pre-cleaned, vacuum-type, .45-micron filter in two-way hose fitting/reducer fitting after restricting flow to one outlet.
2. After inserting filter firmly into the two-way hose fitting adjust valves so as to divert flow through the filter.
3. Let at least three filter volumes run through the filter before filling sample bottles.

APPENDIX E

Static Net Acid Generation (NAG) Procedure

STATIC NET ACID GENERATION (NAG) PROCEDURE

Sample Preparation

Drill core and bulk rock samples should be crushed to nominal 4 mm and a sub sample pulverized to approximately 200 Mesh (<75 µm). Tailing and process residue samples can be tested 'as received'.

Reagents

Reagent 1: H₂O₂ - BDH 'Analar' Analytical Reagent 30% w/v (100 V), or equivalent, diluted 1:1 with deionized H₂O to 15%. (Refer to Note 1).

Reagent 2: NaOH -0.50 M Standardized Solution.

Reagent 3: NaOH - 0.10 M Standardized Solution.

Method

1. Add 250 ml of Reagent 1(15 % H₂O₂) to 2.5 g of pulverized sample in a 500 ml wide mouth conical flask, or equivalent. Cover with a watch glass, and place in a fume-hood or well ventilated area (refer to note 2). The H₂O₂ should be at room temperature before commencing test.
2. Allow sample to react until 'boiling' or effervescing ceases. Heat sample on hot plate and gently boil until effervescence stops or for a minimum of 2 hours. Do not allow sample to boil dry - add deionized water if necessary.
3. Allow solution to cool to room temperature then record final pH (NAG pH).
4. Rinse the sample that has adhered to the sides of the flask down into the solution with deionized water. Add deionized water to give a final volume of 250 ml.
5. Titrate solution to pH 4.5 while stirring with the appropriate NaOH concentration based on final NAG solution pH as follows:

Table 3: NaOH Concentration Required for Titration, Static Net Acid Generation (NAG) Procedure (from [Miller, S., Robertson, A. and Donahue, T., 1997](#))

NAG SOLUTION pH	REAGENT	NaOH CONCENTRATION
>2	3	0.10 M
<2	2	0.50 M

4. Calculation

Net Acid Generation

$$\text{NAG} = 49 \times V \times M/W$$

where:

NAG = net acid generation (kg H₂SO₄/tonne)

V = volume of base NaOH titrated (ml)

M = molarity of base NaOH (moles/l)

W = weight of sample reacted (g)

NOTE: If NAG value exceeds 25 kg H₂SO₄ per tonne, repeat using a 1.00 g samples.

Notes and Precautions

1. The pH of the H₂O₂ used in the NAG test should be checked to ensure it is between pH 4 and 7. If the pH is less than 4 then add dilute NaOH (use a solution made up by adding 1 g NaOH to 100 ml deionized H₂O) until the pH is greater than 4 (aim for a pH between 4 and 6). The pH is adjusted to greater than pH 4 to ensure that the phosphoric acid, used to stabilize H₂O₂ in some brands, is neutralized. The pH of the 15 % H₂O₂ should always be checked to ensure that any stabilizing acid is neutralized, otherwise, false positive results may be obtained.
2. The NAG reaction can be vigorous and sample solutions can 'boil' at temperatures of up to 120 °C. Great care must be taken to place samples in a well ventilated area or fume cupboard.
3. Caution should be taken in the interpretation of NAG test results for coal reject samples and other materials which may contain a high content of organic material (such as potential acid sulphate soils, dredge sediments and other lake or marine sediments). All organic material must be completely oxidized otherwise acid NAG results can occur which are unrelated to sulphides. Several aliquots of H₂O₂ reagent may be added to the sample to breakdown any organic acidity.
4. Samples with positive NAPP value, high sulphur content and high ANC must be carefully evaluated.

Reference

Miller, S., Robertson, A. and Donahue, T. (1997), *Advances in Acid Drainage Prediction using the Net Acid Generation (NAG) Test*, Proc. 4th International Conference on Acid Rock Drainage, Vancouver, BC, 0533-549.

see also: Lawrence, R.W., Jaffe, S. and Broughton, L.M. (1988), *In-House Development of the Net Acid Production Test Method*, Coastech Research.