NIXON FORK MINE
MONITORING PLAN

Prepared for:
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1.0 INTRODUCTION

1.1 GENERAL

Mystery Creek Resources, Inc. (MCRI), current lessee and operator of the Nixon Fork Mine, has been restoring the existing mining and milling facilities to full operations. MCRI is a wholly owned subsidiary of Fire River Gold, a publicly listed mine company headquartered in Vancouver, British Columbia, Canada. All mining activities will occur on existing unpatented federal mining claims administered by the Bureau of Land Management (BLM). Work to date has been accomplished under a Plan of Operations and Reclamation Plan approved by the BLM, and various permits issued by the Alaska Department of Natural Resources (ADNR), and the Alaska Department of Environmental Conservation (ADEC). MCRI commenced operation of the gravity and flotation mill circuits in July 2011. Operational mill feed is from new ore mined from stopes within the Crystal Portal and an existing 2000 tonne ore stockpile on surface that was left by the last operator. MCRI intends to commission the CIL circuit upon receipt of authorizations, tentatively anticipated in December 2011.

MCRI anticipates performing the following activities at the Nixon Fork Mine in 2011:

- Mine and Stockpile Ore in mine and on surface stockpile (completed April – June 2011)
- Commence processing of new ore (commenced July 2011).
- Completion of CIL circuit (November 2011).
- Commence cyanidation of fresh tailings (November 2011);
- Reprocess existing tailings to recover residual gold (June 2012).

The goal of MCRI for 2011 is to maintain the Nixon Fork Mine in a manner that will assure the protection of air, surface, and groundwater quality, restart mining and milling activities, and commission the cyandiation processing of ore and reclaimed tailings. MCRI will perform the following actions to insure compliance with existing permits:

- The procedures, methods, and schedules to be implemented for the treatment, disposal, and or storage of process water.
- The control of surface and groundwater drainage from the facility and the surrounding area;
- The control of erosion form the Tailings Storage Facility (TSF), Filtered Tailings Disposal Storage (FTDS), and surface landfill;
- Continuation of control activities associated with the tailings disposal facilities including but not limited to dust control, maintenance of the drainage diversion structures, maintenance of all leakage control structures and processes, and maintenance of the TSF including appropriate freeboard as specified by applicable permits;
- Continue monitoring and reporting activities of all active portions of the site including the FTDS, TSF, and surface landfill as specified in the permit; and
- Complete reclamation and corrective action requirements as appropriate.

This Monitoring Plan will assist MCRI with the establishment of operating procedures to ensure the long-term protection of these natural resources. Periodic updates of the Monitoring Plan will coincide with regulatory changes, five year reviews, process modifications, or anomalies noted as a result of the monitoring activities prescribed in this plan. This Monitoring Plan is a comprehensive facility wide plan that includes a description of the environmental monitoring that will be performed at the Nixon Fork Mine. This plan does not cover internal mill process monitoring of fluids not released outside the mill or resource assay work. To minimize duplication of information, the Monitoring Plan works with the Plan of Operations (POO) document, and although an effort was made to present applicable background information, the reviewer may need to reference the POO for operation specifics to understand the rationale for the monitoring contained herein.

MCRI is submitting this Monitoring Plan for the Nixon Fork Mine to the ADEC in accordance with AS 46.03.010 et seq., 18 AAC60.015 et seq. and 18 AAC80.005 et seq. ADEC has stated that they intend to forward this Monitoring Plan to other applicable regulatory agencies.

1.2 ADMINISTRATIVE INFORMATION

This section contains specific legal and corporate information about the applicant.

Corporate Information
Business Name: Mystery Creek Resources, Inc.
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Contact: Richard Goodwin, President and COO
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1.3 LOCATION AND SITE DESCRIPTION

The Nixon Fork Mine is located within the McGrath Mining District approximately 32 miles northeast of McGrath and 8 miles north of Medfra in west central Alaska (Figure 1, Appendix B). The mine site consists of federal and state mining claims that lie on either side of the line between Township 26 South, Ranges 21 and 22 East, Kateel River Meridian (KRM). The mine site is located in a northeast to southwest trending highland that reaches an elevation of approximately 1500 feet (ft) (500 meters [m]) (Figure 2, Appendix B).

The existing Nixon Fork Mine area road network, airstrips, exploration areas, and other improvements that have been made since the early 1900s are shown on Figure 3, Site Plan. The mine is underground where the ore is accessed by the Crystal and Mystery Portals and milled at the surface. The mill tailings during the previous years of operations were disposed off in the zero discharge tailings impoundment shown on Figure 3. MCRI intends to reprocess these existing tailings and new ore at a refurbished mill that will utilize a combination gravity, flotation, cyanide leach and gold recovery. The milling operation will generate two types of tailings based on the source of the ore and consistency of the tailings as described below:

> 1. Filtered Reprocessed Tailings: Existing tailings will be cyanide leached generating “reprocessed tailings” that are filtered to a low moisture content and placed (dry stacked) in a Filtered Tailings Disposal Site (FTDS) located near the north end of the airport runway.
>
> 2. Filtered New Ore Tailings: New ore will be mined producing fresh tailings that will also be cyanide leached and deposited in the FTDS.

In addition, it is possible that at times both the filtered reprocessed tailings and filtered new ore tailings may be generated concurrently. MCRI intends to commence mining operations in 2011.

1.4 OBJECTIVES

The general types of monitoring described in this plan are: surface water quality monitoring and compliance monitoring. The objective of the water quality monitoring is to collect data that documents the current conditions related to potential historic mining impacts since mining has been active in the project area since the 1920’s (i.e. Stamp Mill tailings at head of Ruby Creek). The water quality monitoring will include collecting water samples at Mystery Creek, Ruby Creek, and the Nixon Fork River. The objective for compliance monitoring also referred to as “Operation and Closure Monitoring" is to ensure that MCRI operates and closes the Nixon Fork Mine within permit limitations, minimizing impacts to the environment. As discussed below, surface water and shallow groundwater, where collection is possible, will be monitored to characterize the environmental performance of the facilities. Additional water quality or operational monitoring of deep groundwater in the bedrock is not proposed at this time.

2.0 SURFACE WATER QUALITY MONITORING

This section of the Monitoring Plan for surface water quality monitoring will provide information on the following:

- Monitoring locations and rationale;
- Sampling procedures;
- Parameters and analytical methods; and
- Quality Assurance / Quality Control (QA/QC) Program.

2.1 MONITORING LOCATIONS AND RATIONALE

The surface water quality sampling program covers the surface waters nearest to the mine operations, which include: Ruby and Mystery Creek, and the Nixon Fork of the Takotna River. In the upper reaches of Ruby and Mystery Creek the flow is ephemeral and locally comprised of isolated ponded water without connected surface flow. The monitoring locations for the surface water sampling are presented on Figure 4 (Appendix B) and discussed in more detail below.

2.1.1 Ruby Creek

The down gradient surface water quality sample location (RC-1) for Ruby Creek was the most upstream location with detectable stream flow during the June 2004 sampling event (Figure 4). This sampling location monitors water quality below the proposed mining activities and historic mining impacts as discussed below. In order to collect a sample that represented the flow through the Ruby Creek basin and not ponded water in local low spots, visible flow was a criterion in choosing an appropriate sampling location. Further, depending on flow conditions at later times of the year, especially further into July, this location may not contain flowing water. Therefore, future samples may be collected farther downstream at the first location of flowing water as needed.

A second Ruby Creek water sampling location has been established for surface water quality sampling. It is located farther up the Ruby Creek drainage as shown on Figure 4, just below the spring near the historic stamp mill (RC-2). Sample location RC-2, while up gradient of the current mining activities, is within an area of historic mining impacts. Due to the historic mining activity and deposition of tailings in Crystal Gulch, there is no continuous stream flow above human influence in this drainage. Even the springs that flow periodically at the head of the drainage contact tailings from pre-1990 mining operations. Any water samples collected at the spring during rain or spring runoff will represent the chemical signature of melting snow/permafrost or local perched groundwater flow and would not be representative of the Ruby Creek drainage basin farther downstream as measured at RC-1.

2.1.2 Mystery Creek

There are two proposed sampling locations on Mystery Creek: one (MC-1) approximately 250 meters downstream, and one (MC-2) approximately 200 meters upstream of the mine drinking water in-take structure location shown on Figure 4. Samples collected previously (June 2004) were from an area just downstream of the drinking water in-take structure. The intent of collecting the sample downstream of the in-take structure is to assess the quality of water in the limestone geologic terrain below the mineralized limestone/monzonite contact, which crosses Mystery Creek near the water intake structure. MC-1 monitors water quality below the existing development rock dump and road fill below the Mystery Creek Portal. During the open water season field water quality parameters will be measured approximately 150 feet downstream of MC-1 for comparison to results at MC-1. The second sample location is planned upstream of the existing mine facilities, water in-take and geologic contact zone. MC-2 will provide up gradient surface water quality data.

2.1.3 Nixon Fork

The Nixon Fork of the Takotna River located approximately 4.5 miles downstream receives flow from both Ruby and Mystery Creek. In order to assess the surface water quality of the first significant receiving water body, samples will be collected from the Nixon Fork of the Takotna River upstream (NF-1) and downstream (NF-2) of the confluence with Ruby Creek. The approximate sampling locations are shown on Figure 2.

2.1.4 Intermittent Spring at Encino Gulch

An intermittent spring in Encino Gulch located below the FTDS will be sampled if flowing water is present at the time other surface water quality samples are collected.

2.2 SAMPLING PROCEDURES

2.2.1 Sample Collection and Preservation

All samples will be collected in bottles provided by the analytical laboratory with appropriate preservatives in the bottles. Field parameters (pH/temperature/conductivity) will be measured in the field when weather conditions allow and in the mine laboratory during inclement weather. Sampling procedures to preserve the integrity of the water quality samples will include:

- Collection of representative and undisturbed water from flowing portions of the stream;
- Using new disposable sample collection equipment for each sample (i.e. gloves, tubing, and 0.45 micron filter for the peristaltic pump); and
- Collection and documentation of field parameters at each location (except as noted above).

After collection, the samples will be returned directly to the mine and placed in a refrigerator or preserved with ice. If filtration is required, this will be performed at the mine before refrigeration or preservation. The samples will then remain in a refrigerator or on ice until they are shipped, in ice packed coolers, to the laboratory for analysis.

2.2.2 Frequency

The Ruby Creek, Mystery Creek, and Encino Springs samples will be collected four times a year (one winter sample and three evenly spaced samples occurring between May and October). The Nixon Fork sample location requires the use of a helicopter or snowmobile, when conditions allow safe access to the area. Therefore, Nixon Fork water quality sampling will be limited or incidental to when a helicopter is at the mine on other business for MCRI. Access by snowmobile will also be considered when snow conditions allow access without damaging vegetation. The goal for the Nixon Fork samples will be once per year coincidental with the availability of a helicopter or conditions that allow the use of a snowmobile at the site.

2.2.3 Shipping and Chains of Custody

Standard methods will be followed for shipping the collected samples including preservation in coolers with ice, completing a chain of custody, and attaching seals to each cooler to detect any potential tampering. Samples will be flown out of the mine in order to meet the shortest holding times for analyses.

2.3 PARAMETERS AND ANALYTICAL METHODS

Tables 2-1 and 2-2 list the parameters and analytical methods that will be utilized for the surface water samples collected at the Nixon Fork Mine. Trace metals will be analyzed for both total recoverable and dissolved values. Due to the short holding time (48 hours) for analysis of speciated NO3 and NO2 (nitrate and nitrite, respectively) and shipping limitations from the Nixon Fork Mine, MCRI proposes to analyze for total NO3/NO2 as Nitrogen (N) after preliminary characterization of these species. Any surface water sample that has a positive result for cyanide will be reported to ADEC as soon as possible, but by no later than the end of the next working day. Resampling for sample confirmation will occur as soon as is practicable.

2.4 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The Nixon Fork Mine QA/QC Program for the compliance monitoring is presented in Appendix A. Samples will be submitted to a laboratory certified to conduct analysis in the State of Alaska. The MCRI contract laboratory QA/QC program, incorporated into the Nixon Fork Mine QA/QC Program, will be reviewed whenever there is a change in laboratories used for the monitoring program.

TABLE 2-1: MAJOR IONS – SURFACE WATER QUALITY SAMPLES

Parameter	Method	Units	Method Detection Limit (MDL)	Practical Quantitation Limit (PQL)	Potential Regulatory Criteria[1]
Major Ion Chemistry					
pH (field and lab)	EPA 4500H EPA 4500B	Standard	n/a	n/a	6.5 to 8.5
Temperature (field)	Elect. probe	Degrees C	n/a	n/a	
Conductivity (field and lab)	SM2510B	umhos/cm	0.477	1	
Settleable Solids (field)	Cone	mL/L/hr	n/a	n/a	
Total Dissolved Solids	EPA 2540C	mg/L	3.1	10.0	500 mg/L
Total Suspended Solids	EPA 2540D	mg/L	0.15	0.5	
Turbidity (lab)	EPA 2130B	NTU	0.05	0.1	5 NTU above background
Alkalinity, Total	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	Min. of 20
Alkalinity, Bicarbonate	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	
Alkalinity, Carbonate	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	
Alkalinity, Hydroxide	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	
Calcium$^{T\&D}$	EPA 200.8	mg/L	0.062	0.2	
Iron$^{T\&D}$	EPA 200.8	mg/L	0.0124	0.04	1
Magnesium$^{T\&D}$	EPA 200.8	mg/L	0.062	0.2	
Potassium$^{T\&D}$	EPA 200.8	mg/L	150	500	
Silicon$^{T\&D}$	EPA 200.8	mg/L	62	200	
Sodium$^{T\&D}$	EPA 200.8	mg/L	150	500	

Note: (T&D) = Analyzed for total recoverable and dissolved
(1) Potential Criteria based on the 15th percentile of the Ruby Creek hardness data to date (37.64).
umhos/cm is micromhos per centimeter
mL/L/hr is milliliters per liter per hour
mg/L is milligrams per liter
NTU is Nephelometric Turbidity Units
ug/L is micrograms per liter

TABLE 2-2: MINOR & TRACE IONS - SURFACE WATER QUALITY SAMPLES

Parameter	**Method**	**Units**	**Method Detection Limit (MDL)**	**Practical Quantitation Limit (PQL)**	**Potential Regulatory Criteria[1&2]**
Minor Ion Chemistry					
Phosphorus, Total	SM 4500P-B,E	µg/L	62	200	0.1
Manganese[T&D]	EPA 200.8	mg/L	0.31	1	0.05
Chloride	EPA 300.0	mg/L	0.031	0.1	230 Chloride + Sulfate cannot exceed 250
Fluoride	EPA 300.0	mg/L	0.031	0.1	1
Nitrate (as N)	EPA 300.0	mg/L	0.0031	0.01	10
Sulfate	EPA 300.0	mg/L	0.031	0.1	Chloride + Sulfate cannot exceed 250
Total Nitrite + Nitrate (as N)	EPA 4500 NO3F	mg/L			10
Nitrite (as N)	EPA 300.0	mg/L	0.0031	0.01	1
Cyanide, Total	SM 4500 CN-C,E	mg/L	0.0025	0.005	0.0052
Cyanide (WAD) Dissolved	SM 4500 CN-I	mg/L	0.0025	0.005	
Nitrogen, Ammonia-	SM 4500 NH3-G	mg/L	0.0258	0.0500	pH and Temperature dependent
Trace Ion Chemistry[T&D]					
Aluminum	EPA 200.8	µg/L	6.20	20	87
Antimony	EPA 200.8	µg/L	0.31	1	6
Arsenic	EPA 200.8	µg/L	1.5	5	10
Barium	EPA 200.8	µg/L	0.94	3	2,000
Bismuth	EPA 200.8	µg/L	0.31	1	-
Cadmium	EPA 200.8	µg/L	0.05	0.5	0.13/0.12
Chromium, Total	EPA 200.8	µg/L	0.31	1	100
Copper	EPA 200.8	µg/L	0.31	1	4.05/3.89
Lead	EPA 200.8	µg/L	0.062	0.2	0.92/0.86
Manganese	EPA 200.8	µg/L	0.31	1	50
Nickel	EPA 200.8	µg/L	0.62	2	22.82/22.75
Selenium	EPA 200.8	µg/L	1.5	5	5/4.60
Silver	EPA 200.8	µg/L	0.31	1	07.6/0.64
Zinc	EPA 200.8	µg/L	1.5	5	52.36/51.2
Mercury	EPA 1631A	ng/L	50	1	50

Note: (T&D) = Analyzed for total recoverable and dissolved
(1) Potential Criteria based on the 15th percentile of the Ruby Creek hardness data to date (37.64).
(2) Total recoverable/Dissolved criteria when a conversion factor is established in the 2008 Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances.

3.0 OPERATION AND CLOSURE MONITORING

The operation and closure monitoring plans in this section are intended to meet the requirements of the Multi-Sector General Permit (MSGP-2008), and the solid waste regulations 18 AAC 60.800-860, and include monitoring of materials placed in the FTDS, tailings impoundment, development rock dump, and solid waste landfill. The monitoring and reporting activities will be tracked through MCRI in-house personnel. Laboratory data will be managed using in-house personnel with assistance from a MCRI consultant. Copies of inspection and sampling logs will be filed in the MCRI project files for a minimum of five years.

The mine facilities where operation and closure monitoring activities are performed are summarized in Table 3-1.

3.1 VISUAL MONITORING PROGRAM

The visual monitoring program will include inspections of the mine facilities or operations for signs of instability, erosion, or chemical contamination. The mining facilities will be observed on a regular basis, with MCRI employees encouraged to report conditions that could impact the environment. Facilities operating under the solid waste and/or dam safety permits that will have formally scheduled visual monitoring include: the FTDS, tailings impoundment, development rock dump and solid waste landfill.

3.1.1 Filtered Tailings Disposal Site

Visual monitoring of the FTDS physical characteristics will be conducted on a daily basis by the operational staff and noted in daily logs. Operation personnel will be instructed to look for unusual signs of settlement, seeps, and erosion in the FTDS, as well as any unusual water color or sheens. Annual inspections by the qualified engineer-of-record will be completed and documented in a report. A qualified engineer will conduct formal Facility Safety Inspection (FSI) using a checklist. The operational life of the FTDS is about 5 years, after which the facility will be closed per the closure plan. Visual monitoring will continue per the closure plan requirements.

Details for the visual monitoring of the FTDS are presented in Table 3-2.

TABLE 3-1. OPERATION AND CLOSURE MONITORING SUMMARY

Monitored Operation/Facility	Sampling Point	Comment/Purpose of Sampling	
Filtered Tailings Disposal Site (FTDS or Dry Stack Area)			
Filtered Reprocessed Tailings	Mill	Disposed of in FTDS	These will likely be commingled.
Filtered New Ore Tailings	Mill	Disposed of in FTDS	
FTDS Collection Pond			
Water in Pond (storm water)	Pond	Grab sample per specified storm event or as water collects in pond.	
Perched Groundwater	Modified wells as described in Section 3.5.1	Groundwater within shallow unconsolidated sediments above bedrock. The need for groundwater monitoring will be based on storm water sampling results.	
Tailings Impoundment			
Slurried New Ore Tailings	Mill	Slurried and pumped to tailings impoundment.	
Pond Water	Pond	Water that collects in tailings pond.	
Perched Groundwater/Seeps	Wells/Seeps as described in Section 3.5.3	Seasonally perched groundwater on bedrock so wells typically dry. Seeps will be monitored, if any.	
Development Rock Dump			
Rock	Dump	Bulk samples from dump for acid generating and metal leaching potential.	
Groundwater/Seeps	Seeps (if any)	Groundwater with shallow unconsolidated sediments above bedrock. Wells are typically dry so seeps will also be monitored, if any.	
Storm Water Runoff	Varies/Water	Grab sample down slope of rock dump per specified storm event.	
Surface Water	RC-1; RC-2; MC-1; MC-2; NF-1; NF-2; Encino Gulch	Sampled quarterly as described in Section 2.0.	
Solid Waste Landfill			
Seepage	Unknown	Sampling only if discolored seepage observed.	
Other Monitoring			
Revegetation Monitoring	Various	Closure monitoring as needed (i.e. FTDS, tailings pond, roads, development rock dump, etc.).	
Impacts to Avian and Terrestrial Wildlife	Various	Tailings pond and other areas as needed.	

TABLE 3-2. VISUAL MONITORING OF DISPOSAL AREAS PHYSICAL CONDITION

Item	Personnel	Scope	Frequency	Deliverable
Inspections	Operational Personnel	Visual Assessment	Daily[1] Weekly[2]	Daily log Weekly log
Facility Safety Inspection (FSI)	Qualified Engineer	Detailed visual assessment and review of placement records	Annually	Comparable to dam safety format
Closure Monitoring	Qualified Engineer	Review of design and compliance with closure requirements	Closure and as specified in the closure plan	Report to MCRI and applicable regulatory agency

(1) Daily inspections completed on days when mechanical equipment is operating on the FTDS.
(2) Weekly completed inspections during warm weather or thawed conditions for periods when mechanical equipment is not operating on the FTDS.

3.1.2 Tailings Impoundment

New ore tailings will be placed in the tailings impoundment as a slurry after the impoundment is put back in to service. The reprocessed tailings (solids) will be analyzed for acid generating potential, trace metals, WAD CN, and leaching potential and compared to the previous results to evaluate trends in tailings composition. The solids will be analyzed using the ABA procedure and the trace metals per the methods and frequency presented in Table 3-4. The leaching potential will be evaluated per the MWMP, and the list of parameters presented in Table 3-5, as long as the Net Potential Ratio (NPR) is 3 or greater based on the ABA results. If the NPR ration is less than 3, then kinetic testing (Humidity Cell Testing) will be performed to further evaluate the material. Results will be provided to ADEC and ADNR for evaluation prior to the termination of each kinetic test.

3.1.3 Development Rock Dump

No geotechnical testing or inspection is anticipated for the development rock dump, except the visual monitoring that will be conducted per the schedule in Table 3-2. Signs of instability or erosion will be reported to a qualified engineer for consideration of further testing and solutions for stabilizing the development rock dump.

3.1.4 Solid Waste Landfill

The solid waste landfill visual monitoring will be performed by operation personnel each time waste is placed and covered in the landfill. Operation personnel will be instructed to look for unusual signs of settlement, seeps, or erosion, as well as any unusual water color or sheens. A qualified engineer will conduct the formal reviews on an annual basis. Visual monitoring will continue per the closure plan requirements.

3.1.5 Wildlife

Operations personnel will be required to report any wildlife mortality observed at any of the mine waste and solid waste facilities at the mine. Any wildlife mortalities detected, including any Defense of Life and Property (DLP), will be recorded in a log maintained with the mine manager and reported to the ADNR Office of Habitat Management and Permitting, Fairbanks, Alaska as specified in section 6.2. A log will also be maintained of wildlife sightings in the project area that include bear, moose, caribou and larger furbearers such as wolves. However, operations personnel will not log birds and other smaller wildlife typically observed in the project area.

3.2 GEOTECHNICAL MONITORING

The FTDS is planned to be active beginning the summer of 2011. Geotechnical monitoring of the FTDS, tailings impoundment, development rock dump, and solid waste landfill is required periodically to verify stability and to make sure that each facility is operated within the geotechnical design parameters.

3.2.1 Filtered Tailings Disposal Site

The FTDS pile has been designed using soil strength parameters based on laboratory testing and the site investigation conducted by MCRI. The filtered tailings pile is expected to be stable based on its design parameters and with the design for the tailings to be placed directly on bedrock within a shallow pit for containment. As a result, limited confirmation geotechnical testing, consisting of moisture content, is proposed to compare the FTDS materials with the samples used for design as specified in Table 3-3. A liner will be installed above a drain system beneath the FTDS to collect any seepage or runoff water into a collection pond where the water can be periodically tested. The drain systems' primary function is to detect and sample any water that may percolate through the stack and liner.

TABLE 3-3. FILTERED TAILINGS GEOTECHNICAL MONITORING

Test Description	ASTM Method	Frequency[1]	Test Criteria and Design Basis
Moisture Content	D-2216	Daily for 2 weeks, then weekly, and repeat when there is a feed stock change or if there is an exceedance of 15% moisture content.	Less than 15% and field capacity

(1) All samples will be grab samples collected at mill from the pile at the end of the filter belt.

Tailings placed in the FTDS will consist of less than 15% moisture content. Formal placement and compaction criteria are not established or required for structural integrity, but some general guidelines for placing the filtered tailings in the facility are important to maximize the reduction of permeability of the tailings. In addition to the sampling program listed in Table 3-3, the compaction program will include placing and spreading the tailings in lifts of 1 foot or less and compacting the tailings lift with the available heavy equipment, either the end loader or bull dozer, until compaction is achieved. The compaction at the FTDS will be visually assessed by MCRI personnel on a daily basis. A qualified engineer will inspect the FTDS annually, during the summer, until closure.

3.2.2 Tailings Impoundment

Geotechnical testing and inspection for the tailings impoundment will be conducted as outlined in the Nixon Fork Tailings Dam Operations, Maintenance and Emergency Action Manual (Section 5.0 and Table 3). Visual monitoring will be conducted per the schedule in Table 3-2. In addition, thermistors installed in boreholes G04-1 and G04-2 will be monitored monthly. Signs of instability or erosion will be reported to a qualified engineer for consideration of further testing and solutions for stabilizing the tailings impoundment.

3.2.3 Development Rock Dump

No geotechnical testing or inspection is anticipated for the development rock dump, except the visual monitoring that will be conducted per the schedule in Table 3-2. Signs of instability or erosion will be reported to a qualified engineer for consideration of further testing and solutions for stabilizing the development rock dump.

3.2.4 Solid Waste Landfill

No geotechnical testing or inspection is anticipated for the landfill, except the visual monitoring that will be conducted per the schedule in Table 3-2. Signs of instability or erosion will be reported to a qualified engineer for consideration of further testing and solutions for stabilizing the landfill.

3.3 GEOCHEMICAL MONITORING

Geochemical monitoring of the tailings and development rock is needed to confirm the previous testing concerning the long-term leaching potential of mostly metals and acid generating potential of the tailings and development rock. Three types of tailings will be disposed at the mine: filtered reprocessed tailings; filtered new ore tailings; and slurried new ore tailings. The first two types will be placed in the FTDS and the later possibly placed in the tailings impoundment as slurry as shown in Table 3-1. MCRI plans on operating the mill and adding material to the FTDS, TSF, and waste rock dumps. Geochemical testing will be performed in accordance with the provisions of the following sections

3.3.1 Filtered Tailings Disposal Site (FTDS)

3.3.1.1 Reprocessed and New Ore Tailings – Solids Chemistry

The reprocessed tailings (solids) will be analyzed for acid generating potential, trace metals, WAD CN, and leaching potential and compared to the previous results to evaluate trends in tailings composition. The solids will be analyzed using the Acid-Base Accounting (ABA) procedure and the trace metals per the methods and frequency presented in Table 3-4. The leaching potential will be evaluated per the Meteoric Water Mobility Procedure (MWMP), and the list of parameters presented in Table 3-5, as long as the NPR is 3 or greater based on the ABA results. If the NPR is less than 3, then kinetic testing (Humidity Cell Testing) will be performed to further evaluate the material. Results will be provided to ADEC and ADNR for evaluation prior to the termination of each kinetic test.

3.3.1.2 Reprocessed and New Ore Tailings – Pore Water Chemistry

Since the geotechnical data shows that there is limited risk that the tailings will generate drainage water in the FTDS, MCRI has no plans at this time to perform pore water (interstitial water) chemistry testing in the filtered tailings. The monitoring presented in this plan is a contingency sampling plan that would be implemented if any one of two conditions is found during other monitoring activities at the FTDS as follows:

1. Pore water chemistry monitoring would start if seeps are observed coming from the filtered tailings at any time during or after placement: or
2. If the monitoring of storm water collecting in the collection pond has detections that exceed applicable state water quality criteria or standards.

If either of these two above conditions is detected, MCRI will notify ADEC and the ADNR Division of Mining, Land & Water, Mining Section and implement the sampling plan as outlined in Table 3-6, Filtered Tailings Pore Water Chemistry. The frequency of sampling will be twice per week for 4 weeks, then monthly and repeat cycle when, or if, there is a feed stock change. If the results after the one month of sampling are lower than the applicable water quality criteria, then a reduced sampling schedule will be discussed with ADEC and/or the sampling schedule will continue on a monthly basis. Results of sampling shall be submitted to the ADEC and ADNR Division of Mining, Land & Water, Mining Section.

A mister will be used to dispose of water that collects in the FTDS retention pond. The mister will be directed over the tailings in the FTDS and no water from the retention pond will be discharged outside of the lined FTDS.

3.3.2 Tailings Impoundment

New ore tailings will be placed in the tailings impoundment as a slurry after the pond is emptied, liner inspected and repaired, and the impoundment is put back in to service. The reprocessed tailings (solids) will be analyzed for acid generating potential, trace metals, WAD CN, and leaching potential and compared to the previous results to evaluate trends in tailings composition. The solids will be analyzed using the ABA procedure and the trace metals per the methods and frequency presented in Table 3-7. The leaching potential will be evaluated per the MWMP, and the list of parameters presented in Table 3-5, as long as the NPR is 3 or greater based on the ABA results. If the NPR is less than 3, then kinetic testing (Humidity Cell Testing) will be performed to further evaluate the material. Results will be provided to ADEC and ADNR for evaluation prior to the termination of each kinetic test.

TABLE 3-4 TAILINGS GEOCHEMICAL TESTING – SOLIDS

Parameter	Units	Method	Sample Type and Frequency
Modified Acid Base Accounting (ABA)			
Paste pH	Standard Units	Standard Modified ABA test (Lawrence, 1989 and Canadian MEND report).	Twice per week for 4 weeks, then monthly and repeat cycle when there is feed stock change.
Sulfur-total (S)	wt. %		
Sulfide (S_{-2})	wt. %		
Sulfate(SO_4)	wt. % SO_4		
Total Inorganic Carbon (TIC)	wt. %		
Carbonate (CO_3)	wt. %		
Neutralization Potential (NP)	T $CaCO_3$/1000 t		
Acid Generating Potential (AP)	T $CaCO_3$/1000 t		
Net Neutralization Potential (NNP)	T $CaCO_3$/1000 t		
Net Potential Ratio (NPR)	T $CaCO_3$/1000 t		
Long-term Leaching Potential			
MWMP (1)	mg/L	NDEP (2)	Twice per week for 4 weeks, then monthly and repeat cycle when there is feed stock change
Kinetic	mg/L	See note (3)	Applicable if NPR becomes < 3
Other Testing			
CN, WAD	mg/L	SM4500- CN I	Daily for 2 weeks then twice per week and repeat cycle when there is feed stock change.

Notes: t = U.S. ton
(1) Meteoric Water Mobility Procedure (See Table 3-5 for Parameter List)
(2) NDEP = Nevada Department of Protection test procedure or other acceptable by ADEC.
(3) Humidity Cell Testing. American Society for Testing and Materials (1996), ASTM Designation: D5744-96 Standard Test Method for Accelerated Weathering of Solid Materials Using a Modified Humidity Cell, ASTM, West Conshohocken, PA, 13p. Results will be provided to ADEC and ADNR for evaluation prior to the termination of each kinetic test.

TABLE 3-5 MWMP TEST PARAMETER LIST

Parameter	**Method Detection Limit (MDL)**	**Method**
pH	unit 0.01	EPA 150.1
Alkalinity	1 mg/L	SM 2320
Bicarbonate	1 mg/L	SM 2320
TDS	10 mg/L	EPA 160.1
CN(WAD)	0.01 mg/L	SM4500- CN I
Cl	0.5 mg/L	EPA 300
F	1 mg/L	EPA 300
NO_3 as N	0.5 mg/L	EPA 300
NO_2 as N	0.5 mg/L	EPA 300
Total Nitrates as N	0.5 mg/L	EPA 300
SO_4	1 mg/L	EPA 300
Hg	0.0005 mg/L	CVAAS
Ag	0.003 mg/L	ICP-OES
Al	0.02 mg/L	ICP-OES
As	0.01 mg/L	ICP-MS
B	0.01 mg/L	ICP-MS
Ba	0.002 mg/L	ICP-MS
Be	0.001 mg/L	ICP-MS
Ca	0.5 mg/L	ICP-OES
Cd	0.002 mg/L	ICP-MS
Cr	0.004 mg/L	ICP-MS
Cu	0.003 mg/L	ICP-MS
Fe	0.03 mg/L	ICP-OES
K	1 mg/L	ICP-OES
Mg	0.5 mg/L	ICP-OES
Mn	0.01 mg/L	ICP-OES
Na	0.5 mg/L	ICP-OES
Ni	0.01 mg/L	ICP-OES
Pb	0.02 mg/L	ICP-MS
Sb	0.02 mg/L	ICP-OES
Se	0.02 mg/L	ICP-MS
Tl	0.03 mg/L	ICP-MS
Zn	0.04 mg/L	ICP-OES

TABLE 3-6 FILTERED TAILINGS PORE WATER CHEMISTRY

Parameter	Method	Units	Method Detection Limit (MDL)	Practical Quantitation Limit(PQL)	Potential Regulatory Criteria (1&2)
Major Ion Chemistry					
Total Dissolved Solids	EPA 160.1	mg/L	3.1	10.0	
Iron	EPA 200.7	mg/L	0.0124	0.04	1
Minor Ion Chemistry					
Manganese	EPA 200.8	ug/L	0.31	1	0.05
Chloride	EPA 300.0	mg/L	0.031	0.1	230 Chloride + Sulfate cannot exceed 250
Nitrate (as N)	EPA 300.0	mg/L	0.0031	0.01	10
Sulfate	EPA 300.0	mg/ L	0.031	0.1	Chloride + Sulfate cannot exceed 250
Nitrite (as N)	EPA 300.0	mg/L	0.0031	0.01	1
Cyanide (total)	SM 4500-CN C,E	mg/L	0.0025	0.005	0.0052
Cyanide (WAD) Dissolved	SM 4500CN-I	mg/L	0.0025	0.005	0.0052
Nitrogen, Ammonia-	SM 4500NH3-F	mg/L	0.0258	0.0500	
Trace Ion Chemistry					
Aluminum	EPA 200.8	ug/L	6.20	20	87
Antimony	EPA 200.8	ug/L	0.31	1	6
Arsenic	EPA 200.8	ug/L	1.5	5	10
Barium	EPA 200.8	ug/L	0.94	3	2,000
Bismuth	EPA 200.8	ug/L	0.31	1	
Cadmium	EPA 200.8	ug/L	0.05	0.5	0.11/0.10
Chromium (total)	EPA 200.8	ug/L	0.31	1	100
Copper	EPA 200.8	ug/L	0.31	1	3.18/3.05
Lead	EPA 200.8	ug/L	0.062	0.2	0.64/0.62
Manganese	EPA 200.8	ug/L	0.31	1	50
Nickel	EPA 200.8	ug/L	0.62	2	17.96/17.91
Selenium	EPA 200.8	ug/L	1.5	5	5/4.6
Silver	EPA 200.8	ug/L	0.31	1	0.46/0.39
Zinc	EPA 200.8	ug/L	1.5	5	41.19/40.61
Mercury	EPA 1631A	**ng/L**	1	50	50

(1) Potential Criteria based on the 15th percentile of the Mystery Creek hardness data to date (28.36).

(2) Total recoverable/Dissolved criteria when a conversion factor is established in the 2008 Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances.

3.3.3 Development Rock – Solids

Development rock will be placed in the area down slope of the mill and will mostly consist of limestone with lesser quantities of quartz monzonite. The purpose of characterization of the development rock is to evaluate the potential for dissolution and mobility of certain chemical parameters. The rock will be analyzed for acid generating potential, trace metals, and leaching potential and compared to the previous results to evaluate trends in development rock composition per the methods and frequency presented in Table 3-7. The leaching potential will be evaluated per the MWMP as long as the NPR is 3 or greater based on the ABA results. If the NPR is less than 3, then kinetic testing (Humidity Cell Testing) will be performed to further evaluate the material. Results will be provided to ADEC and ADNR for evaluation prior to the termination of each kinetic test.

TABLE 3-7 DEVELOPMENT ROCK GEOCHEMICAL TESTING – SOLIDS

Parameter	Units	Method	Sample Type and Frequency
Acid Base Accounting (ABA)			
Paste pH	Standard Units	Standard	Once per month for 4 months, then annually thereafter.
Sulfur-total (S)	wt. %	Modified ABA test (Lawrence, 1989 and Canadian MEND report).	
Sulfide (S^{-2})	wt. %		
Sulfate(SO_4)	wt. % SO_4		
Total Inorganic Carbon (TIC)	wt. %		
Carbonate (CO_3)	wt. %		
Neutralization Potential (NP)	T $CaCO_3$/1000 t		
Acid GeneratingPotential (AP)	T $CaCO_3$/1000 t		
Net Neutralization Potential (NNP)	T $CaCO_3$/1000 t		
Neutralization Potential Ratio (NPR)	T $CaCO_3$/1000 t		
Long-term Leaching Potential			Twice per week for 4 weeks, then monthly and repeat cycle when there is feed stock change
MWMP (1)	mg/L	NDEP (2)	
Kinetic	mg/L	See note (3)	Applicable if NPR becomes < 3
Other Testing			

Notes: t = U.S. ton
(1) Meteoric Water Mobility Procedure
(2) NDEP = Nevada Department of Protection test procedure or other acceptable

3.3.4 Evaporator Tank

A large evaporator tank addition to the existing mill is proposed as part of the cyanidation process upgrades at the Nixon Fork Mine. Following cyanide destruct, excess WAD CN waters from the mill will enter tank and be evaporated by misting. This water will not contain free cyande but may contain WAD cyanide levels less than 1.0 mg/L. Soil monitoring around the tank will be performed prior to winter shutdown of the evaporator. Soil samples will be collected from around the tank and analyzed for WAD cyanide, nitrate, nitrite, and ammonia. Since cyanide is rapidly degraded in the environment, the addition of nitrate, nitrite, and ammonia parameters will monitor for breakdown products in soil. Prior to the start of evaporator operations, all parameters will be collected to provide a WAD-CN, nitrate, nitrite, and ammonia level in the material at the Crystal Portal bench.

3.4 TAILINGS IMPOUNDMENT WATER

Water in the tailings pond will be sampled prior to land application. For example, when the existing tailings are reprocessed, the tailings pond will need to be emptied of water for inspection and repair prior to receiving slurried new ore tailings. Water will also have to be applied to land at closure. The parameters to be analyzed for each sampling event are presented in Tables 3-8 and 3-9. In addition, at least 90% of the samples will contain less than 10 mg/L of WAD CN and none will contain more than 25 mg/L of WAD CN.

In the event that tailings impoundment water will be used in land application, samples will be tested for the parameters and mass-based limits presented in Table 3-10 (see Appendix E for derivation). Daily visual monitoring will be performed to ensure that runoff does not occur and that vegetation is not adversely affected. Prior to land application, the mass loading for a specific application area will be calculated as follows. To determine the maximum allowable loading, take the mass-based limit from Table 3-10, subtract the previous loading to that area (in kg/acre), and divide by the measured concentration in the Tailings Pond water (in mg/L), and then divide by the factor 3.8×10^{-6} to make the unit conversions. The result gives the allowable amount of water, in gallons that can be applied to the area. No land application area is to receive greater than the allowable mass-based limit, with the exception of nitrate (NO_3) as described in the following paragraph.

As described in Appendix E, nitrogen uptake by plants allows for additional mass-based loading of NO_3. Up to 50 kg/acre additional NO_3 loading (total mass based limit of 182 kg/acre) can be accommodated. Additional monitoring will be conducted in the first year to verify uptake, as follows. A total of 10 soil samples for nitrate levels will be collected from the land application areas soon after spring breakup, or when a new land application area is started. Samples will be collected from near the root zone of plants within the land application area. Samples will be collected from near the same locations after the following spring breakup. The difference in values, averaged over the application area, will indicate the mass loading of nitrogen that occurred. The nitrogen uptake allowance for future land application events will be adjusted up or down based on these results.

TABLE 3-8. TAILINGS IMPOUNDMENT WATER SAMPLES - MAJOR IONS, PARAMETER METHODS AND DETECTION LIMITS

Parameter	**Method**	**Units**	**Method Detection Limit (MDL)**	**Practical Quantitation Limit (PQL)**	**Potential Regulatory Criteria**
Major Ion Chemistry					
pH (field and lab)	EPA 150.1	Standard	n/a	n/a	6.5 to 8.5
Temperature (field)	Elect. probe	Degrees C	n/a	n/a	
Conductivity (field and lab)	SM2510B	umhos/cm	0.477	1	
Settleable Solids (field)	Cone	mL/L/hr	n/a	n/a	
Total Dissolved Solids	EPA 160.1	mg/L	3.1	10.0	500
Total Suspended Solids	EPA 160.2	mg/L	.15	0.5	
Turbidity (lab)	EPA 180.1	NTU	.05	0.1	5 NTU above background
Alkalinity, Total	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	Min. of 20
Alkalinity, Bicarbonate	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	
Alkalinity, Carbonate	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	
Alkalinity, Hydroxide	SM 2320B	mg/L as $CaCO_3$	3.1	10.0	
Calcium	EPA 200.7	mg/L	0.062	0.2	
Iron	EPA 200.7	mg/L	0.0124	0.04	1
Magnesium	EPA 200.7	mg/L	0.062	0.2	
Potassium	EPA 200.8	µg/L	150	500	
Silicon	EPA 200.8	µg/L	62	200	
Sodium	EPA 200.8	µg/L	150	500	

Note: Analysis will be for dissolved parameters unless noted
(1) Potential Criteria based on the Ruby Creek average hardness of 65 mg/L.

TABLE 3-9. TAILINGS IMPOUNDMENT WATER SAMPLES - MINOR & TRACE IONS, PARAMETER METHODS AND DETECTION LIMITS

Parameter	Method	Units	Method Detection Limit (MDL)	Practical Quantitation Limit (PQL)	Potential Regulatory Criteria[1&2]
Minor Ion Chemistry					
Phosphorus, Total	EPA 200.8	µg/L	62	200	
Manganese	EPA 200.8	mg/L	0.31	1	0.05
Chloride	EPA 300.0	mg/L	0.031	0.1	230
Fluoride	EPA 300.0	mg/L	0.031	0.1	1
Nitrate(as N)	EPA 300.0	mg/L	0.0031	0.01	10
Sulfate	EPA 300.0	mg/L	0.031	0.1	250
Nitrite-(as N)	EPA 300.0	mg/L	0.0031	0.01	1
Cyanide (total dissolved)	SM 4500 CN-C,E	mg/L	0.0025	0.005	0.0052
Cyanide (WAD) Dissolved	SM 4500 CN-I	mg/L	0.0025	0.005	0.0052
Nitrogen, Ammonia-	SM 4500NH3-F	mg/L	0.0258	0.0500	pH/Temperature dependent
Trace Ion Chemistry					
Aluminum	EPA 200.8	µg/L	6.20	20	87
Antimony	EPA 200.8	µg/L	0.31	1	6
Arsenic	EPA 200.8	µg/L	1.5	5	10
Barium	EPA 200.8	µg/L	0.94	3	2,000
Bismuth	EPA 200.8	µg/L	0.31	1	
Cadmium	EPA 200.8	µg/L	0.05	0.5	0.05/(0.05)
Chromium (total)	EPA 200.8	µg/L	0.31	1	100
Copper	EPA 200.8	µg/L	0.31	1	1.28/(1.23)
Lead	EPA 200.8	µg/L	0.062	0.2	0.16/(0.19)
Manganese	EPA 200.8	µg/L	0.31	1	50
Nickel	EPA 200.8	µg/L	0.62	2	7.28/(7.26)
Selenium	EPA 200.8	µg/L	1.5	5	5.0/(4.6)
Silver	EPA 200.8	µg/L	0.31	1	0.07/(0.06)
Zinc	EPA 200.8	µg/L	1.5	5	16.67/(16.30)
Mercury	EPA 1631A	ng/L		1	50

Note: Analysis will be for dissolved parameters unless noted

(1) Potential Criteria based on 15 percent of the Ruby Creek average hardness of 65 mg/L.

(2) Criteria (i.e. 0.20/(0.18)) show the total recoverable with dissolved criteria when a conversion factor is established in 18 AAC 70.

TABLE 3-10. TAILINGS IMPOUNDMENT WATER SAMPLES FOR LAND APPLICATION - PARAMETER METHODS AND DETECTION LIMITS

Parameter	Method	Units	Method Detection Limit (MDL)	Practical Quantitation Limit (PQL)	Mass-Based Limit (kg/acre)[1]	Soil Based Cleanup Standards (18 AAC 75)[2] mg/Kg
Aluminum	EPA 200.8	mg/L	6.20	20	1.32	None established
Antimony	EPA 200.8	mg/L	0.31	1	0.08	33
Arsenic	EPA 200.8	mg/L	1.5	5	2.78	3.7
Cadmium	EPA 200.8	mg/L	0.05	0.5	0.013	65
Chromium	EPA 200.8	mg/L	0.31	1	1.59	250
Copper	EPA 200.8	mg/L	0.31	1	9.27	3,300
Cyanide (WAD) Dissolved	SM 4500 CN-I	mg/L	0.0025	0.005	2.65	27
Iron	EPA 200.7	mg/L	0.0124	0.04	13.2	None established
Lead	EPA 200.8	mg/L	0.062	0.2	0.12	400
Manganese	EPA 200.8	mg/L	0.31	1	0.66	None established
Mercury	EPA 1631A	mg/L			0.19	13
Nickel	EPA 200.8	mg/L	0.62	2	3.97	1,700
Nitrate-Nitrogen	EPA 300.0	mg/L	0.0031	0.01	182	None established
Selenium	EPA 200.8	mg/L	1.5	5	0.066	410
Silver	EPA 200.8	mg/L	0.31	1	7.68	410
Zinc	EPA 200.8	mg/L	1.5	5	3.23	24,900

(1) See Section 3.4 and Appendix E for derivation of Mass-Based Limits.
(2) No known groundwater resources beneath land application area; most stringent over 40-inch MCL

3.5 SEEPS AND GROUNDWATER MONITORING

The regional groundwater table is deep and located within the bedrock at the Nixon Fork Mine site. The general stratigraphy in the mine area includes relatively thin unconsolidated sediments overlying bedrock. The unconsolidated sediments locally may be saturated, or permafrost, but are not characterized as an aquifer nor a continuous hydrogeologic unit. Water quality monitoring of the bedrock groundwater table from surface wells is not considered practical due to the depth (500+ ft below ground surface), relative hydrologic isolation from the surface facilities (long travel time), and the availability of surface monitoring locations (seeps and springs). These conditions prevent monitoring deep groundwater using standard monitoring well designs impractical at any of the facilities including the FTDS, Tailings Impoundment, and Development Rock Dump. As a result, other groundwater monitoring options have been developed for each of the facilities as discussed below.

3.5.1 FTDS

Two groundwater monitoring wells (FTMW-1 and FTMW-2) will be installed down slope of the collection pond (Figure 4). The completion intervals of these wells will extend a short distance into the bedrock. The well locations and construction details will be approved by ADEC prior to installation. Groundwater sampling at the Nixon Fork Mine has typically been unsuccessful from wells because they are either dry or have insufficient water to allow sample collection. This is likely due to the transient and seasonal nature of the shallow groundwater flow system at the site. These wells will continue to be monitored for the presence of water on a quarterly schedule and following rainfall events; if any water is present, samples will be collected and analyzed for the same parameters noted in Section 3.0, Tables 3-1 and 3-2. If any samples tested exceed the State Water Quality Standards (WQS) of 18 AAC 70, or show a statistically significant increase (as defined in 18 AAC 60.830) above the applicable WQS, the following corrective actions will be implemented:

- Verbally notify ADEC and ADNR within 24 hours of receipt of monitoring results.
- Determine the extent of the exceedance.
- Implement a plan to determine the cause and/or source of the exceedance, in consultation with ADEC.
- Submit a plan to ADEC for corrective actions to prevent adverse environmental impacts and further exceedances of applicable water quality standard or permit limits, within seven working days.
- Implement the corrective action plan as approved by ADEC.

If the collection pond monitoring described in Section 3.7.1 indicates that the quality of this water exceeds the criteria over two consecutive sampling events, then an operational mitigation plan will be developed and submitted to ADEC for review and comment. Seeps will not likely develop or be observed near the FTDS because of its location. The FTDS will be inspected for seeps on a monthly basis. If detected, seeps will be sampled and analyzed following the parameter list developed for the surface water quality samples discussed in Section 2.0, Tables 2-1 and 2-2.

Any samples collected that have a positive result for cyanide will be reported to ADEC as soon as possible, but by no later than the end of the next working day after receipt of results. Resampling for sample confirmation will occur as soon as practicable.

3.5.2 Tailings Impoundment

Two groundwater monitoring wells (MW-1 and MW-2) are located near the toe of the tailings impoundment dam. The completion intervals of these wells extend a short distance into the bedrock. Groundwater sampling is typically unsuccessful using these wells because they are either dry or have insufficient water to allow sample collection. This is likely due to the transient and seasonal nature of the shallow groundwater flow system at the site. These wells will continue to be monitored for the presence of water on a quarterly schedule; if any water is present, samples will be collected. If any samples tested exceed the State Water Quality Standards (WQS) of 18 AAC 70, or show a statistically significant increase (as defined in 18 AAC 60.830) above the applicable WQS, the following corrective actions will be implemented:

- Verbally notify ADEC within 24 hours of receipt of monitoring results;
- Determine the extent of the exceedance;
- Implement a plan to determine the cause and/or source of the exceedance, in consultation with ADEC;

- Submit a plan to ADEC for corrective actions to prevent adverse environmental impacts and further exceedances of applicable water quality standard or permit limits, within seven working days; and
- Implement the corrective action plan as approved by ADEC.

In addition, the toe area of the tailings impoundment dam will be monitored for seeps on a monthly basis. The seep with the most flow will be set up so that a water sample can be collected for laboratory analysis. The parameter list for these samples will be the same as the list used for the surface water quality samples discussed in Section 2.0, Tables 2-1 and 2-2. Any samples collected that have a positive result for cyanide will be reported to ADEC as soon as possible, but by no later than the end of the next working day. Resampling for sample confirmation will occur as soon as practicable.

3.5.3 Development Rock Dump

Two groundwater monitoring wells (DRMW-1 and DRMW-2) will be installed down slope of the Crystal Portal development rock dump. The completion intervals of these wells will extend a short distance into the bedrock. The well locations and construction details will be approved by ADEC prior to installation. Groundwater sampling at the Nixon Fork Mine has typically been unsuccessful from wells because they are either dry, frozen, or have insufficient water to allow sample collection. This is likely due to the transient and seasonal nature of the shallow groundwater flow system at the site. These wells will continue to be monitored for the presence of water on a quarterly schedule and following rainfall events; if any water is present, samples will be collected and analyzed using the same parameters noted in Section 2.0, Tables 2-1 and 2-2. If any samples tested exceed the State Water Quality Standards (WQS) of 18 AAC 70, or show a statistically significant increase (as defined in 18 AAC 60.830) above the applicable WQS, the following corrective actions will be implemented:

- Verbally notify ADEC and ADNR within 24 hours of receipt of monitoring results.
- Determine the extent of the exceedance.
- Implement a plan to determine the cause and/or source of the exceedance, in consultation with ADEC.
- Submit a plan to ADEC for corrective actions to prevent adverse environmental impacts and further exceedances of applicable water quality standard or permit limits, within seven working days.
- Implement the corrective action plan as approved by ADEC.

The hillside below the development rock dumps will be inspected on a monthly basis for seeps. If seeps are located, up to three separate seeps will be setup for sample collection. Samples will then be collected from the seeps on a monthly basis. The parameter list for the seep samples will be the same as the list used for the surface water quality samples discussed in Section 2.0, Tables 2-1 and 2-2.

Any samples collected that have a positive result for cyanide will be reported to ADEC as soon as possible, but by no later than the end of the next working day. Resampling for sample confirmation will occur as soon as practicable.

3.6 STORM WATER MONITORING

Benchmark monitoring water quality results will be documented using forms in the Storm Water Pollution Prevention (SWPP) Plan. In addition, a Discharge Monitoring Report (DMR) will be filled out and sent to the ADEC, Major Facilities & Water Permits Section. These completed forms will be maintained with the SWPP for at least three years from the date the facility's coverage under the Multi-Sector General Permit expires or is terminated.

A storm water pollution prevention plan (SWPPP) has been prepared in accordance with the Alaska Department of Environmental Conservation, Alaska Pollutant Discharge Elimination System (APDES), Multi Sector General Permit for Industrial Activities Permit (MSGP). The following sections provide a summary of storm water monitoring but the reader is referred to the SWPPP for specific monitoring and record keeping required to comply with the APDES MSGP.

3.6.1 FTDS Pond

Storm water will collect in the collection pond at the FTDS during rain-storm and snowmelt events. The existing percolation pond will be expanded and lined with 60-mil LLPDE liner to collect this runoff. This water in the pond will be evaporated across the FTDS for disposal. The quality of this pond water will be monitored to evaluate whether filtered tailings are impacting the stormwater runoff that reaches the pond. Monitoring of the collection pond storm water will be performed on a monthly basis while the facility is operational.

Grab samples will be collected monthly from the pond during day light hours within 30 minutes of when the runoff begins collecting or reaches the pond. Grab samples will be taken after a storm event that occurs at least 72 hours from the previously measurable storm event. If these storm event conditions can not be met by mid-month, a sample will be collected the second half of the month when sufficient water is in the pond to collect a sample.

The storm water samples for benchmark monitoring will be collected in laboratory prepared sample bottles and by laboratory prepared protocols that have been approved under 40 CFR Part 136. The samples will be sent for analyses to a state-certified laboratory. The laboratory will analyze the sample for total recoverable WAD CN and aluminum, iron, total recoverable lead, and zinc.

3.6.2 Development Rock Dump

Monitoring of storm water management for the development rock dump will consist of weekly visual monitoring to identify potential areas of erosion, scour, ponding, and general stability. Observations will be documented in monthly reports with recommendations for general improvements in storm water management. Temporary use of silt fencing and other erosion control methods will be employed as needed.

3.6.3 Infrastructure

Infrastructure at the site includes the airport, ore processing area, access roads, mine areas, vent shafts, and utility corridors. Monitoring of storm water management for each of the pertinent structures will consist of monthly visual monitoring to identify potential areas or erosion, scour, ponding, and general stability. Observations will be documented in monthly reports with recommendations for general improvements in storm water management. Temporary use of silt fencing and other erosion control methods will be employed as needed.

4.0 RECLAMATION AND CLOSURE MONITORING

4.1 PERMIT MANAGEMENT

The operation and closure monitoring plans in this section are intended to meet the requirements of the Multi-Sector General Permit (MSGP-2008), and the solid waste regulations 18 AAC 60.800-860, and include monitoring of materials placed in the FTDS, tailings impoundment, development rock dump, and solid waste landfill. The monitoring and reporting activities will be tracked through MCRI in-house personnel. Laboratory data will be managed using in-house personnel with assistance from a MCRI consultant. Copies of inspection and sampling logs will be filed in the MCRI project files for a minimum of five years.

The mine facilities where operation and closure monitoring activities are performed are summarized in Table 3-1.

4.2 CLOSURE AND RECLAMATION MONITORING

Operational monitoring of surface water and storm water, as discussed previously, will continue at the Site on a quarterly basis until closure and reclamation activities are completed. Closure and reclamation activities are anticipated to require approximately one to two years after mining and ore processing.

4.3 POST-CLOSURE MONITORING

After the completion of reclamation, visual and storm water and surface water quality monitoring, will continue at the site in years 1, 2, 5, 10, 15, 20, and 30, after closure. Sampling locations would include: 1) monitoring wells located below the toe of the tailings dam, down slope of the collection pond at the FTDS, and down slope of the development rock dump at Crystal Portal; 2) Mystery Creek and Ruby Creek surface waters; and 3) applicable seeps in the project area. However, ultimate post closure monitoring locations will be determined by ADEC in consultation with ADNR and BLM, prior to final facility closure. Annual vegetation monitoring of reclaimed areas and revegetation work (if required) will be completed until the 70% vegetation cover requirement is met.

5.0 MONITORING RECORDS AND REPORTING

If any samples tested exceed the State Water Quality Standards (WQS) of 18 AAC 70, or show a statistically significant increase (as defined in 18 AAC 60.830) above the applicable WQS, the following corrective actions will be implemented:

- Verbally notify ADEC and ADNR within 24 hours of receipt of monitoring results.
- Determine the extent of the exceedance.
- Implement a plan to determine the cause and/or source of the exceedance, in consultation with ADEC.
- Submit a plan to ADEC for corrective actions to prevent adverse environmental impacts and further exceedances of applicable water quality standard or permit limits, within seven working days.
- Implement the corrective action plan as approved by ADEC.

5.1 FIELD MEASUREMENTS AND RECORDS

All field activities pursuant to this monitoring plan will be recorded on field forms that will included the following information:

- Location, date, time of inspection, observations, measurements;
- The person(s) performing the inspection or monitoring activity;
- The laboratory performing the analysis;
- Chain-of-Custody records;
- Laboratory reports; and
- Consultant or engineering report.

5.2 WASTE DISPOSAL AND RECORDS

All wastes disposed into the tailings impoundment, FTDS, underground mine workings and surface landfill will be recorded on forms that will include the following information:

- Date of disposal,
- Estimated volume of waste, and
- A description of the waste.

5.3 RETENTION OF RECORDS

During the period of operation, closure, and reclamation, all records associated with the monitoring activities will be retained by MCRI or an MCRI representative for a period of 3 years.

5.4 MONITORING REPORTS AND SUBMISSION SCHEDULES

Monitoring reports will be submitted quarterly to BLM, ADEC and ADNR. All quarterly reports will be submitted no more than 60 days after the last day of the quarter, in hard copy and electronic format. In addition, an annual report will be prepared for each year, through December 31, and will be submitted to BLM and the ADEC on or before March 1 of the subsequent year in hard copy and electronic format. The electronic reports will be prepared in accordance with requirements established by the ADEC. The annual reports will summarize all visual geotechnical and water monitoring that has taken place during that year. Copies of laboratory reports will be submitted with the quarterly reports for the first year of data collection and analysis, and for the first year after a change of the laboratory performing the analysis is made. Quarterly and annual reports will include information necessary to determine data validity, data variations and trends, and any exceedence of limits. All records and information which validate the QAPP, resulting from monitoring activities, including but not limited to all records of analyses performed, calibration and maintenance of instrumentation, and recordings from continuous monitoring instrumentation, shall be retained in Alaska for observation by the Department for three years. Upon request from the Department, the permittee shall submit certified copies of such records. The Department may at its discretion perform field and laboratory audits of monitoring activities.

Quarterly reports for quarters in which a land application of wastewater occurred will include a section with the following information:

- Total amount of solution applied;
- Flow rate of applied water;
- Concentration of chemical constituents in applied water;
- Surface area of active application area;
- A map showing active application area and past areas of application;
- Total hydraulic loading rate per acre;
- Total metals loading per acre, for each parameter listed in Table 3-10 of this plan; and
- Cumulative metals loading per acre for each parameter listed in Table 3-10 of this plan including all past application events.

6.0 OTHER MONITORING AND REPORTING

6.1 REVEGETATION MONITORING PROGRAM

Revegetation criteria for reclaimed areas are 70 vegetation cover achieved prior to requesting bond release. MCRI will monitor the revegetation process every spring and fall the mine is in operation and if 30 % vegetative cover is not achieved within 3 years, MCRI will determine the cause and develop a solution with BLM to improve the vegetation cover. Vegetation cover will be determined by field transects utilizing standard acceptable sampling methods such as various points of occurrence techniques (step point, ten point frame, etc.) belt transects or other similar techniques. These techniques will also be used to determine desired species composition.

MCRI will initiate an Invasive species management program at the Nixon Fork Mine. The scope and level of invasive species management begins with quantifying the presence of invasive species at the mine site and performing an ecological risk assessment in accordance with ASTM E2590-09. Once the presence and species composition of invasive plants is known, MCRI will work BLM to develop an Invasive species management plan for the Nixon Fork Mine.

6.2 IMPACTS TO AVIAN AND TERRESTRIAL WILDLIFE

All MCRI employees will be instructed to report unusual circumstances involving wildlife encounters and mortalities to the security officer on duty or to the mine manager. Wildlife mortalities occurring in the Nixon Fork Mine leased lands will be reported to the U.S. Fish and Wildlife Service (USF&WS), ADF&G, ADNR office of Habitat Management Permitting, Fairbanks office, and ADEC. Specific areas that will be monitored on a regular basis will include the tailing impoundment because of the open water and potential for soft unconsolidated tailings, although operation standards require that tailings discharge to both areas be non-toxic to avian and terrestrial wildlife.

Wildlife mortalities discovered in operational areas of the mine will require special collection and sampling procedures. After reporting the mortalities to the security officer or mine manager, the species and a standing solution (e.g., water or liquid associated with soft tailings) sample will be collected. The standing solution sample will be collected as close to the site of the carcass as possible. The solution sample will be preserved immediately with sodium hydroxide to attain a pH>10 and submitted to an outside laboratory for WAD cyanide analysis. The collected wildlife species will be immediately preserved by freezing (size dependant) and temporarily stored in a facility under the control of mine security.

USF&WS, the ADF&G, and ADEC will be contacted to report mortalities within 24 hours or during the next scheduled workday. A written follow-up report will be submitted to USF&WS and ADF&G with the date the mortality was discovered, identification of species, and WAD cyanide level of the solution sample. The follow-up report will be submitted within 7 days of the initial verbal notification to allow verification of analytical results. A semi-annual summary will be prepared by MCRI and will review mortality occurrences during the ice-free period (generally April through September) and during the ice cover (October through March). The semi-annual report will be submitted within 30 days of the end of the reporting period if mortalities have occurred.

All carcasses will be available for final collection by USF&WS or ADF&G, depending on species (i.e., migratory bird or game species). Laboratory results of analysis for WAD cyanide concentration from solution samples will determine final disposal procedure for all carcasses collected. WAD cyanide levels ≥ 10 parts per million (ppm) will trigger a necropsy to determine cause of death. WAD cyanide levels < 10 ppm will not require further analytical analysis. Final deposition of all carcasses will be determined by the appropriate agency.

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

6.3 FUEL STORAGE TANK MONITORING

There are a total of nine storage tanks located at the Airport Tank Farm: eight 9,400 gallon capacity single walled above ground storage tanks (AST) and one 1,000 gallon capacity double walled AST. Seven of these tanks are used for the storage of diesel fuel, one is used for the storage of low-sulfur diesel fuel, and the 1,000 gallon tank is used for the storage of gasoline. Monitoring and inspections of the tanks and associated infrastructure are performed as described in the approved Spill Prevention and Countermeasure Control (SPCC) Plan for the Nixon Fork mine site.

6.3.1 Daily Monitoring

From Section 3.7 of the SPCC Plan: Bulk storage containers, secondary containment, piping, valves, joints, flanges, pumps, hoses, and/or other associated equipment receive a walkabout inspection daily during mine operation, and a detailed inspection monthly by qualified MCRI personnel for general condition and signs of leakage. MCRI personnel qualified to perform the inspections shall be knowledgeable of storage facility operations, the type of AST and its associated components, and characteristics of the liquid stored.

6.3.2 Monthly Monitoring and Inspections

From Section 3.7 of the SPCC Plan: Monthly inspections are performed in general conformance with the monthly and more thorough annual inspections described in the Steel Tank Institute (STI) Standard SP001-04, titled "Standard for Inspection of In-Service Shop Fabricated Aboveground Tanks for Storage of Combustible and Flammable Liquids." The AST record information, as required by STI Standard SP001-04, is included in Appendix D (of the SPCC), as are the written procedures and the monthly inspection checklist.

Monthly inspections are reviewed and signed by the Mine Manager following their completion. Any non-conformance items that are noted during the inspections are promptly corrected. Nonconforming items important to tank or containment integrity are evaluated by an engineer experienced in AST design, a certified inspector, or manufacturer who determines the corrective action. Records of inspections will be maintained on a continuing basis and retained in a logbook at the facility for a period of at least three (3) years.

The liquid level of the bulk fuel tanks are measured using a calibrated dip stick at least once monthly during facility operations, and before and after the tank has been serviced. Tank levels and fuel transfer quantities are recorded on a fuel usage log forms that are kept in the office building.

APPENDIX A

NIXON FORK MINE PROJECT
QUALITY ASSURANCE/QUALITY CONTROL
AND
FIELD PROCEDURES MANUAL

NIXON FORK MINE
QUALITY ASSURANCE/QUALITY CONTROL
AND
FIELD PROCEDURES MANUAL

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1.0 INTRODUCTION

This manual was developed to ensure that samples collected as part of facility monitoring at the Nixon Fork Mine meet applicable data performance objectives. Sample collection procedures are provided to ensure that monitoring data is collected under consistent methodology.

1.1 OBJECTIVES

This manual will be used to maintain the quality of field activities, sample collection, sample handling, laboratory and data analysis, and to document the quality of data at each processing level. The quality assurance/quality control (QA/QC) program identifies major aspects of the project requiring specific quality control and identifies that meeting quality control objectives is the focus of the monitoring program at the Nixon Fork Mine. Additionally, this manual will be used for training employees in approved field monitoring procedures (i.e. instrument calibrations, measurements, and maintenance).

1.2 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The QA/QC program consists of the following 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 (QA) requirements are established in this QA/QC program to achieve the project objectives for the data uses. Applicable quality control (QC) 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 MCRI to comply with the analytical permit requirements during operation and ultimately closure of the Nixon Fork Mine Project. The analyses to be conducted on the various sample types have been presented in the Nixon Fork Mine Project Monitoring Plan. Protocols and appropriate detection limits are included in the laboratory's QA/QC plan available to all MCRI 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.

1.4.1 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 represented by the following equation:

$$RPD = (S1-S2/m)*100$$

where:

RPD = Relative percent difference (precision)
S1 = Results of sample 1
S2 = Results of sample 2
m = (S1-S2/2)

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.

1.4.2 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 percent recovery. A quantitative definition of percent recovery is represented by the following equation:

$$\text{Percent R} = [(Ax-Bx)/Sx]*100$$

where:

Percent R = Percent recovery (accuracy)
Ax = Concentration of analyte determined
Bx = Background concentration of analyte
Sx = Concentration of analyte added into sample or blank

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.

1.4.3 Representativeness

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 and field duplicates obtained at a minimum frequency of 5 percent or one per sampling 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.

1.4.4 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.

1.4.5 Completeness

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

2.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

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. 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; and
- 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.

2.1 QUALITY CONTROL SAMPLES

To aid in evaluating the accuracy of the analytical data, a field filter and rinse blank and duplicate samples 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 samples, or one per sampling event (quarterly) whichever is greater.

Equipment blanks for surface water sampling are taken by pouring laboratory provided distilled water into a decontaminated sample collection bucket, then sample bottles are filled from the sample collection bucket with a decontaminated one-liter plastic pitcher. Blanks will be analyzed along with the unknown samples. Equipment blanks will not be necessary if site conditions allow direct fill into the sample bottles without using a non-disposable transfer vessel. In addition, an equipment blank will not be necessary if the transfer vessel used to initially collect a sample is previously unused and disposable, and is not used for any other sample locations.

2.2 SAMPLE COLLECTION, LABELING, AND HANDLING PROCEDURES

Sample collection, labeling, and handling procedures are periodically checked by the QA/QC leader to verify that the following conditions are 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 and sample custody can be adequately documented; and
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.

2.2.1 Surface Water and Seep Water Grab Sampling

Surface/seep water samples are collected in the following order:

1. Total and dissolved metals;
2. Settable solids;
3. Total suspended solids;
4. Ammonia nitrogen; and

5. Remaining parameters (i.e. fluoride, phosphorous, etc.).

The surface/seep water grab sampling procedures and sampling sites are listed below.

1. Decontaminate compositing container and any other containers used to transfer the sample to the laboratory bottles. Decontamination procedures are described in Section 2.2.12.
2. Locate sampling site at a point in the stream exhibiting greatest flow and/or highest velocity, if possible.
3. Surface/seep water sample sites at the Nixon Fork Mine Project require filling the plastic-bucket by direct submergence. If insufficient water depth is encountered, the bucket should be tilted into the flowing water to allow the bucket to fill. 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 in plastic bucket and then transfer water from bucket into the laboratory sample bottle. Dissolved metals samples are field filtered with a 0.45 µm filter as they are transferred to the laboratory sample bottles. Water field filtering procedures are described in Section 2.2.13.
4. Fill out appropriate field data form(s). Field documentation procedures are described in Section 2.2.9.

2.2.2 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. Sampling procedures for winter sampling through ice are described below.

1. Clear snow off the surface ice in an area large enough to drill a hole for sample collection and to set 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 inches deep) to dip the sample collection container in.
4. Purge three 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/seep water grab sample procedures steps 3 through 4 described in Section 2.2.1, Surface Water and Seep Water Grab Sampling, above.

2.2.3 Groundwater Sampling

The groundwater monitoring wells are sampled with disposable bailers. A description of the groundwater sampling procedure is provided 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)
(1.47 gal/ft for 6" well)

2. Purge at least three well casing volumes using a disposable bailer and line/rope prior to sampling. Measure field parameters (pH, conductivity, and temperature) after purging each casing volume. After finishing purging and if field parameters were stable (within 10% between readings or ±0.2 pH units, fill sample bottles directly from the bailer. If field parameters were unstable during well purging, continue purging well until stable field parameters are achieved.
3. Fill out appropriate field data form(s) documenting sample location, time, and other pertinent information (as described in Section 2.2.9, below) before leaving the sampling site.

2.2.4 Solids Sampling Procedure

2.2.4.1 Development Rock

Development rock samples will be collected at the surface by MCRI personnel. Aside from ensuring that all material originated from a single a geologic unit, no consideration for rock type will be made during the collection of approximately 20 lbs of sample in a cloth sack.

Discrete Sample Procedure (modified from Price, undated):

- A discrete sample shall be collected from material placed on the dump once per week.
- The sampler shall confirm with the mining engineer that all material placed on the development dump originated within a single geologic unit.

IF MORE THAN ONE GEOLOGIC UNIT WAS MINED IN THE PRECEDING WEEK THEN A DISCRETE SAMPLE FROM EACH ROCK UNIT SHALL BE COLLECTED

- The geologic unit from which the waste rock originated shall be recorded.
- The sample shall be composed of fines exposed within a small hand dug trench.
- The sample shall contain a mass of no less than 20 pounds following collection.
- The sample will be stored out of the weather until it is time to composite all the samples collected over the period for the laboratory.

The fines will be presumed to be representative of the material placed on the waste rock dump during that week.

Only samples collected from a single geologic unit are to be composited. If more than one geologic unit is sampled, compositing must be performed by rock unit. All the discrete samples from a single geologic unit, normally four, will be mixed by the geologic technician and then split into 4 approximately equal portions. One of these sample portions will be randomly selected and submitted to the laboratory for analysis, with one of the remaining portions stored on site, in a cloth sack, for additional analysis at a future date, if needed. The remaining sample will be discarded in the development rock dump.

The cloth sample sack containing the saved sample portion will be labeled with a code to uniquely identify the sample. Following receipt of the analytical results, appropriate QA/QC of the data will be performed as described in Section 4.0, below. If the analytical results vary significantly from previous sampling events, the saved sample portion will be shipped to the laboratory for confirmation analysis. Otherwise, if the analytical results are consistent with previous results, the remaining sample will be discarded on the development rock dump.

2.2.4.2 Mill Tailings

Filtered and slurried tailings at the mine will be collected for laboratory analysis at an off-site analytical laboratory. A composite filtered tailings sample will be collected from the temporary pile that will accumulate at the end of the filtration belt. Each composite sample will consist of 5 discrete samples collected from “fresh” tailings coming off the tailings belt over a 10 minute period. All the samples, normally 5, will be mixed by the MCRI personnel and then split into 4 approximately equal portions. Each split portion will be labeled with a code for unique identification. One of these sample portions will be randomly selected and shipped to the off-site laboratory for analysis, with one of the remaining portions submitted to the on-site laboratory for additional analysis. The remaining sample portions will be stored for up to 12 weeks for future analysis, if needed.

Following receipt of the analytical results, appropriate QA/QC of the data will be performed as described in Section 4.0, below. If the analytical results vary significantly from previous sampling events, the saved sample portion will be shipped to the appropriate laboratory for confirmation analysis. Otherwise, if the analytical results are consistent with previous results, the remaining sample will be discarded on the development rock dump.

2.2.4.3 Evaporator Tank

Soil samples will be collected from four locations around the evaporator tank prior to winter shutdown of the evaporator system by MCRI personnel. Other than focusing sample efforts on the collection of fine grained materials, no consideration for rock type will be made during the collection of approximately 20 lbs of sample in a cloth sack. The sample will be stored out of the weather until it is time to composite all the samples collected over the period for the laboratory. All the samples, normally four, will be mixed by the geologic technician and then split into 4 approximately equal portions. One of these sample portions will be randomly selected and submitted to the laboratory for analysis, with one of the remaining portions stored on site, in a cloth sack, for additional analysis at a future date, if needed. The remaining sample will be discarded in the development rock dump.

The cloth sample sack containing the saved sample portion will be labeled with a code to uniquely identify the sample. Following receipt of the analytical results, appropriate QA/QC of the data will be performed as described in Section 4.0, below. If the analytical results vary significantly from previous sampling events, the saved sample portion will be shipped to the laboratory for confirmation analysis. Otherwise, if the analytical results are consistent with previous results, the remaining sample will be discarded on the development rock dump.

2.2.5 Sample 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:

- Project name;
- Date and time of collection;
- 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 will identify each sampling location.

2.2.6 Packaging

Each water sample bottle will be packed in an iced cooler immediately following collection to keep the samples cooled to 4°C and to prevent breakage during delivery/shipment to the laboratory. For hand delivered and shipped samples, one copy of the chain-of-custody seal will be attached to the outside of the cooler such that the seal(s) must be broken if the cooler is opened. Before sealing coolers, the field QA/QC leader will inspect the sample packaging.

2.2.7 Chain of Custody

Chain-of-custody forms will be used for all samples shipped off site. 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. One carbon copy or photocopy of the chain-of-custody form will be retained by MCRI and the original and one carbon copy is sent to the laboratory. The laboratory will forward the original to MCRI with the laboratory report. Samples analyzed by the on-site laboratory will be tracked in the laboratory log book.

The following information is to be included on the chain-of-custody form and on-site laboratory log book:

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

2.2.8 Shipping

MCRI personnel will have the samples delivered to the designated laboratory as soon as feasible after collection and in compliance with the specified method holding times for the required analysis. The remote location of the mine will require that samples be shipped by air using the available services. The shipping containers will be sealed, which will be opened in transit only by airline personnel as part of airport security, if required, and then at the receiving laboratory. Samples may also be hand delivered by MCRI personnel as the opportunity is available. A copy of the chain-of-custody, signed by the laboratory at the time of delivery, will be sent with the laboratory report to MCRI.

2.2.9 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 have waterproof paper.

Proper documentation for sample custody includes keeping records of all materials and procedures involved in sampling. Project notebooks and data sheets will be used to record field data. The field crews will record information regarding the sampling station, including the station position, and respective samples and replicates collected at each. 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 managers will regularly inspect field documentation, notebooks, and data sheets.

2.2.10 Corrections to Documentation

All original data will be recorded using waterproof ink unless prevented by weather conditions. 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 single 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.

2.2.11 Field Equipment Calibration

Field equipment used for collection, measurement, and testing is subject to a strict program of control, calibration, adjustment, and maintenance as discussed in Attachment 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 National Institute of Standards Technology (NIST), 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 appropriated 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 in Section 2.2.14, below.

2.2.12 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 tap water to remove visible particles/material from equipment.
2. Wash in Alconox, (or equivalent)/tap water solution.
3. Double rinse in de-ionized or distilled water, and air dry if not to be used right away.
4. Place in plastic bag immediately after air-drying for storage and/or transport to next sampling location.

The purpose of the Alconox (or equivalent)/water solution washes is to remove all visible particulate matter. This is followed by a de-ionized or distilled water rinse to remove the detergent. It is not anticipated that high concentrations of organics will be encountered. If organics are detected in the field, a solvent rinse will be added followed by a de-ionized or distilled water rinse.

2.2.13 Dissolved Metal Field Filtration Method

Water sample filtration for selected samples will be performed either at the sampling station whenever possible, or at the mine office, if necessary, when sampling locations are remote and difficult to transport filtration equipment to. Filtration will be performed using an electronically operated peristaltic pump to transfer the sample through the filter and into the sample bottles except for groundwater wells sampled with downhole pumps. Separate descriptions for surface water sample and groundwater sample (collected with downhole pumps) filtration are presented below.

<u>Surface Water</u>:

1. Use a new, disposable, high capacity, pre-cleaned, vacuum-type, 0.45-micron filter for each sample.
2. Use a new length of clean, flexible poly tubing for each sample.
3. Visually inspect filter, and tubing for damage. Replace parts or repair equipment as necessary.

4. Attach length of poly tubing to drive head of peristaltic pump. Attach one end of poly tubing to inlet of the filter. Place other end of poly tubing in container containing collected sample for filtration. Purge approximately 3 filter and tubing volumes through system using peristaltic pump.
5. If sample water is extremely turbid, use the same procedure but pre-filter the water (usually with a 3-micron filter) and then use 0.45-micron filter.
6. Immediately after purging, fill sample container to appropriate level with filtered sample.
7. Repeat step 6 until all required sample bottles are filled.

Groundwater sampled with downhole pump:

1. Place disposable, high capacity, pre-cleaned, vacuum-type, 0.45-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.

2.2.14 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:

1. Comparing data readings being measured with readings previously recorded;
2. Recalibration of equipment (i.e., pH meters);
3. Replacing or repairing faulty equipment; and
4. 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 MCRI personnel and a copy is also located in the Nixon Fork mine office.

4.0 DATA QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The data QA/QC program serves four major functions:

- Maintenance of a duplicate record of all field data;
- Sample tracking through laboratory analysis;
- Data validation; and
- 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 receipt of the analytical data package from the laboratory, 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; and
- Adherence to holding times.

Where data do not meet the requirements specified in the 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.

5.0 FIELD INSTRUMENTATION STANDARD OPERATING PROCEDURES

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

5.1 ELECTRICAL CONDUCTANCE

Instrument Calibration

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

1. Rinse probe with de-ionized water.
2. Measure conductivity of two potassium chloride (KCI) solution standards, which bracket expected sample values.
3. Measure temperature of both KCI 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 KCI 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 de-ionized 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.

5.2 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 de-ionized water.
3. Immerse electrode and temperature probe from solution, and then rinse with de-ionized water
4. Remove electrode and temperature probe from solution, and then rinse with de-ionized water.
5. Immerse electrode and temperature probe from solution, and rinse with de-ionized water.
6. Remove electrode and temperature probe from solution, and rinse with de-ionized 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 de-ionized water.

5.3 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 de-ionized 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.

5.4 DISSOLVED OXYGEN

Instrument Calibration

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

1. Switch instruments 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.

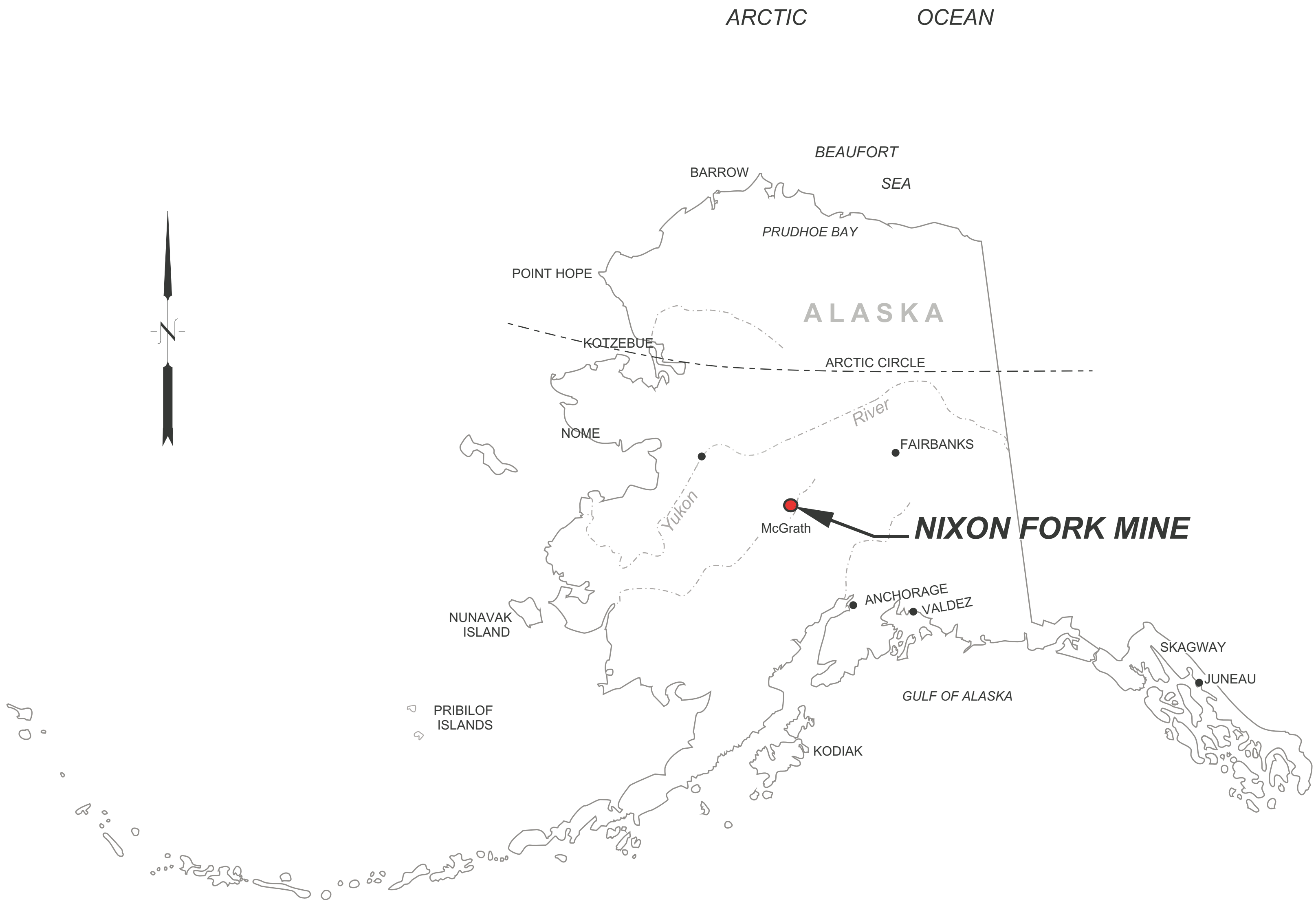
The probe membrane must be replaced prior to sampling. There should be no cracks, tears, or wrinkles in the membranes as well as no air bubbles in the KCL solution filled probe tip. Also any extra membrane should be cut to avoid covering the stainless steel temperature sensor. Store the probe in a saturated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

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.

1. Read dissolved oxygen value.
2. Record appropriate data on field forms.

APPENDIX B

FIGURES



Golder Associates
Anchorage, Alaska

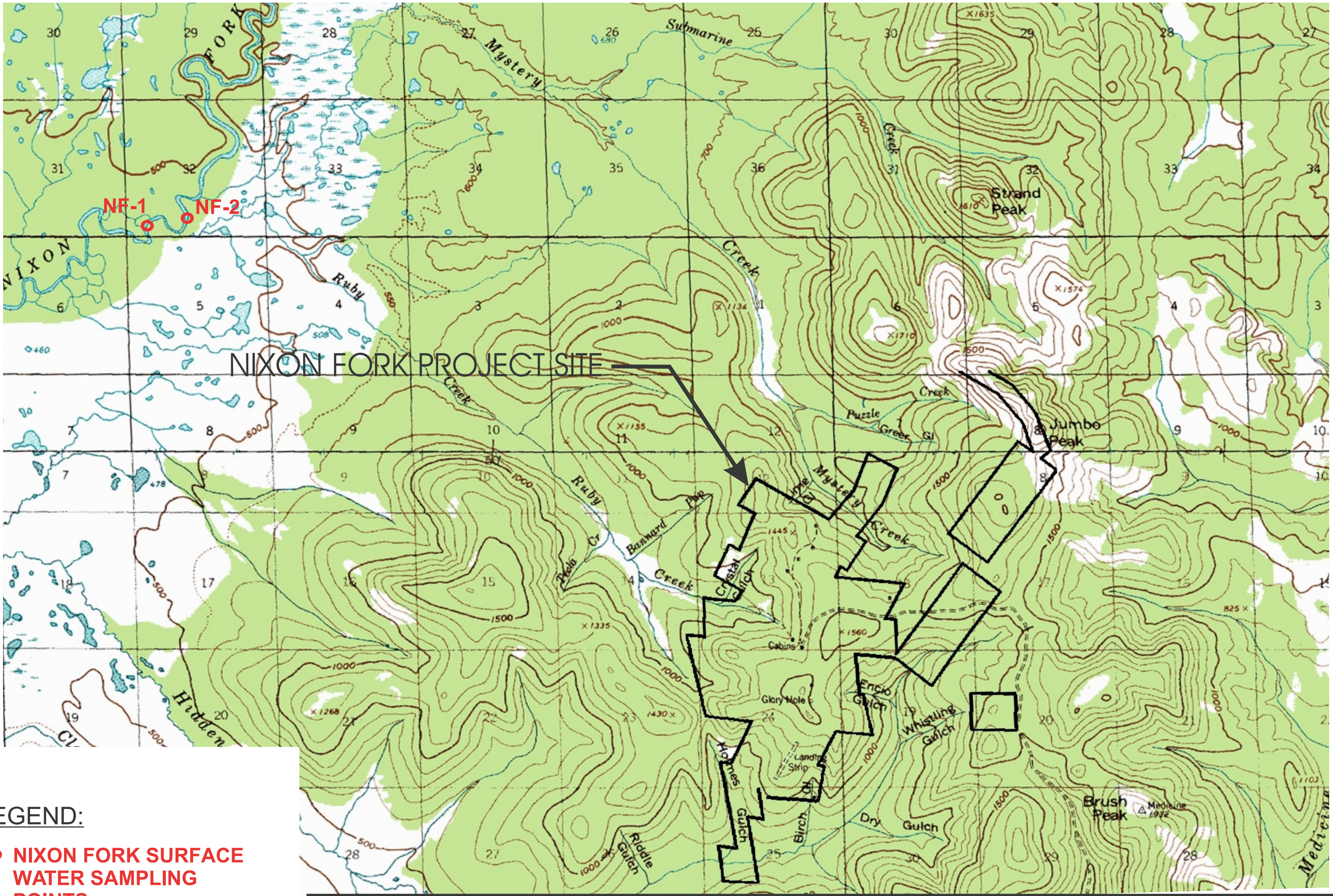
FILE No.	0335632A003
PROJECT No.	033-5632x002.004
SCALE	1 IN.=300 MI.
CADD	CAV
DATE	06/28/05
CHECK	JFD
DATE	06/28/05
REV.	0

TITLE

VICINITY MAP
NIXON FORK MINE
NEAR MCGRATH, ALASKA

MYSTERY CRK / MONITORING PLAN / AK

FIGURE 1



LEGEND:

○ **NIXON FORK SURFACE WATER SAMPLING POINTS**

1 0 1

1 IN. = 1 MILE

MILE

REFERENCES: USGS QUADRANGLE MAPS
MEDFRA A(4) & B(4)

Golder Associates
Anchorage, Alaska

FILE No.	0335632A004
PROJECT No.	033-5632x002.004
SCALE	AS SHOWN
CADD	CAV
DATE	3/30/05
CHECK	JFD
DATE	6/28/05
REV.	0

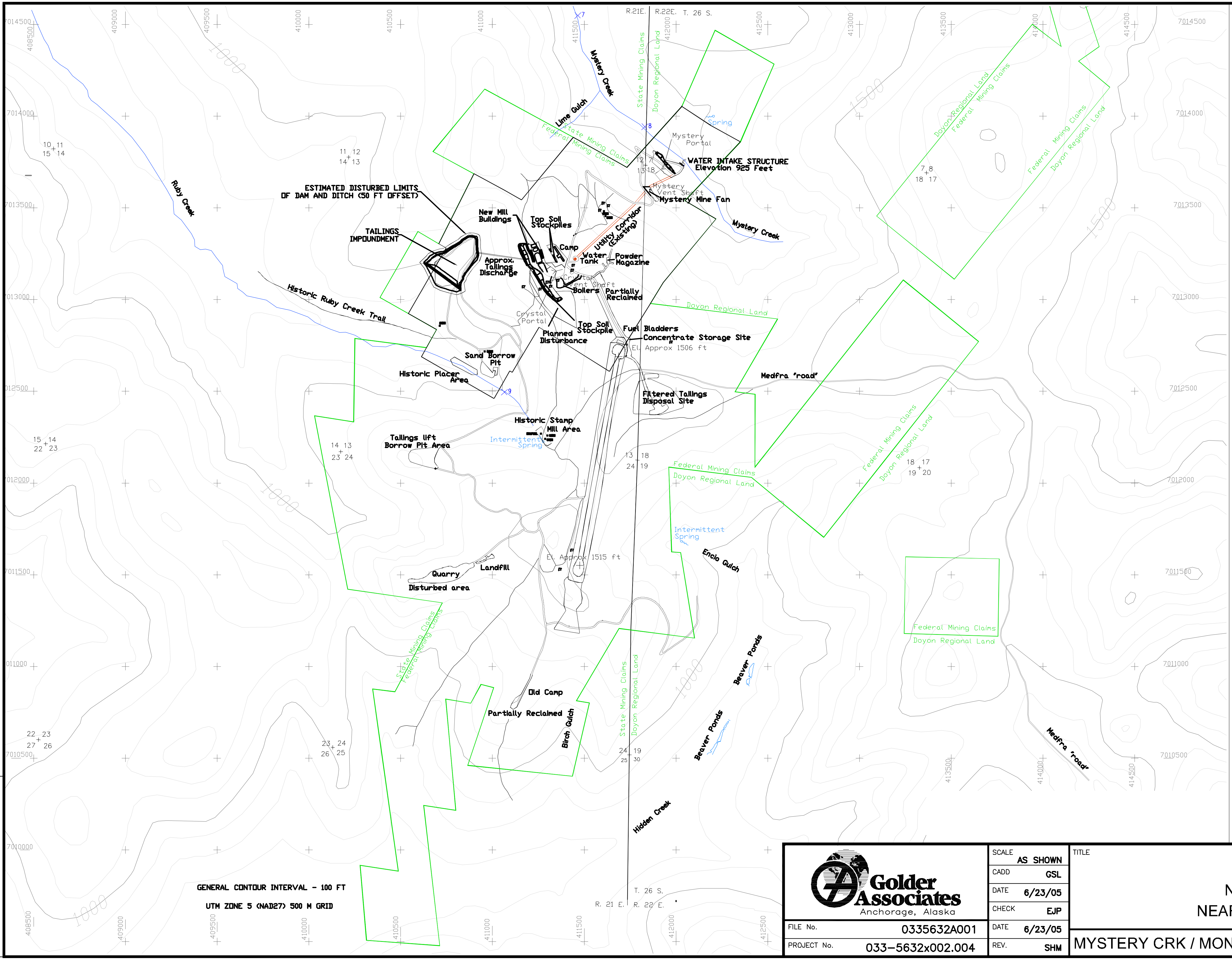
TITLE

PROJECT LOCATION

NIXON FORK MINE
NEAR MCGRATH, ALASKA

MYSTERY CRK / MONITORING PLAN / AK

FIGURE 2



LEGEND

- ✕ Former stream gauge aproximate location and number from 1990 project
- Approximate location of spring
- Active Mine Portal
- Active Ventilation Shaft
- Existing Shaft
- ▪ Existing Building
- ☐ Existing Disturbance
- ☐ Planned Disturbance
- ☐ Federal Claims Surveyed
- 🟩 Federal Claims Unsurveyed

REFERENCES

1.) FIGURE PROVIDED BY MYSTERY CREEK RESOURCES INC.

Golder Associates
Anchorage, Alaska

FILE No.	0335632A001
PROJECT No.	033-5632x002.004
SCALE	AS SHOWN
CADD	GSL
DATE	6/23/05
CHECK	EJP
DATE	6/23/05
REV.	SHM

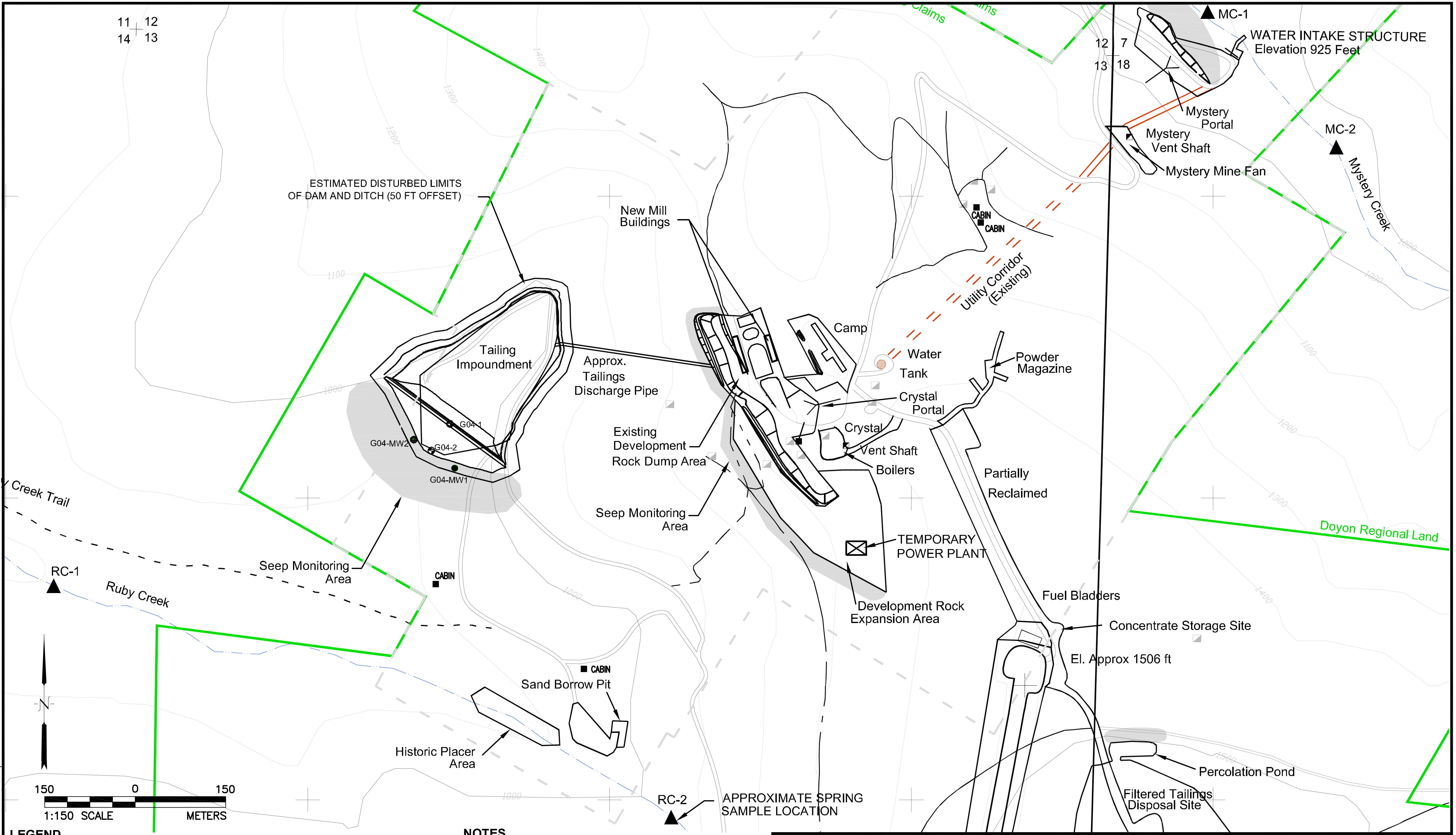
TITLE

SITE PLAN

NIXON FORK MINE
NEAR MCGRATH, ALASKA

MYSTERY CRK / MONITORING PLAN / AK

FIGURE 3



LEGEND

G04-1	BOREHOLES WITH THERMISTERS	1100	GROUND SURFACE CONTOURS IN FEET
G04-MW2 ●	MONITORING WELLS	☒	TEMPORARY POWER PLANT LOCATION
▨	SHAFT		
▲	SURFACE WATER SAMPLE LOCATION	▨	SEEP MONITORING AREA

NOTES

1. LOCATION OF 2004 BOREHOLES AND WELLS ARE BASED ON MEASUREMENTS FROM KNOWN FEATURES AND SHOULD BE CONSIDERED APPROXIMATE.

REFERENCES

1. BASEMAP PROVIDED BY MYSTERY CREEK RESOURCES INC.

Golder Associates
Anchorage, Alaska

FILE No.	0335632A002	SCALE	AS SHOWN
		CADD	ACM
		DATE	06/20/05
		CHECK	EJP
		DATE	6/23/05
PROJECT No.	033-5632x002.004	REV.	SHM

TITLE

WATER MONITORING LOCATIONS

NIXON FORK MINE
NEAR MCGRATH, ALASKA

MYSTERY CRK/ MONITORING PLAN/ AK

FIGURE 4

APPENDIX C

DEVELOPMENT ROCK SAMPLING

INTRODUCTION

Appendix A describes the procedures that will be utilized to sample, analyze, and track development rock characteristics placed in the dump during the production phase of the mine. The majority of the development rock brought to the surface and placed in the dump below the mill is expected to be limestone with a high neutralization capacity. Quartz monzonite is generally avoided during mining development because of its geotechnical qualities, and as a result, a much smaller percent of the development rock brought to the surface will be this material. In addition, Mystery Creek Resources, Inc. (MCRI) will use the quartz monzonite development rock underground as backfill material in the mine as much as possible. There will be no effort to segregate the two general types once brought to the surface and placed in the rock dump.

DEVELOPMENT ROCK SAMPLING

Development rock samples will be collected at the surface by a MCRI geologic technician in the area most actively being used at the time. No consideration for rock type will be made during the collection of approximately 20 lbs of sample in a sack. The sample will be stored out of the weather until it is time to composite all the samples collected over the period for the laboratory. All the samples, normally four, will be mixed by the geologic technician and then split in to 4 samples. One of these samples will be randomly selected and submitted to the laboratory for analysis, with two of the remaining samples stored on site for additional analysis, if needed.

GEOCHEMICAL ANALYSIS

Each sample will be analyzed the Acid-Base Accounting (ABA) procedure, the Meteoric Water Mobility Procedure (MWMP). If the NPR) of any samples is less than 3 the second sample will be submitted to the laboratory for the same testing. If the NPR is again less than 3, then kinetic testing (Humidity Cell Testing) will be performed to further evaluate the material. Results will be provided to ADEC and ADNR for evaluation prior to the termination of each kinetic test.

APPENDIX D

FLUID MANAGEMENT MONITORING PROGRAM

FLUID MANAGEMENT MONITORING PROGRAM

This appendix presents the fluid management monitoring procedures that will be performed as part of the milling process at the Nixon Fork Mine. The purpose of this program is to monitor process water to verify the water balance. The Fluid Management Program is designed to provide appropriate information for the water budget whether the mill is reprocessing tailings from the tailings pond, ore from the stamp mill waste rock or a combination of both.

Water for milling processes will be supplied from two sources: 1) the tailings pond water; and 2) an infiltration gallery in Mystery Creek. The quantities used from each of these sources will vary during the mill operations as described below.

Existing tailings will be dredged and pumped to the mill as a low-density slurry requiring large quantities of water from the tailings pond. Most of the slurry water would be returned to the tailings pond before entering the mill process during the filtering process to create low moisture tailings for the Filtered Tailings Disposal Site (FTDS). No make-up water from Mystery Creek will be required during the reprocessing of the existing tailings. If ore is processed concurrently with the reprocessing of the existing tailings, or before all the existing tailings are reprocessed, all the resultant tailings will be filtered and placed in the FTDS.

After the tailings pond dredging is complete, the mill feed will be ore from underground. During this phase, portions of the water in the tailing pond will be land applied and portions will be used in the mill. If necessary, additional mill make-up water will come from the Mystery Creek Infiltration Gallery.

When the tailings pond is repaired, tailings will once again be discharged as a slurry to the tailings pond and, if necessary, mill make-up water will be pumped from the Mystery Creek infiltration gallery.

All process water leaving the mill will be: 1) contained in the tailings slurry piped to the tailings impoundment for settlement (if necessary and approved by ADEC); 2) transported to the Filtered Tailing Disposal Site (FTDS) as pore water in the filtered tailings; or 3) shipped off-site as pore water in the flotation concentrate filter cake. The tailings will be ground to approximately 80 percent 200 mesh (74 micron) or smaller, thus removing pore water is not feasible. To determine the volume of water in the tailings routed to the FTDS, a moisture determination will be performed during every 12- hour shift and the cumulative monthly volume of water recorded. Once the tailing pond is repaired and tailings slurry routed back to the pond, the volume of water in the slurry will be calculated during every 12-hour shift from the measured pulp density and the known solids tonnage and the cumulative monthly volume of water recorded. Also, a moisture determination will be performed for each bag of concentrate filter cake and the cumulative monthly volume of water recorded. Process water not trapped in the tailings within the impoundment would be detoxified and returned to the tailing impoundment until needed for future use in the mill. This return water will be monitored with a flow meter and recorded monthly.

Water meters will be installed on the piping systems at the appropriate locations within the process. Total flows will be monitored and recorded monthly at these locations. An example monitoring form is attached to this appendix. These forms will be maintained in the operating record at the Mine and the recorded flows will be discussed in the annual reports.

APPENDIX E

DERIVATION OF MASS-BASED LIMITS AND NITROGEN UPTAKE RATES IN SUBARCTIC PLANTS

Derivation of Mass-Based Limits

According to *Waste Management Permit 2003-DB0055, Nixon Fork Mine,* limits for land application of Tailings Pond water are set by specifying the concentration of a compound or element, and a maximum loading to land of 3.5 million gallons per acre. These limits are required to ensure that Water Quality Standards are met in the ground water beneath the land application sites. The limits are translated to mass-based limits by multiplying the concentrations times the mass of the volume of water, as summarized in Table 3-10. Achieving the mass-based limits will ensure that Water Quality Standards are met in groundwater.

Nitrogen Uptake Rates in Subarctic Plants

Numerous studies of arctic and subarctic ecosystems in both North America and Europe have shown that plant community composition and plant productivity are sensitive to changes in nutrient availability, in particular nitrogen and phosphorus (Jonasson et al. 1999). Studies of the effect of climate change on these plant communities have indicated that an increase in temperature accelerates organic matter decomposition. The increased release of nitrogen will lead to increased plant uptake and plant productivity in these presently nutrient-limited communities. Studies have documented an interplay between when plants require nutrients (during the growing season), and when nutrients are typically released by microbes (during the non-growing season). The plants appear to have their main access to enhanced nutrients in the autumn, when microbial populations die back, but before they recover in the spring (Jonasson et al. 1999, Larsen 2006). Larsen (2006) has also documented nitrogen uptake by plants in winter months, when they had previously thought to have been dormant.

Studies of nutrient uptake by arctic and subarctic plants do not typically result in an actual “uptake rate” in kg/acre, because the focus is more on nutrient cycling of particular plants and plant communities, and the fate of nutrients in the soil environment. The studies do indicate, however, that with increased nitrogen and phosphorus, the plants constitute a strong sink for the added nutrients, taking them up to create additional biomass (Jonasson et al. 1999, Larsen 2006).

There is an extensive body of literature on nitrogen and other nutrient uptake in agricultural settings, since the EPA established the Comprehensive Nutrient Management Planning (CNMP) process in confined animal feeding operations (CAFO), principally dairies and feedlots. In a CAFO, solid and liquid manure (nutrients) are used to fertilize fields of corn, soybeans, alfalfa, oats, and bromegrass, among others. An operator is required to calculate the balance between nitrogen and phosphorus addition to the field, and their uptake by plants. Each nutrient application event is balanced by measuring the nutrient content and applied flow rate in irrigation, and the acreage of each type of crop. This balance is the basis of the CNMP.

This issue was also addressed in the revegetation of the Trans-Alaska Pipeline System (TAPS). There were no specific revegetation fertilizer standards at the time, and as a result the nutrient application rate was determined by analogy to agricultural nutrient application (McKendrick 2002). The approach was to take a CNMP-like view, and apply fertilizer at rates determined in agricultural settings. The areas were then examined afterwards to determine whether the application rates were successful. The results of that evaluation (McKendrick 2002) concluded that much of the nutrient addition resulted in increased plant growth. For revegetation efforts such as that following installation of the TAPS, the study recommended better topsoil management during pipeline installation, and allowing natural recruitment to take place.

For land application at the Nixon Fork Mine, nitrogen uptake by plants will increase the allowable mass-based limit. The approach is similar to the CNMP process; the application of nitrates will be in balance with the local plant community's ability to utilize it. The literature documents that subarctic plant communities are nitrogen-limited, and that nitrate will be taken up by plants. However, there are no site-specific data for uptake rates. The following table summarizes uptake rates for several studies conducted in arctic and subarctic Alaska. The nitrogen uptake rates in the table are the range of values from various test plots.

Plant Type	**Nitrogen Uptake (kg/ac)**
Alkali grasses, mosses, Prudhoe Bay[1]	212 to 425
Timothy Grass, lower Kenai Penninsula[2]	331 to 425
Smooth bromegrass, oat, subarctic Alaska[3]	100 to 200

Notes:

[1] McKendrick and Mitchell 1978

[2] Laughlin et al. 1976

[3] Zhang et al. 2006

The data indicate that a conservative (low) estimate for uptake by subarctic plant communities would be 100 kg/acre. This monitoring plan uses half this value (50 kg/acre) for further conservatism. **Therefore, this monitoring plan proposes to provide a 50 kg/acre credit for plant uptake, resulting in an allowable nitrate loading rate of (132 + 50) = 182 kg/acre.** The nitrate uptake rate may be modified based upon soil sampling conducted in the first year.

References

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Larsen, K.S. 2006. Carbon and Nitrogen Dynamics of Temperate and Subarctic Heath Ecosystems with Emphasis on Cold-Season Processes. Institute of Biology, Faculty of Science. University of Copenhagen.

Laughlin et al. 1976. Lime and Nitrogen Influence on Timothy Yield and Composition. Agronomy Journal. Agron, 68, 1976, pp. 881-885. American Society of Agronomy.

McKendrick J. and Wm. W. Mitchell. 1978. Fertilizing and Seeding Oil-Damaged Arctic Tundra to Effect Vegetation Recovery Prudhoe Bay, Alaska. Arctic, Vol. 31, No. 3 Sept. 1978, pp. 296-304.

McKendrick J., Ph.D. 2002. Soils and Vegetation of the Trans-Alaska Pipeline Route: A 1999 Survey. Agricultural and Forestry Experiment Station, School of Agriculture and Land Resources Management, University of Alaska Fairbanks and BP Exploration, Alaska.

Zhang et al. 2006. Solid and Liquid Cattle Manure Application in a Subarctic Soil. Agronomy Journal. Agron, 98, 2006, pp. 1551-1558. American Society of Agronomy

APPENDIX F

MONITORING SCHEDULE

Quarter	Monitoring Task	Reporting Period
First	Surface Water Quality (§2.0)	March 1 – March 31
	Facility Visual Monitoring (§3.1)	January 1 – March 31
	Facility Geotechnical Monitoring (§3.2)	January 1 – March 31
	Facility Geochemical Monitoring (§3.3)	January 1 – March 31
	Seeps and Groundwater Monitoring (§3.5)	March 1 – March 31
	Storm Water Monitoring (§3.6)	January 1 – March 31
	Wildlife Monitoring (§6.2)	January 1 – March 31
	FIRST QUARTER MONITORING REPORT	**May 1**
Second	Surface Water Quality (§2.0)	May 1 – May 31
	Facility Visual Monitoring (§3.1)	April 1 – June 30
	Facility Geotechnical Monitoring (§3.2)	April 1 – June 30
	Facility Geochemical Monitoring (§3.3)	April 1 – June 30
	Tailings Impoundment Water (§3.4)	April 1 – June 30
	Seeps and groundwater monitoring (§3.5)	May 1 – May 31
	Storm Water Monitoring (§3.6)	April 1 – June 30
	Wildlife Monitoring (§6.2)	April 1 – June 30
	SECOND QUARTER MONITORING REPORT	**August 1**
Third	Surface Water Quality (§2.0)	July 1 – July 31
	Facility Visual Monitoring (§3.1)	July 1 – September 30
	Facility Geotechnical Monitoring (§3.2)	July 1 – September 30
	Facility Geochemical Monitoring (§3.3)	July 1 – September 30
	Tailings Impoundment Water (§3.4)	July 1 – September 30
	Seeps and groundwater monitoring (§3.5)	July 1 – July 31
	Storm Water Monitoring (§3.6)	July 1 – September 30
	Vegetation/Invasive Species Monitoring (§6.1)	July 1 – July 31
	Wildlife Monitoring (§6.2)	July 1 – September 30
	THIRD QUARTER MONITORING REPORT	**November 1**
Fourth	Surface Water Quality (§2.0)	October 1 – October 31
	Facility Visual Monitoring (§3.1)	October 1 – December 31
	Facility Geotechnical Monitoring (§3.2)	October 1 – December 31
	Facility Geochemical Monitoring (§3.3)	October 1 – December 31
	Tailings Impoundment Water (§3.4)	October 1 – December 31
	Seeps and groundwater monitoring (§3.5)	October 1 – October 31
	Storm Water Monitoring (§3.6)	October 1 – December 31
	FOURTH QUARTER MONITORING REPORT	**February 1**
	ANNUAL MONITORING REPORT	**February 1**