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May 25, 2012 Project No. C384

Kenwyn George
Alaska Department of Environmental Conservation
410 Willoughby Ave
Juneau, AK 99801

Subject: Niblack Exploration Project
Water Quality Monitoring Plan 2012 Post-Construction Update

Dear Mr. George:

On behalf of Niblack Project LLC (NPLLC), this letter transmits the draft version of the Niblack Water Quality Monitoring Plan 2012 Post-Construction Update. This draft plan was prepared in support of the application for renewal of Waste Management Permit 2006-DB0037 (Permit); the plan will be finalized following issuance of a new Permit. This report describes a plan for surface water and groundwater quality monitoring for the Niblack mineral exploration project.

On a telephone call that we had on May 21, 2012, we discussed the following proposed changes to the monitoring program:

- Reduce PAG pond chemistry sampling to quarterly. The leachate and runoff from the PAG waste rock pile and temporary storage facility is captured in the PAG pond, where it is monitored on a weekly basis for field parameters including pH, sulfate, conductivity, dissolved oxygen, and total dissolved solids. Additional chemistry parameters including conventional parameters, major cations and anions, and metals have been collected on a monthly basis from August 2008 to May 2012. Monthly PAG monitoring reports have been submitted to ADEC during this time period. Results have consistently demonstrated circumneutral pH and low concentrations of sulfate and metals. NPLLC requests approval to begin a quarterly monitoring and reporting schedule for PAG pond chemistry parameters beginning in the second quarter of 2012. Field parameter monitoring will continue on a weekly schedule and will serve as an early indicator for any potential changes in PAG pond water quality. If a significant reduction in pH, or increase in sulfate, is observed, the chemistry monitoring frequency may be increased as determined by NPLLC and ADEC/ADNR. If the change to quarterly PAG pond chemistry sampling is acceptable, then these results will be submitted with the quarterly water quality monitoring reports.

- Modify the format of the Niblack quarterly reports such that the data tables include results collected only in that quarter. The full set of results (1996 – present) will be submitted electronically each quarter with the report in Microsoft Excel format. This will make the quarterly reports more succinct and easier to read, but will not reduce the amount of information reported.

- Modify the annual reports to discontinue the voluntary Alternative Population statistical tool. NPLLC will continue to screen data with the State's Natural Conditions tool and the voluntary Upper Prediction Limit test and will report these results in the annual reports.

Assuming that the proposed changes are approved and incorporated into the Permit, quarterly monitoring and reporting of analytical chemistry for the PAG pond will begin in the second quarter of 2012.

Following receipt of the State's comments on this draft report and finalization of the Permit, we will develop and submit a final report which addresses and incorporates the State's comments.

If you have any questions regarding this submittal, please contact Patrick Smith or me.

Sincerely,

Alice R. W. Conovitz
Project Manager

Enclosure

integral consulting inc

cc: Patrick Smith, Niblack Project LLC
Loretta Ford, Niblack Project LLC
Graham Neale, Niblack Project LLC
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NIBLACK WATER QUALITY MONITORING PLAN

2012 Post-Construction Update

Prepared for

NIBLACK
PROJECT LLC

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May 25, 2012

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ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
ALS	ALS Environmental
APDES	Alaska Pollutant Discharge Elimination System
CAS	Columbia Analytical Services
COC	chain of custody
DQO	data quality objective
EDD	electronic data deliverables
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
LAD	land application/dispersion
LIMS	lab information management system
NAG	non-acid-generating
NC Tool	Natural Conditions Tool
NMC	Niblack Mining Corporation
NPLLC	Niblack Project LLC
PAG	potentially acid-generating
PARCC	precision, accuracy, representativeness, completeness, and comparability
PVC	polyvinyl chloride
QAPP	quality assurance project plan
QA/QC	quality assurance and quality control
RPD	relative percent difference
SWPPP	Storm Water Pollution Prevention Plan
UPL	upper prediction limit

1 INTRODUCTION

This report describes a plan for surface water and groundwater quality monitoring for the Niblack mineral exploration project. The plan includes programs for monitoring to be conducted during project activities (initiated in September 2007 and ongoing) and post-closure monitoring at the Niblack property. Data collected during exploration provides an overview of the existing water quality conditions at reference stations, as well as compliance monitoring to ensure that water quality meets protective Alaska water quality standards at locations downgradient of project facilities. Pre-activity baseline monitoring conducted from 1996 through 2006 is discussed in the Niblack Water Quality Baseline and Site Monitoring Plan (Knight Piésold 2007b). Per requirements set forth in 18 AAC 60.210(b)(3)(D), a visual monitoring plan to evaluate vegetative health and erosion is also outlined in this document.

This report updates the Niblack Water Quality Baseline and Site Monitoring Plan (Knight Piésold 2007b). Changes to the 2007 monitoring plan include:

- Incorporation of the quality assurance project plan (QAPP; Integral 2007)
- Surface water and groundwater monitoring locations and frequency
- Initiation of a monitoring program for waste rock pile leachate/runoff
- Addition statistical data evaluation tools
- Reduction of the monitoring analyte list.

This report meets the requirements specified in the Alaska Industrial Waste Monofill Solid Waste Permit Application (Part 8 – Monitoring Plan) and the regulations referenced therein. The Niblack Project operates under the Alaska Department of Environmental Conservation (ADEC) Waste Management Permit 2006-DB0037 (the Permit). Permit 2006-DB0037 covers both the disposal of non-domestic waste water and the management and disposal of potentially acid-generating (PAG) solid waste material that are associated with project development activities, exploration drift dewatering, and underground drilling.

The Niblack Exploration Project plans referred to herein are presented in the following:

- Underground Exploration Plan of Operations Post-Construction Update (Integral 2012b)
- Underground Exploration Plan of Operations (NMC 2007c)
- Reclamation and Closure Plan Post-Construction Update (Integral 2012a)
- Reclamation and Closure Plan (RTR 2007)
- Stormwater Pollution Prevention Plan (SWPPP; RTR 2006)
- QAPP (Integral 2007)

- Operational Characterization Plan (Knight Piésold 2007a)
- Niblack Wastewater Treatment and Disposal Application under the Waste Management Permit (NMC 2007a)
- Niblack Industrial Solid Waste Landfill Application under the Waste Management Permit (NMC 2007b)

Sampling and analysis of groundwater and surface water are performed as required by the Permit, with the parameter list, monitoring frequency, and monitoring location changes as approved by Kenwyn George of ADEC (George 2008, pers. comm.). The changes were implemented beginning in the third quarter of 2008 and are described in detail in Section 2 below.

Water quality monitoring results are reported and evaluated in reports that are submitted to ADEC on a regular schedule. The annual reports (e.g., Integral 2012c) are comprehensive summaries of current and historical water quality. These reports include water quality monitoring results presented as time series plots, statistical analyses, screening against Alaska water quality standards, quality assurance/quality control (QA/QC) evaluations, tabulated data, and visual monitoring logs. Quarterly reports (e.g., Integral 2011b) present water quality monitoring results for a given quarter. Results of onsite waste rock kinetic tests and PAG pond monitoring were reported monthly from August 2008 to May 2012 (e.g., pHase 2011). NPLLC has requested approval to incorporate PAG pond and kinetic test results with the quarterly reports beginning in the second quarter of 2012.

Niblack Project LLC (NPLLC) will retain all records of monitoring activities for the duration of the project, including the post-closure monitoring period. The monitoring program will be modified as needed to comply with future permitting requirements including any potential future Alaska Pollutant Discharge Elimination System (APDES) requirements in the event a discharge to waters of the U.S. may be necessary.

1.1 BACKGROUND

The Niblack Exploration Project is a copper-gold- zinc-silver prospect located off Moira Sound on southeastern Prince of Wales Island, approximately 30 miles southwest of the town of Ketchikan (Figure 1). The property is located at Section 34, T. 78 and 79 S., R. 88 E., Copper River Meridian; Latitude 55º 03′ 53″, Longitude -132º 08′ 48″. The property is composed of 17 patented claims, 298 staked federal lode claims and 7 Alaska State tideland claims. All claims are owned 100 percent by NPLLC.

The Niblack area has been explored for minerals since the initial copper discovery at Niblack Anchorage in 1899. A detailed history of site ownership and project activities, including tons of ore produced and dates of operation, is presented in the Niblack Underground Exploration Plan of Operations 2012 Post-Construction Update (Integral 2012b). The property was first developed in 1902-3 by the Wakefield Mineral Lands Company and in 1904 was leased by the Niblack Copper Company. Available records show that the mine shipped ore from 1905 through 1908, producing just over 30,000 tons. More recently, Cominco American (1974-1976), Anaconda (1977), Noranda (1982), and Lac (1984–1993) performed exploration at the site. Abacus Minerals Corporation became involved in 1995, and Niblack Mining Corporation (NMC) most recently in 2005. NMC was acquired as the principal asset of Abacus Alaska Inc. by Committee Bay Resources Ltd. on October 1, 2008, which subsequently underwent a corporate name change to CBR Gold Corporation. NPLLC acquired 100 percent ownership interest in the Niblack Exploration Project in early 2012. Table 1 summarizes drilling activities from 1975 to 2011.

Modern day underground development on the Niblack Exploration Project was initiated by previous owners NMC on September 21, 2007, and was completed on July 12, 2008. The initial phase of underground drilling was completed on October 7, 2008 and the second phase of underground drilling was initiated on September 26, 2009.

1.2 GENERAL PHYSICAL AND HYDROLOGICAL SETTING

Most of the Niblack Project area is forested. The Project site is situated along the bottom and lower slopes of a small, steep-sided watershed that drains directly into Niblack Anchorage. Four perennial streams referred to as Waterfall Creek, Camp Creek, Unnamed Creek 1 and Unnamed Creek 2 flow through the project area (Figure 2). Many small intermittent drainages, swales and rivulets flow through the project area and eventually feed into these creeks or directly into Niblack Anchorage.

The terrain is mountainous and rugged, with steep to moderate slopes. Elevations range from sea level to peaks of 2,600 ft and greater. The underground exploration drift is constructed at the 380-ft level within Lookout Mountain, which has an elevation of 2,300 ft. The slopes are covered with temperate rain forest and gives way to sparse vegetation only at the highest elevations, generally 1,800 ft and above. In the lower elevations of the Project area much of the land surface is occupied by wetlands that are classified as saturated needleleaf forest wetlands and saturated needleleaf forest/broadleaf scrub-shrub mix wetlands. Wetlands and surface hydrology features are shown on Figure 2.

Temperatures are moderate and rainfall is high. Typical temperatures for the region average 45.6°F and range from 28°F to 65°F. Total precipitation averages 138 in. annually, and is generally greatest from September through February. Because of the mild temperatures, most precipitation falls as rain, with less than 40 in. of annual snowfall on average. Air temperature and precipitation measured at the Niblack project site and at Ketchikan Airport are presented in the annual reports (e.g., Integral 2012c).

Recharge from precipitation forms the shallow groundwater system that discharges to surface streams, either by overland flow or saturated interflow, and likely has a short residence time unless it reaches the bedrock. The valley bottom is likely composed of unconsolidated alluvium, colluvium/landslide deposits, and glacial sediments. Subsurface water may temporarily flow through these sediments and will likely report to streamflow, or wetlands at lower elevation. The amount of groundwater from the shallow system that percolates downward to the deeper bedrock flow system is not known.

1.3 SITE OVERVIEW

Figure 2 presents an overview of site facilities. The major components associated with the Project are an underground mine exploration drift, a temporary storage facility for PAG waste rock, a non-acid generating (NAG) waste rock disposal area, settling/treatment ponds, a water land application/dispersion (LAD) discharge system, access roads, and a marine dock and barge camp facility. Ancillary facilities include topsoil stockpiles, an ore stockpile, diversion systems, fuel storage, and supply laydown and staging areas.

Water from the mine portal flows to a pair of settling ponds (Figure 2). The settling ponds receive the portal water, as well as water from the PAG pond, which collects runoff and leachate from the PAG waste rock pile temporary storage facility. If necessary, water may be pumped from the first settling pond through a water-treatment chemical mixing tank, which can be used to increase pH and reduce trace element concentrations through lime addition and flocculation. To date, mine water treatment has not been necessary. The second pond allows for additional precipitation and settling of trace elements.

Since project activities began in September 2007 through December 2011, portal discharge typically contributed more than 90 percent of the total settling pond inflow, while flows from the PAG pond and direct precipitation each contributed about 5 percent.

From the settling ponds, water is discharged through the LAD system, which is a network of drip irrigation emitters spread over approximately 2.9 acres (Figure 2). From October 2007 through December 2011, the average LAD discharge rate was 122 gallons per minute (gpm). The maximum allowable discharge is 300 gpm (Nakanishi 2009, pers. comm.).

2 CHANGES TO THE WATER QUALITY MONITORING PROGRAM AND PERMIT REQUIREMENTS

Since issuance of the Niblack Waste Management Permit (2006-DB0037) on June 29, 2007, Niblack Project managers have requested and received approval for the following changes to requirements set forth in the Permit.

2.1 WASTEWATER DISCHARGE VOLUME

Section 1.4 of the Permit describes wastewater treatment and discharge. The original wastewater discharge limit was 150 gpm. During initial underground construction in 2007 and 2008, groundwater flows exceeded pre-project estimates and necessitated grouting to remain below the permitted wastewater discharge limit of 150 gpm. To reduce flows, grout was applied along almost the entire length of the exploration drift. The resulting grout curtain has been successful in eliminating significant water seepage into the drift. On August 13, 2008, approval was granted by ADEC for an increase in the permitted wastewater discharge limit to 250 gpm (George 2008, pers. comm.). An additional increase in the permitted wastewater discharge limit up to 300 gpm was approved by ADEC on December 31, 2009 (Nakanishi 2009, pers. comm.).

2.2 PAG WASTE ROCK MANAGEMENT

A waiver of the intermediate cover requirement (18 AAC 60.243) under the Permit was granted by ADEC on January 26, 2009 (Buteyn 2009, pers. comm.). In January 2009, former site owners Committee Bay Resources requested approval to leave the pile uncovered for large-scale kinetic testing (Kleespies 2009, pers. comm.). The uncovered pile provides an opportunity to evaluate the weathering behavior of the PAG rock and provides quantitative information for waste management practices for possible future site development. The PAG effluent is entirely captured and controlled through the liner and PAG pond system. A cover will be placed on the PAG pile if required due to a change in the chemistry of the PAG effluent or at the request of ADEC or ADNR.

The leachate and runoff water captured in the PAG pond is monitored on a weekly basis for field parameters including pH, sulfate, conductivity, dissolved oxygen, and total dissolved solids. Additional chemistry parameters, including conventional parameters, major cations and anions, and metals, were collected on a monthly basis from August 2008 to May 2012. Monthly PAG monitoring reports were submitted to ADEC during this time period. NPLLC has requested approval to begin a quarterly monitoring and reporting schedule for PAG pond chemistry parameters beginning in the second quarter of 2012. Field parameter monitoring will continue on a weekly schedule and will serve as an early indicator for any potential changes in PAG pond water quality. If a significant reduction in pH, or increase in sulfate or other field parameters, is observed, the chemistry monitoring frequency may be increased as determined by NPLLC and ADEC/ADNR.

2.3 WATER QUALITY MONITORING AND EVALUATION TOOLS

Sampling and analysis of groundwater and surface water through Q2 2008 was performed as required by the Permit and as described in the Niblack Water Quality Baseline and Site Monitoring Plan (Knight Piésold 2007b) and QAPP (Integral 2007). On July 15, 2008, Niblack submitted to ADEC a technical memorandum (Locke 2008, pers. comm.) outlining a series of recommended changes to the water quality monitoring program. These recommendations were developed in light of permit requirements, the results of groundwater and surface monitoring conducted to date, and results of graphical and statistical evaluations of water quality at the project site before and after underground exploration began in late September 2007. In an e-mail dated August 13, 2008 from Kenwyn George of ADEC to Darwin Green of Niblack (George 2008, pers. comm.), ADEC approved these recommended changes, as follows:

1. Reduce the monitoring frequency at surface water monitoring sites to quarterly beginning in Q3 2008.

2. Reduce the monitoring frequency at groundwater monitoring sites to quarterly beginning in Q3 2008 (after a total of 20 samples have been collected at each site).

3. Discontinue the concurrent measurement approach for surface water on Waterfall Creek (WQ8), Camp Creek (WQ7), and Unnamed Creek #1 (WQ12).

4. Discontinue regular monitoring of groundwater monitoring sites MW7, MW8, MW9.

5. Reduce the analyte list to include only those parameters needed to determine permit compliance and selected additional general water quality parameters needed to track trends in overall water quality.

These changes were implemented beginning in Q3 2008 and are incorporated into the guidelines for sample collection (Section 4), monitoring locations (Section 5), monitoring frequency (Section 6), and site-specific water quality standards (Section 7) presented in this monitoring plan.

3 DATA QUALITY AND QA/QC

The Niblack Mining Corporation QAPP (Integral 2007) identifies the following two data quality objectives (DQOs) to ensure that data of adequate quantity and quality are generated to support the requirements of the State of Alaska's Waste Management Permit No. 2006-DB0037:

> DQO 1—Surface Water Quality Compliance. The DQO for surface water quality compliance is to ensure that data of sufficient quantity and quality are collected to determine whether concentrations of water quality parameters in designated surface water compliance monitoring locations comply with site-specific natural conditions-based water quality standards. The site-specific standards for surface water will be established by the combined data set from surface water monitoring conducted at pre-project reference locations before exploratory activity and from ongoing monitoring of reference locations.
>
> DQO 2—Wetlands Groundwater Quality Compliance. The DQO for wetlands groundwater quality compliance is to ensure that data of sufficient quality and quantity are collected to determine whether concentrations of water quality parameters in designated wetlands compliance wells conform to site-specific natural conditions-based water quality standards. The site-specific standards will be determined based on pre-construction monitoring of wetlands wells and monitoring of remote wetlands reference location(s).

In accordance with the project DQOs, field and laboratory procedures for water quality monitoring have been established to ensure that the quantity and quality of data generated by field and laboratory activities are sufficient to evaluate compliance with the site-specific water quality standards at an acceptable level of confidence. An overview of the sampling process and field procedures is presented in this monitoring plan. Specific protocols for sample analysis and QA/QC are detailed in the QAPP (Integral 2007).

3.1 DATA QUALITY MEASURES

The quality of the data obtained for a project is assessed via their adherence to the pre-set data DQOs defined above. DQOs provide a means of assessing whether the data in question are precise, accurate, representative and complete. Data quality indicators such as the precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters (USEPA 2002) and analytical sensitivity will be used to assess conformance of data with quality control criteria. PARCC parameters are commonly used to assess the quality of environmental data.

Accuracy

Accuracy or bias represents the degree to which a measured concentration conforms to the reference value. The results for matrix spikes, laboratory control samples, field blanks, and method blanks will be reviewed to evaluate bias of the data. The following calculation is used to determine percent recovery for a matrix spike sample:

$$\%R = \frac{M - U}{C} x100$$

%R = Percent recovery
M = Measured concentration in the spiked sample
U = Measured concentration in the unspiked sample
C = Concentration of the added spike

The following calculation is used to determine percent recovery for a laboratory control sample or reference material:

$$\%R = \frac{M}{C} x100$$

%R = Percent recovery
M = Measured concentration in the reference material
C = Established reference concentration

Results for field and method blanks can reflect systematic bias that results from contamination of samples during collection or analysis. Any analytes detected in field or method blanks will be evaluated as potential indicators of bias.

Precision

Precision reflects the reproducibility between individual measurements of the same property. Precision will be evaluated using the results of matrix spike duplicates, laboratory duplicates, and field replicates. Precision is expressed in terms of the relative standard deviation for three or more measurements and the relative percent difference (RPD) for two measurements. The following equation is used to calculate the RPD between measurements:

$$RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2} x100$$

RPD = Relative percent difference
C1 = First measurement
C2 = Second measurement

The relative standard deviation is the ratio of the standard deviation of three or more measurements to the average of the measurements, expressed as a percentage.

Representativeness
Representativeness is the degree to which data represent a characteristic of an environmental condition. In the field, representativeness will be addressed primarily in the sampling design by the selection of sampling sites and sample collection procedures. In the laboratories, representativeness will be ensured by the proper handling and storage of samples and initiation of analysis within holding times.

Comparability
Comparability is the qualitative similarity of one data set to another (i.e., the extent to which different data sets can be combined for use). Comparability will be addressed through the use of field and laboratory methods that are consistent with methods and procedures recommended by the U.S. Environmental Protection Agency (EPA) and by statistical evaluation of the data.

Completeness
Completeness is the comparison between the amount of usable data collected versus the amount of data called for in the permit and/or certification. Completeness will be determined by comparing sampling and analyses completed with the requirements in the permit. The overall completeness goal is 95 percent.

3.2 QUALITY ASSURANCE/QUALITY CONTROL

A strict QA/QC program will be implemented to ensure that representative data of the highest quality is obtained in a manner which is scientifically defensible, repeatable and well documented. In order to ensure the highest level of QA/QC, standard methods and protocols will be used for the collection of all environmental media samples. Quality assurance is obtained at the project management level through organization and planning and the enforcement of both external and internal quality control. The following lists summarize the QA/QC procedures and practices that will be followed from the onset of the monitoring program:

Internal Quality Control:

- Staffing the project with experienced/trained individuals
- Ensuring that representative, meaningful data are collected, through thorough planning and efficient research
- Use of standard protocols for sample collection, preservation and documentation

- Regular calibration and maintenance of all field equipment
- Collection of blind duplicate, blank and filter blank samples to be submitted for analysis (approximately 10 percent of overall samples).

External Quality Control:

- Employment of a fully accredited analytical laboratory for the analysis of all of the water quality samples
- Determination of analytical precision and accuracy through the interpretation of the analysis reports for the blind duplicate, blank and filter blank samples.

Quality control samples will be prepared in the field and at the laboratories to monitor the bias and precision of the sample collection and analysis procedures.

3.2.1 Field Quality Control Samples

Field QC samples for this study will include field replicates and field blanks. A summary of field QC samples that will be collected for each sampling event is provided below.

Field replicates are samples collected at the same station using the same sampling equipment and procedures. The data for field replicates are used to evaluate variability at the sampling site. One field replicate will be collected for each event at a surface water station and a separate field replicate will be collected for each event at a groundwater station.

Field blanks are samples processed with typical sampling equipment and procedures using laboratory distilled/deionized water instead of native water. The results from field blanks are used to monitor equipment decontamination procedures and to ensure that the sample containers and laboratory water do not contain analytes of interest at concentrations that impact the project samples. One equipment rinse blank is collected for every fifteen normal samples.

3.2.2 Laboratory Quality Control

Extensive and detailed requirements for laboratory QC procedures are provided in the QAPP (Integral 2007). Every method protocol includes descriptions of QC procedures, and many incorporate additional QC requirements by reference to separate QC chapters. QC requirements include control limits and, in many cases, requirements for corrective action. QC procedures will be completed by the laboratories, as required in each method protocol and as indicated in the QAPP.

The frequency of analysis for laboratory control samples, matrix spike samples, matrix spike duplicates or laboratory duplicates, and method blanks will be one for every 20 samples, or one per extraction batch, whichever is more frequent. Surrogate spikes and internal standards will be added to every field sample and QC sample, as required by the method. Calibration procedures will be completed at the frequency specified in each method description. As required for EPA SW-846 methods (USEPA 2007b), performance-based control limits have been established by each laboratory. These and all other control limits specified in the method descriptions will be used by the laboratories to establish the acceptability of the data or the need for reanalysis of the samples. Control limits for laboratory control sample/laboratory control sample duplicates and matrix spike/matrix spike duplicates are provided in the QAPP (Integral 2007).

4 SAMPLE COLLECTION AND ANALYSIS

4.1 GENERAL CONSIDERATIONS

4.1.1 Field Preparations

4.1.1.1 Necessary Equipment

Prior to each field trip the necessary field equipment should be organized to ensure that there are no critical oversights. A checklist of the necessary equipment for both surface water and groundwater sampling is provided in Appendix A. All sampling personnel should consult this list prior to each sampling event and this checklist should be updated as necessary.

4.1.1.2 Field Equipment Calibration and Maintenance

Prior to each field trip all equipment should be inspected and tested to ensure that it is operating as per the manufacturer's specifications. All *in situ* water quality probes should be maintained and calibrated as per the manufacturer's recommendations. The pre-calibration and post-calibration data readings should be recorded in a designated calibration logbook, along with the calibration dates and any maintenance activities. Calibration of all sensors may not be necessary prior to every field trip, but some sensors such as dissolved oxygen may require calibration several times in one day given changes in atmospheric pressure and elevation. Be certain to record each calibration in the field logbook if the calibration log book is not available at the time.

4.1.2 Field Notes and Observations

Daily field records (a combination of field logbooks and field data sheets) will make up the main documentation for field activities. The records and procedures most applicable to field activities are summarized in field logbooks, field data sheets, and field data management. Field notes should be directly recorded into a bound field book or onto field data sheets. The minimum information to be collected each sampling day and at each site is summarized in Table 2. Any unusual conditions or deviations from standard protocols should be documented in the field notes. The contents of the field notes should be entered into a database immediately upon return from the field and the field notes should be photocopied and placed in a hard copy and/or electronic filing system separate from the originals.

4.2 SURFACE WATER SAMPLING

The surface water sampling protocols presented here are modified from the guidelines presented in the Niblack Water Quality Baseline and Site Monitoring Plan (Knight Piésold 2007b). The protocols for collection of filtered surface water samples for dissolved metals analysis have been adjusted to follow the groundwater sampling protocols in order to reduce the possibility of sample contamination.[1]

4.2.1 *In Situ* Measurements

In situ parameters will be monitored at every water quality sampling station during each sampling event. A multi-parameter probe or several individual probes will be used *in situ* to measure the following key parameters: dissolved oxygen, specific conductance (temperature compensated to 25ºC), temperature, and pH. Field turbidity measurements will be collected opportunistically when a turbidity probe is available. The unit will be regularly calibrated and maintained to ensure the accuracy of the data collected. A calibration and maintenance logbook will be kept, with each calibration event recorded (pre- and post-calibration values); this book will be separate from the field logbook.

4.2.1.1 Field Sulfate Measurements

In addition to the regularly monitored *in situ* parameters, the PAG pond, field barrel, and settling pond station EFF1 are field tested for sulfate using the Hach SF-1 turbidimetric field test kit. Total (unfiltered) sulfate samples are collected directly into a verified clean plastic or glass sample bottle (bottles are not pre-rinsed). Sample testing procedures will follow the guidelines in the Hach Model SF-1 Sulfate Test Kit procedures manual for sulfate. A sample volume of 25 mL is required for analysis with the Hach sulfate kit.

4.2.2 Surface Water Sampling, Field Filtration and Preservation Techniques

Surface water samples will be collected by experienced field staff using standard protocols. The water quality samples will be submitted for analysis for the parameters that are specified in Table 3. The surface water samples to be collected for the Niblack Project are grab samples (not composite) from streams and creeks and, if possible, these samples should be collected from the upper foot of the water column, mid-stream, away from back eddies and possible salt water

[1] As discussed in the 2011 Annual Report, Section 3.2.1.1 (Integral 2012c), possible zinc contamination was observed in field blanks and filtered samples collected from July 2007 through March 2008. Filtered sample collection methods were revised starting in Q2 2008. No systematic evidence of contamination was observed in samples collected since Q2 2008. The improvements in the field blank results suggest that the changes in the surface water sampling protocols reduced zinc contamination during filtration.

interference or tidal influences.[2] Samples will be collected only when and where the conditions are safe. The following steps briefly outline the sampling methods:

- Ensure that the sampling technician is well anchored to the shoreline if the bank is steep and not collecting the sample alone (i.e., one arm holding onto bank object and the other is sampling).
- The sampling technician must reach out, one full arm's length towards the middle of the stream to achieve the optimal sample location.
- Each station will be sampled using a peristaltic pump equipped with clean high or low-density polyethylene tubing. New or laboratory cleaned tubing is used at each station (dedicated to that station only). The field environmental coordinator must ensure that sufficient replacement supplies are available at all times. A minimum of 250 mL of surface water will be flushed through the dedicated tubing using the peristaltic pump before collection of any samples.
- The sampling technician will remove the lid of sample bottle while being careful to ensure that no contact is made with the inside of the cap or bottle. The bottles should not be pre-rinsed as they should be clean as provided by the supplying laboratory and may contain a chemical preservative.
- When filling the sample bottles, no sampling equipment (i.e., tubing or filter housing) should touch either the bottle or the water within it.

The following outlines the basic protocols that will be adhered to during the collection, filtration and preservation of the surface water samples:

- When sampling several locations within the same stream, samples should always be collected in order from downstream to upstream.
- When the technician arrives at the site they will first place the *in situ* probe(s) into the stream, just downstream from the sample collection location (ensures that sediment disturbance does not impact the water quality samples).
- Samples must be clearly labeled, using an indelible marker, indicating the water quality sample site name, the date, the required analysis, the preservation (i.e., HNO_3 for metals samples) and any field filtration done (dissolved metals only).

[2] Due to shallow stream levels, it may not be possible to collect surface water samples from the top foot of the water column. Additionally, it may be unsafe to collect samples from the middle of the channel during periods of high stream flows. Therefore, samples should be collected at a depth and stream location determined by the sampler to be representative of flowing stream conditions and which avoids disturbance and introduction of streambed sediment into the sample.

- New disposable, powder-free sample gloves will be worn during the collection, filtration and preservation of each new set of samples. The gloves should not come into contact with the sample, the interior of the container or the interior of the cap.
- General chemistry (physical parameters, dissolved anions and nutrients) will be collected directly from the dedicated tubing into a 1-liter plastic bottle. The bottles will not be pre-rinsed.
- Total metals samples will be collected directly into a 250-mL verified clean sample bottle (not pre-rinsed) containing reagent grade nitric acid (HNO_3). Pre-preserved sample bottles typically will be provided by the analytical laboratory. If pre-preserved sample bottles are not available, or if preservative is lost, samples can be preserved in the field using one vial of the reagent grade nitric acid (HNO_3) that is provided by the laboratory. After the sample bottle has been filled (and preservative has been added if needed), the cap will be replaced and the sample bottle inverted several times to ensure that the preservative is fully mixed. The nitric acid should be handled with care (gloves and goggles), with further safety information outlined in the material safety data sheet.
- Dissolved metals samples are filtered using a 0.45-µm geotech in-line high-capacity filter. Prior to collecting the sample, a minimum of approximately 250 mL should pass through the filter and be discarded, then the dissolved sample should be collected directly from the flowing water passing though the filter into a 250 mL verified clean sample bottle (not pre-rinsed) containing reagent grade nitric acid (HNO_3). Pre-preserved sample bottles typically will be provided by the analytical laboratory. If pre-preserved sample bottles are not available, or if preservative is lost, samples can be preserved in the field using one vial of the reagent grade nitric acid (HNO_3) that is provided by the laboratory. After the sample bottle has been filled (and preservative has been added if needed), the cap will be replaced and the sample bottle inverted several times to ensure that the preservative is fully mixed. The nitric acid should be handled with care (gloves and goggles), with further safety information outlined in the material safety data sheet.
- Record the *in situ* parameters in field logbook and also record any other relevant field observations. The minimum information to be collected at each sampling day and at each site is summarized in Table 2.

4.3 GROUNDWATER SAMPLING

4.3.1 Water Levels and Purging

In order to ensure that samples are representative of the formation groundwater, samplers should attempt to purge a minimum of three well volumes. Each well will be equipped with dedicated systems that include a peristaltic pump paired with 5/8-in. high or low-density polyethylene tubing. Peristaltic pump tubing is dedicated to specific sampling stations. Tubing is replaced when deteriorated or contaminated as a result of regular use. The field environmental coordinator must ensure that sufficient replacement supplies are available at all times.

4.3.2 *In Situ* Measurements

The depth to bottom of well and well stick-up were measured during initial well sampling; these measurements are not expected to change unless the well is altered. The field measurements for water level, purge volume, and *in situ* parameters are recorded as the data is collected. One or a combination of several *in situ* meters should be used to simultaneously measure dissolved oxygen, specific conductivity, temperature, and pH using a flow cell system. If for some reason a flow cell is not practical for the sample (e.g., low water levels in the well), *in situ* measurements may be collected by lowering a multi-probe into the well immediately after all of the samples have been collected, or in a bucket of freshly purged water, though temperature and dissolved oxygen may not be as representative of *in situ* conditions when collected in this manner. The *in situ* measurements should be recorded following stabilization of the meter readings. Field data, time of collection, and method of collection (flow cell, purge bucket, or in-well) are recorded in the field book immediately.

4.3.3 Groundwater Sampling, Field Filtration, and Preservation Techniques

Groundwater samples will be collected by experienced field staff using standard protocols. The water quality samples will be submitted for analysis for the parameters that are specified in Table 3. Samples are to be collected directly from the dedicated tubing, into sterile sample containers provided by the laboratory. Individual sample container specifics, preservation, and filtration procedures are outlined below:

- Samples must be clearly labeled, using an indelible marker, indicating the water quality sample site name, the date, the required analysis, the preservation (i.e., HNO_3 for metals samples) and any field filtration done (dissolved metals only).
- New disposable, powder-free, sample gloves will be worn during the collection, filtration and preservation of each new set of samples. The gloves should not come into contact with the sample, the interior of the container, or the interior of the cap.
- General chemistry (physical parameters, dissolved anions, and nutrients) will be collected directly from the dedicated tubing into a 1-liter plastic bottle. The bottle will not be pre-rinsed.
- Total metals samples will be collected directly into a 250-mL verified clean sample bottle (not pre-rinsed) containing reagent grade nitric acid (HNO_3). Pre-preserved sample bottles typically will be provided by the analytical laboratory. If pre-preserved sample

bottles are not available, or if preservative is lost, samples can be preserved in the field using one vial of the reagent grade nitric acid (HNO_3) that is provided by the laboratory. After the sample bottle has been filled (and preservative has been added if needed), the cap will be replaced and the sample bottle inverted several times to ensure that the preservative is fully mixed. The nitric acid should be handled with care (gloves and goggles), with further safety information outlined in the material safety data sheet.

- Dissolved metals samples are filtered using a 0.45-µm Geotech® (or equivalent) in-line high-capacity disposable polyethersulfone groundwater filter. Prior to collecting the sample, a minimum of approximately 250 mL should pass through the filter and be discarded, and then the sample bottle should be filled directly from the flowing water passing though the filter. Dissolved metals samples will be collected directly into a 250-mL verified clean sample bottle (not pre-rinsed) containing reagent grade nitric acid (HNO_3). Pre-preserved sample bottles typically will be provided by the analytical laboratory. If pre-preserved sample bottles are not available, or if preservative is lost, samples can be preserved in the field using one vial of the reagent grade nitric acid (HNO_3) that is provided by the laboratory. After the sample bottle has been filled (and preservative has been added if needed), the cap will be replaced and the sample bottle inverted several times to ensure that the preservative is fully mixed. The nitric acid should be handled with care (gloves and goggles), with further safety information outlined in the material safety data sheet.

4.4 MINE EFFLUENT AND WASTE ROCK SAMPLING

The leachate and runoff water captured in the PAG pond and in the three field barrel kinetic test cells (HW1, LO1, and LO2) are monitored for *in situ* parameters and sampled for laboratory analysis. These samples provide information on waste rock weathering and chemistry. The site settling ponds, which capture mine water, water from the PAG pond, and precipitation are monitored at station EFF1. PAG pond, EFF1, and field barrel samples are collected following the surface water sample collection methods described in Section 4.2. In addition to the regularly monitored *in situ* parameters, the PAG pond, field barrel, and settling pond station EFF1 are field tested for sulfate using the Hach SF 51 turbidimetric field test, as described in Section 4.2.1.1.

4.5 SAMPLE STORAGE, CHAIN OF CUSTODY, AND SAMPLE SHIPPING

From the time of collection, all samples will be stored on ice or refrigerated at an approximate temperature of 4°C (the samples will not be frozen) until they are received at the laboratory for analysis.

The purpose of chain of custody (COC) procedures is to provide evidence that a sample has not been tampered with. This is achieved by creating an accurate written record tracing the possession of the sample from collection through final analysis and possible introduction as court evidence. The field coordinator, or the designated field sample custodian, will be responsible for sample tracking in the field. Samples will remain in the field coordinator's custody until COC forms and final sample inventory are completed in the field or at the field sample processing facility. COC forms will be used for samples that are in transit from the field site to the analytical laboratory. The custodian will relinquish the samples by signing the COC. One copy of the COC should be retained by the custodian and the remaining copies should be enclosed in a Ziploc bag and sealed into the coolers to accompany the samples via courier to the laboratory.

Samples are considered to be in custody if they are 1) in the custodian's possession or view, 2) in a secured location (under lock) with restricted access, or 3) in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). The principal documents used to identify samples and to document possession are COC records, field logbooks, and field tracking forms. COC procedures will be used for all samples at all stages in the analytical or transfer process and for all data and data documentation, whether in hard-copy or electronic format. An example of a COC form is provided in Appendix B.

Samples will be shipped to the laboratory in ice chests sealed with custody seals. Each ice chest will have three seals, one on the front of the chest and one on each side. The laboratory sample custodian will establish the integrity of the seals at the laboratory. The way bill of the carrier used to ship samples will provide additional custody and sample tracking information. The way bills will be maintained in the project file. Prior to shipping the samples the individual bottles and labels should be re-examined to ensure that all information is filled in and that the bottles are sealed. The coolers should be packed with paper or other clean packing materials to prevent excess bottle movement and then they should be sealed very securely with packing tape. The exterior of each of the coolers will be clearly labeled with the address of the laboratory and with all of the necessary handling stickers (e.g., "This Side Up," "Test Samples – Not For Drinking Water," "Fragile," etc.).

The sample custodian at the laboratory will accept custody and log samples into the lab information management system (LIMS). The sample custodian will check that the COC forms were properly completed and signed, that a sample receipt form is completed for each cooler, and that samples are stored under the required temperature conditions. The laboratory will deliver a copy of the COC and sample receipt form to the QA manager. Any breaks in the COC or non-conformances will be noted and reported in writing to the QA manager within 24 hours of receipt of samples. Specific laboratory COC procedures are described in the QAPP (Integral 2007).

4.6 LABORATORY ANALYTICAL TECHNIQUES AND RECOMMENDED HOLDING TIMES

Laboratory methods to be used for the Project are consistent with approved methods listed in 40 CFR 136. Columbia Analytical Services (CAS) in Kelso, Washington, analyzed all Niblack Project surface water and groundwater samples collected since July 24, 2007. CAS holds full approval from ADEC as a Contaminated Sites Lab (Approval UST-040) and is accredited by NELAP to ISO 17025:2005 standards. The water quality samples collected from 1996 through July 2, 2007 were sent to ALS Environmental (ALS; Vancouver, BC).

Samples are analyzed for the following:

- Conventional analyses
- Cations/anions
- Total/dissolved metals.

Specific parameters analyzed and reported are listed in Table 4. Detailed information about laboratory methods for sample preparation and analysis is presented in the QAPP (Integral 2007). The analytical techniques and recommended sample holding times for each specific analysis are also provided in Table 4.

As described in Section 2, in 2008, ADEC approved changes to the permit requirements for sampling and analysis of groundwater and surface water (George 2008, pers. comm.). These changes included reduction of the Project analyte list to include only those parameters needed to determine permit compliance, as well as selected additional general water quality parameters needed to track trends in overall water quality. Parameters included in the reduced and original analyte lists are identified in Table 4. The reduced analyte list was implemented beginning in Q3 2008 and is incorporated into these guidelines for future analyses.

4.7 DATA MANAGEMENT

Daily field records (a combination of field logbooks and field data sheets) will make up the main documentation for field activities. The records and procedures most applicable to field activities are summarized in field logbooks, field data sheets, and field data management.

Data that are generated during sample collection and sample preparation will be manually entered into the field logbook and field data sheets. Data from these sources will be entered into an electronic database directly from the field logbook. These data include station location coordinates, station names, sampling dates, sample identification codes, and additional station and sample information (e.g., water depth, sample type). Data will be reviewed for accuracy and completeness, and any errors will be corrected before the data are considered final in the Niblack Project database and approved for release to data users.

A wide variety of manually entered and electronic instrument data are generated at the laboratories. The LIMS is the central data management tool for each laboratory. All manual data entry into the LIMS is proofed at the laboratory. All data collected from each laboratory instrument, either manually or electronically, are reviewed and confirmed by analysts before reporting. The LIMS is used for every aspect of sample processing, including sample log-in and tracing, instrument data storage and processing, generation of data reports for sample and QC results, and preparation of electronic data deliverables (EDDs). Laboratory data will be entered directly into the Niblack Project database from the EDD.

The water quality will be reported according to the requirements in Section 8.2 – Water Quality Reporting Requirements and Frequency.

5 SURFACE WATER AND GROUNDWATER MONITORING LOCATIONS

Onsite surface water and groundwater quality monitoring locations are shown on Figure 3, with currently active monitoring stations shown in blue. Stations shown in green and orange are not monitored on a regular basis at this time, as discussed in more detail below. Figure 4 shows offsite reference surface stream monitoring locations. Table 6 presents station coordinates, descriptions, and activity status, and purpose. Generally, the points for evaluating compliance with site-specific natural condition criteria are downstream surface water sites and downgradient wetland groundwater sites. The sections below present additional detail about each monitoring station.

As described in Section 2, in 2008 ADEC approved changes to the Permit requirements for sampling and analysis of groundwater and surface water (George 2008, pers. comm.). These changes included reduction in the location and frequency of surface water and groundwater monitoring. In particular, regular water quality monitoring was discontinued at upstream (i.e., concurrent monitoring) surface water locations on Waterfall Creek (WQ8), Camp Creek (WQ7), and Unnamed Creek 1 (WQ12) and at upgradient/offsite groundwater sites MW7, MW8, and MW9. These changes were implemented beginning in Q3 2008 and are incorporated into these guidelines for future monitoring. Since Q3 2008, surface water stations WQ4, WQ6, WQ10, and WQ13, and groundwater wells MW1, MW2, MW3, and MW4 have been monitored on a regular basis. These are also the locations of planned future monitoring during active site operations.

5.1 SURFACE WATER MONITORING STATIONS

The surface water quality monitoring stations located at or near the areas of active operations are shown on Figure 3, and the general station details are in Table 6. Active water quality stations are shown with blue symbols. Stations which were used for baseline monitoring that are currently inactive are shown as orange symbols. Stations which were discontinued in Q3 2008 per agreement with ADEC are shown in green.

Within Waterfall Creek two water quality sites were established, WQ4 and WQ8. WQ4 is located near the creek outlet, just upstream from the high tide water line. This station was monitored for pre-activity baseline conditions and serves as a compliance monitoring station now that the site is in a phase of active operation. WQ8 is located on the northern headwaters tributary, upstream of the access road. WQ8 is considered to be the upstream control site for the Waterfall Creek stream system. This station is no longer monitored per agreement with ADEC (George 2008, pers. comm.).

Three sites were established within the Camp Creek stream system: WQ6, WQ5 and WQ7. WQ6 is located near the creek outlet. Pre-activity baseline was collected at WQ6; this station now serves as a compliance monitoring station. WQ5 is located upstream, and approximately 50 to 100 m below the access road; this station was monitored during historical baseline sampling from 1996 to 2006 and is no longer sampled. WQ7 is located further upstream, just above the road. WQ7 is considered to be the upstream control site for the Camp Creek stream system and is no longer monitored per agreement with ADEC (George 2008, pers. comm.). Future sampling within Camp Creek will occur at only site WQ6.

There are three water quality sample sites within the Unnamed Creek 1 drainage system: WQ10, WQ12 and the "Seep." WQ10 is situated just upstream of the old camp site (outside the influence of any historic mining) and downstream of the access road and PAG temporary waste disposal area. Pre-activity baseline was collected at WQ10; this station now serves as a compliance monitoring station. WQ12 is located upstream of the road in the southern most headwater tributary to this stream, which is routed via a ditch to Unnamed Creek 1. The "Seep" site was unearthed during the construction of the road and is a well-defined groundwater channel, originally several meters below the natural ground surface. This seep has a strong flow that is directly related to precipitation events, and water from this site now enters into the ditch that flows into Unnamed Creek 1 upstream of WQ10. Water from the "Seep" and WQ12 are considered to be upstream control sites within Unnamed Creek 1. WQ12 is no longer monitored per agreement with ADEC (George 2008, pers. comm.), and monitoring at the "Seep" station is not required by the Permit. Future sampling within Unnamed Creek 1 will occur at only site WQ10.

Four other water quality sites were established further from the central core of the study area in creeks referred to as Dear Pasture Creek, Lookout Creek, Myrtle Creek, and Boulder Bay (Figure 4). WQ1 is a reference site located at the base of Dear Pasture Creek, just above the high tide line. This site is located near the mouth of the inlet, approximately 1.4 miles (2.2 km) to the southeast of the main property. WQ2 is situated at the base of Lookout Creek, just above the high tide line. This site is located on the southern side of the inlet approximately 0.8 miles (1.3 km) to the southeast of the main property. WQ3 is located at the base of Myrtle Creek, just above the high tide line. Myrtle Creek is the main drainage point to the isolated small lake to the north of the main property. WQ14 is located near the outlet of a stream that drains the south side of Lookout Mountain. Monitoring at the four offsite stations is conducted in order to develop additional baseline data and is not required by the Permit. The frequency of monitoring and target parameter list will be determined by NPLLC.

5.2 GROUNDWATER MONITORING STATIONS

The locations of the groundwater quality monitoring stations are shown on Figure 3, and the general station details are in Table 6. Active water quality stations are shown with blue symbols. Stations which were used for preliminary monitoring that are currently inactive are shown as orange symbols. Stations which were discontinued in Q3 2008 per agreement with ADEC are shown in green.

5.2.1 Preliminary Groundwater Sample Sites

The two preliminary groundwater sample locations were created in two exploration drill holes that are located in the lower reaches of the property. GW1 in between Camp Creek and the Unnamed Creek 1 and GW 2 is located at a slightly lower elevation, between Camp Creek and Waterfall Creek (Figure 3). Results from these wells were included in the Niblack Water Quality Baseline and Site Monitoring Plan (Knight Piésold 2007b). Sampling at GW1 and GW2 was discontinued following construction of the permanent monitoring wells in 2007.

5.2.2 Permanent Groundwater Monitoring Well Locations

Four permanent monitoring wells (MW1, MW2, MW3, and MW4) were established in February 2007 to monitor the shallow groundwater in wetlands downgradient of the site facilities and water discharge LAD system. MW7 is located south of the active Project area to serve as an offsite reference station. The wells are located in wetlands at depths of 24 to 36 in. The wells consist of a stainless steel mesh, silica sand pre-packed, 2.5-ft PVC screen with 2.5-ft riser. The well inner diameter is 1.5 in. and the outer diameter is 2.4 in. Locking caps and bentonite mounded at the base of the riser prevent downward infiltration of rain and surface waters.

Two bedrock monitoring wells (MW8 and MW9, Figure 3) were installed for baseline groundwater monitoring in June 2007. The boreholes were drilled using an air percussion drill rig with a 4.5-in. diameter carbide button bit. Rock chips were collected approximately every 2 ft for logging purposes. Once each borehole was drilled to the target depth, rock chips were removed to the extent possible using compressed air blown through the drill tool assembly. MW8 and MW9 were constructed of 2-in. diameter Schedule 40 PVC casing with flush-threaded couplings. A 5-ft section of 2-in. diameter 0.010-in. mill-slotted PVC pre-packed well screen with a threaded end cap was placed at the bottom of each borehole. Wells MW8 and MW9 were screened from 7.9 to 12.9 ft and 14.1 to 19.1 ft below ground surface, respectively. Blank PVC casing extended from the top of the screen to approximately 2 ft above ground surface. The annular space was backfilled with #10/20 Colorado silica sand to 2 ft above the top of the pre-packed well screen. A 2- to 3-ft-thick bentonite chip seal was placed on top of the filter pack and hydrated with potable water to ensure a proper seal. The remainder of the annular space was filled with bentonite chips to the ground surface. Following construction, each well was allowed to sit for approximately of 24 hours to allow the bentonite seal to stabilize. The monitoring wells were then developed by over-pumping and surging using a decontaminated 1.5-in diameter, three-stage submersible pump capable of pumping approximately 2 to 3 gpm.

The well locations are shown on Figure 3. Well MW7 is located outside the area impacted by human activities to provide reference data. Monitoring well MW1 is located downgradient of the NAG waste disposal area. Wells MW2, MW3, and MW4 are located immediately downgradient of LAD water discharge system zones. These wells were sited within 50 ft or less of the interface between upland LAD zones and wetland. Wells MW2 and MW3 are also downgradient of the PAG temporary storage facility and the settling/treatment ponds. The two bedrock wells, MW8 and MW9, are located just upgradient of site facilities. MW8 is upgradient of the settling ponds and access road; MW9 is north of the PAG storage facility.

5.3 MINE EFFLUENT AND WASTE ROCK MONITORING

The mine effluent (EFF1), PAG pile leachate/runoff (PAG pond, and PAG Leak Detection) and field barrel (HW1, LO1, LO2) monitoring locations provide information about site effluent quality and waste rock behavior. These stations are monitored for information purposes only and are not used to evaluate compliance.

Station EFF1 is located in the site settling ponds (Figure 3). Sample water is collected from within the ponds at the outlet pipe which flows to the LAD system. Water sampled at station EFF1 is representative of the water which is discharged from the LAD system emitters.

The PAG temporary waste rock storage facility (Figure 2) was constructed in spring 2008 for the temporary storage of the blast rock determined to be potentially acid generating during drift excavation. Runoff and leachate from the PAG waste rock pile is monitored at the PAG pond (Figure 3).

A visual monitoring station was established below the PAG waste disposal area as part of a leak detection system. This site is called PAG Leak Detection. No water is anticipated to collect at this point unless there is a breach in the liner.

Three field barrel kinetic testing cells (HW1, LO1, and LO2) are operated on the Niblack property to evaluate waste rock weathering. The field barrels are located north of the PAG waste rock pile.

5.3.1 Location of Water Quality Stations in Relation to Project Activities and Facilities

Figure 3 shows the location of monitoring stations in relation to Niblack project facilities. Baseline/reference stations WQ8, WQ7 and WQ12 are all situated upstream of project facilities on Waterfall Creek, Camp Creek, and Unnamed Creek 1, respectively. Offsite reference stations (Figure 4) WQ1, WQ2, WQ3, and WQ14 are not located in the vicinity of any of the project activities or components.

Groundwater reference stations MW8 and MW9 are located immediately upgradient of site facilities. Monitoring well MW7 is located in a small area of wetland approximately 600 ft east of the patented mineral claim boundary and well outside the influence of waste rock storage, water treatment/land application facilities, and other types of human disturbance.

Surface water and groundwater compliance points are located downgradient of the active project areas. The surface water stations WQ6 (Camp Creek) and WQ10 (Unnamed Creek 1) are located downstream of LAD discharge system zones and site facilities including the PAG temporary storage area. Surface station WQ4 monitors Waterfall Creek below the site settling ponds and the easternmost zones of the LAD system. Groundwater stations MW2, MW3, and MW4 are located in the shallow wetlands immediately downgradient of the LAD discharge system zones. Surface water station WQ13 (Unnamed Creek 2) and monitoring well MW1 are located downgradient of the NAG waste disposal area.

6 MONITORING FREQUENCY

6.1 SURFACE WATER AND GROUNDWATER MONITORING FREQUENCY

Under the Permit, monthly monitoring of surface water and groundwater sites is required until 20 valid samples have been collected, after which the monitoring frequency becomes quarterly. The minimum requirement of 20 valid samples has been met at monitoring stations identified in the Permit, including surface water stations WQ4, WQ6, WQ7, WQ8, WQ10, WQ12, and WQ13; and groundwater stations MW1, MW2, MW3, MW4, and MW7, as shown on Table 7. Fifteen valid samples were collected at reference monitoring wells MW8 and MW9 prior to discontinuation of these stations per agreement with ADEC (George 2008, pers. comm.). The Permit requires a reversion to monthly monitoring if statistically significant increases over natural levels are observed, or if significant upward concentration trends are observed, unless the cause is shown to be natural or corrected (if caused by project activity).

A quarterly monitoring program was implemented beginning in Q3 2008 at the active surface water stations WQ4, WQ6, WQ10, and WQ13 and groundwater wells MW1, MW2, MW3, and MW4. Because the minimum number of samples had been collected at baseline/reference surface water stations WQ7, WQ8, and WQ12 and reference groundwater well MW7, sampling was discontinued at these stations beginning in Q3 2008. These changes are incorporated into the guidelines for future monitoring presented in this monitoring plan. Future monitoring at surface water and groundwater stations will continue on a quarterly schedule as described in Table 8.

6.2 MINE EFFLUENT AND WASTE ROCK MONITORING FREQUENCY

The setting pond monitoring station EFF1 is sampled for field parameters on a weekly basis and full water chemistry on a quarterly basis. Quarterly samples are collected concurrent with quarterly surface water and groundwater monitoring.

The leachate and runoff water captured in the PAG pond is monitored on a weekly basis for field parameters including pH, sulfate, conductivity, dissolved oxygen, and total dissolved solids. Additional chemistry parameters, including conventional parameters, major cations and anions, and metals, were collected on a monthly basis from August 2008 to May 2012. Monthly PAG monitoring reports were submitted to ADEC during this time period. NPLLC has requested approval to begin a quarterly monitoring and reporting schedule for PAG pond chemistry parameters beginning in the second quarter of 2012. Field parameter monitoring will continue on a weekly schedule and will serve as an early indicator for any potential changes in PAG pond water quality. If a significant reduction in pH, or increase in sulfate or other field parameters, is observed, the chemistry monitoring frequency may be increased as determined by NPLLC and ADEC/ADNR.

Three field barrel kinetic testing cells (HW1, LO1, and LO2) are monitored for field parameters on a weekly basis and full water chemistry on a monthly basis. Barrel samples are collected on a quarterly basis concurrent with surface water and groundwater monitoring. Note that the PAG pond and field barrels are susceptible to freezing during winter months. Additionally, during extended periods without precipitation the PAG pond and barrels may not contain an adequate volume of water for sampling. Samples that are not collected due to frozen or dry conditions are noted in the monthly PAG monitoring reports.

A sample station, called PAG Leak Detection, exists below the PAG waste disposal area as part of a leak detection system. No water is anticipated to collect at the PAG Leak Detection catchment unless there is a breach in the PAG liner. If a liner breach occurs and water is observed in this area, samples will be collected concurrent with PAG pond samples. More frequent sample collection may also be conducted, as needed.

6.3 TEMPORARY CLOSURE AND POST-CLOSURE MONITORING

Post-closure visual and water quality monitoring will be performed according to the Niblack Waste Management Permit (2006-DB0037). The post-closure water monitoring schedule includes and biannual water quality sampling at four groundwater wells and two surface water stations in years 1 and 2. Additional water quality sampling will be conducted at one groundwater well and two surface water stations once annually in years 5, 10, 20 and 30. Additionally, if the closed drift fills and water discharges from the portal, post-closure monitoring of the discharge water is required for years 1, 2, 5, 10, and 30. The post-closure monitoring program schedule is summarized in Table 9. Temporary closure monitoring will be performed on a quarterly basis.

Monitoring after project activities cease will also include visual inspections to evaluate reclamation success, vegetative health, erosion, and the physical integrity of the adit closure, water diversion structures, and roads. Annual inspections of the site will occur during the first 3 years after cessation of project activities, or until release from the reclamation surety. Soil and vegetation monitoring will focus on monitoring reclaimed areas for vegetation success and identifying and correcting any erosion problems. Vegetation surveys will be completed during each year to evaluate the revegetation success criteria outlined in the Niblack Reclamation and Closure Plan 2012 Post-Construction Update (Integral 2012a).

7 APPLICABLE STATE AND FEDERAL WATER QUALITY STANDARDS

EPA compiled the National Recommended Water Quality Criteria, which are pursuant to Section 304(a) of the Clean Water Act. The State of Alaska, ADEC, used these criteria to develop water quality standards under 18 AAC 70 and the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances (ADEC 2008).

As stated in the Niblack Waste Management Permit (2006-DB0037), Section 1.13, ADEC has determined that natural water quality in surface water and groundwater at the Niblack site exceeds water quality for parameters including pH, aluminum, cadmium, copper, lead, nickel, silver, and zinc. For this reason, site-specific natural condition-based water quality criteria have been established for the Niblack Project for surface water and shallow wetland groundwater. Specific procedures for establishing site-specific water quality parameters are specified in the QAPP (Integral 2007) and are based on ADEC's Guidance for the Implementation of Natural-Condition Based Water Quality (ADEC 2006).

Surface water monitoring is designed to determine compliance with site-specific water quality standards. Section 1.6.3 of the Permit describes the following guidelines for determination of compliance with site-specific water quality criteria:

> For surface streams, downstream water quality shall not be statistically significantly higher in any parameter than upstream water unless the reason for that increase can be shown to be natural.

Groundwater monitoring provides information on water quality trends in groundwater within the wetlands downslope of the Project facilities, for compliance review. Permit Section 1.6.4 outlines groundwater quality guidelines:

> For shallow groundwater in the wetlands, water quality shall be maintained at or better than the natural background water quality determined before commencement of any exploratory activity.

As stated in the Permit, if site-specific water quality measures are exceeded, the cause of the exceedance will be determined. If natural occurrences cause the exceedance, as determined by ADEC, monitoring per the guidelines set forth in this plan will be sufficient. If the exceedance is due to waste rock leachate, a plan for additional monitoring and remediation will be submitted to ADEC.

7.1 STATISTICAL METHODS FOR EVALUATION OF WATER QUALITY

As described in Section 2, in 2008 ADEC (George 2008, pers. comm.) approved discontinuation of the concurrent measurement approach for surface waters at the site (Waterfall Creek, Camp Creek, and Unnamed Creek 1). This change was implemented beginning in Q3 2008 and is incorporated into the guidelines for water quality analysis presented here.

The following statistical procedures for determining site-specific criteria and evaluating surface water and groundwater quality have been utilized for the Niblack Project. Details regarding the analytical methods applied in each of these tools and screening results are provided in the annual reports (Integral 2008, 2009, 2010, 2011a, 2012c).

7.1.1 Weight of Evidence Compliance Approach

Prior to evaluation using the statistical methods described below, the Niblack surface water and groundwater data are screened against ADEC chronic aquatic life criteria (ADEC 2008) for trace elements included in Tables B, C, and E of the Permit. This identifies a limited number of analytes and locations where further statistical evaluation is needed to determine compliance with natural conditions-based water quality standards. Water quality trends are also evaluated using time series data plots.

7.1.1.1 Natural Conditions Tool

The ADEC natural conditions approach (also referred to as the statistical characterization approach in ADEC guidance) determines natural conditions-based standards based on statistical characterization of the distribution of historical (pre-activity) data at the site and current (post-initiation) reference station concentrations. The natural conditions approach produces a site-specific standard that is variable in time as more reference sampling results become available. With the natural conditions approach, compliance data are screened against these calculated site-specific standards external to the Natural Conditions Tool (NC Tool). The ADEC Natural Conditions Tool Microsoft Excel spreadsheet (Alaska_NC_Tool_Base.xlsm, Version 2 or most recent update) and associated user guide (Tetra Tech 2010) will be used to determine site-specific standards. Water quality results from compliance stations are then screened against the calculated standards.

The annual reports (e.g., Integral 2012c) describe limitations inherent to the NC Tool, including use of the lower-bound central tendency to select criteria, data trimming techniques, and treatment of nondetect values. Additional statistical tests utilizing common population-level and upper prediction limit statistical techniques are applied to the Niblack data for comparison to the NC Tool results. These tests are described below.

7.1.1.2 Alternative Population Test

The Niblack QAPP (Integral 2007) recommends a general statistical approach to compare compliance and reference data for the Niblack Exploration Project, to be applied in parallel to the ADEC NC Tool. The general statistical method recommended in the QAPP is a single-value *t*-test (or its non-parametric equivalent), with a false positive rate (α) of 0.05. The test evaluates whether or not a compliance sample measurement is significantly different than the central tendency of the reference data. This method is generally consistent with ADEC's guidance for natural conditions assessment, although the treatment of outliers may differ and the treatment of nondetects does differ from ADEC's NC Tool. Software tools to carry out the steps above have been implemented in the R programming language. The tools are a set of R functions that have been tailored specifically for the data and analyses needed for this project. These allow for statistical analyses to be carried out in an interactive and adaptive fashion by issuing commands to execute these functions at the R console.

The Niblack alternative population test is not required under ADEC guidelines. Use of this tool may be discontinued in future annual reports.

7.1.1.3 Upper Prediction Limit Test

As an alternative to the comparisons of central tendency embodied in the NC Tool and the Niblack alternate population test approach described in the previous sections, EPA guidance (e.g., USEPA 1989, 1992, 2006, 2007a) recommends the use of estimates of an upper percentile of a reference data set (e.g., the 90th or 95th percentile) as an appropriate approach to make comparisons between background data and individual measurements from a compliance point. One such estimate is an upper prediction limit (UPL). A UPL is the upper bound of a prediction interval, defined as a statistical interval, based upon historical and/or background data, within which a newly and independently obtained site compliance observation will fall within a given probability (or confidence coefficient; Gibbons 1994). A UPL represents an estimate of a threshold value in the upper tail of the data distribution. Therefore, a UPL should represent a number larger than the lower confidence limit on the mean (as applied in the NC Tool) and the upper confidence limit on the mean (as applied in the alternate population test approach). Upper threshold values, such as UPLs, are commonly used when individual point-by-point compliance observations are compared with a background compliance limit.

8 WATER QUALITY REPORTING

8.1 WATER QUALITY REPORTS COMPLETED TO DATE

Section 1.7.3 of the Niblack Permit requires submittal of a comprehensive annual report to ADEC. A detailed review of baseline surface water and groundwater quality data collected during seven sampling events from 1996 through 2006 is presented in Niblack Water Quality Baseline and Site Monitoring Plan (Knight Piésold 2007b). Up-to-date water quality monitoring results are reported and evaluated in reports that are submitted to ADEC on a regular schedule. The annual reports (Integral 2008, 2009, 2010, 2011a, 2012c) are comprehensive summaries of current and historical water quality. These reports include water quality monitoring results presented as time series plots, statistical analyses, screening against Alaska water quality standards, QA/QC evaluations, tabulated data, and visual monitoring logs. Quarterly reports (e.g., Integral 2011b) present water quality monitoring results for a given quarter. To date, 15 quarterly reports have been submitted to ADEC, beginning with Q3 2007. Results of onsite waste rock kinetic tests and effluent settling pond monitoring are reported monthly (e.g., pHase 2011). Twenty-two PAG reports have been submitted to ADEC since the reporting requirement began in Q3 2008.

8.2 WATER QUALITY REPORTING REQUIREMENTS AND FREQUENCY

Section 1.7.3 of the Niblack permit requires submittal of a comprehensive annual report to the Alaska Department of Natural Resources (ADNR) and ADEC. The annual report must include the following:

- A summary of monitoring results
- Graphical presentations of data for time series analysis and trend detection
- Descriptions of any observed impacts to vegetation in the LAD and wetlands areas
- Volumes of PAG and NAG waste rock produced
- An overview of project progress and work proposed for the coming year
- A summary of foreseen changes to the plan of operations.

If applicable, the annual reports will also include a summary that explains any water quality exceedances of site-specific criteria, the extent of contamination, whether migration from the disposal or treatment facilities caused changes in water quality, and actions taken to correct water quality issues.

In addition to the yearly summary, the Niblack Permit Section 1.7.2 specifies that surface and groundwater monitoring results will be submitted to ADEC on a quarterly basis. Based on the current quarterly monitoring schedule, the following monitoring reports will be submitted: Q1 (January–March), Q2 (April–June), Q3 (July–September), and Q4 (October–November). Q4 monitoring results are incorporated into the annual report and are not reported separately. Reports will include electronic data submission and graphical presentations of data for time series analysis and trend detection. Monitoring reports will be submitted to ADEC within 60 days of receiving laboratory data or by the date(s) stipulated in the permit. Quarterly and annual reports will incorporate all information elements identified in the Groundwater Monitoring Report Format fact sheet (ADEC 2011).

8.2.1 PAG Pond and Field Barrel Reporting

As described in Section 2, a PAG pond monitoring and reporting program was established in 2009 as part of the agreement to waive the PAG waste rock pile cover requirement (Buteyn 2009, pers. comm.). The original monitoring program (August 2008 to May 2012) involved monitoring of field parameters on a weekly basis and full water chemistry on a monthly basis, with monitoring results submitted to ADEC in monthly reports. Beginning in the second quarter of 2012, the analytical chemistry sampling frequency will be reduced to a quarterly basis (field parameters will continue to be monitored on a weekly basis to provide early indications of possible changes in water chemistry). The quarterly water quality monitoring reports will include weekly field parameter and quarterly chemistry results for the PAG pond, settling pond station EFF1, and the field barrels in tabular and graphical format. The reports also include a summary of the PAG waste rock volume and volume of runoff water captured in the PAG pond and routed to the site settling ponds and LAD system.

8.2.2 Violations

As stated in Permit Section 1.6.12, if site-specific water quality measures are exceeded, the results will be evaluated to determine the cause. If the cause of exceedance is due to waste rock leachate, a plan for additional monitoring and remediation will be submitted to ADEC within 90 days of the determination. The plan will include:

- A determination of the extent of contamination
- A determination as to whether or not migration from the disposal or treatment facilities was the cause of the change in water quality.

ADEC will determine the extent of further sampling and corrective action if needed.

9 VISUAL MONITORING

Weekly visual monitoring requirements are specified in Section 1.6.11 of the Waste Management Permit. Visual monitoring includes examination of the LAD dispersal area for stress to vegetation and channelization or other signs of erosion, as well as visual monitoring of the entire facility for signs of damage or potential damage to waste piles, wastewater settlement/treatment and land application systems, roads, and stormwater management structures. Facilities will be inspected for settlement, leakage, erosion, thermal instability, frost action, thawing of waste, or operations at the site. Monitoring of facilities shall also include above-grade portions of groundwater monitoring devices, visible portions of liners (including slippage of flexible liners or damage to anchors) containment structures, retaining walls, erosion control structures, run-on control structures, and diversion structures to ensure that all are not damaged and are operating as designed.

Visual monitoring will be done with a visual inspection checklist form; an example of the form is provided in Appendix C. The visual inspection reports will include a brief summary of observations (completed Visual Site Inspection Form) and any actions taken. The form is used to record all observations and conditions. Copies of the completed visual monitoring forms will be made available for ADEC inspection and are submitted as an appendix to the annual reports. ADEC will be immediately notified of significant changes observed during visual monitoring. Visual inspections will be carried out by a person who is familiar with the ADEC solid waste management permit application, and permit, which includes this monitoring plan, the reclamation and closure plan, and the operations plan.

The inspection will consist of walking the overall facility, including a path at the lower aspects of the landfill footprint, and documenting observations using the Visual Site Inspection Form.

Items in the visual monitoring checklist designed specifically for the PAG waste rock storage area will include, at a minimum, the following:

1. Conduct weekly visual inspections of the PAG waste disposal facility while in operation; this is in addition to routine daily inspections as part of the operation. Check for visible signs of damage to the liner system including slippage of the liner or its anchor(s).
2. Check for signs of potential damage to the facility from settlement, operator negligence, frost action, erosion, or other risks to both the liner integrity and waste pile sealant/cover.
3. Check for violations of conditions of the Waste Management Permit.
4. Observe any escape of leachate.
5. Observe any damage to the structural integrity of the seepage structure or “backwall,” or the diversion berm, or stormwater diversion structures, containment structures,

retaining walls, erosion control structures, and run-on control structures, and ensure that all are operating as designed.

6. Check for blockages in the diversion channels.
7. Check for evidence of death or stress to fish, wildlife, or vegetation cover caused by the facility.

Permit Section 1.7 requires that ADEC be notified within 1 working day if significant changes are observed as a result of visual monitoring. If stress to vegetation or channelization is observed, corrective actions will be initiated.

10 CORRECTIVE ACTION

If any structural change in, or damage to, a facility is found such that environmental damage is likely to occur, or any violation of a permit condition is observed during monitoring or an inspection, NPLLC will take appropriate action to correct the damage or violation, prevent the escape of waste or leachate, and clean up any improperly disposed wastes. A corrective action plan is to be submitted to ADEC for approval prior to commencement of the corrective actions.

If a significant change in water quality is detected at a point of compliance as a result of the surface water monitoring program based on the criteria established in this monitoring plan, or if a water quality standard is exceeded at any surface water point of compliance or downgradient groundwater monitoring well, NPLLC will take the following actions:

- Orally notify and consult with the ADEC within 1 working day
- Submit to ADEC documentation of the occurrence and a plan to determine the cause and/or source of the exceedance
- Evaluate whether the water quality standards in 18 AAC 70 are threatened to be or are exceeded at the point of compliance
- Determine if migration of waste or leachate from the disposal or treatment facilities is the cause of the change in water quality
- Determine the extent of the waste or leachate migration contamination
- Submit for ADEC approval, within 10 working days, a plan of corrective actions to prevent adverse environmental impacts and further exceedances of applicable water quality standards or permit limits
- Implement the corrective action plan as approved by ADEC.

If the engineered liner to the PAG waste disposal facility has visually observable damage, NPLLC shall submit to ADEC, within 30 days of the problem being noticed, details of the problem and a proposal on how to mitigate the problem.

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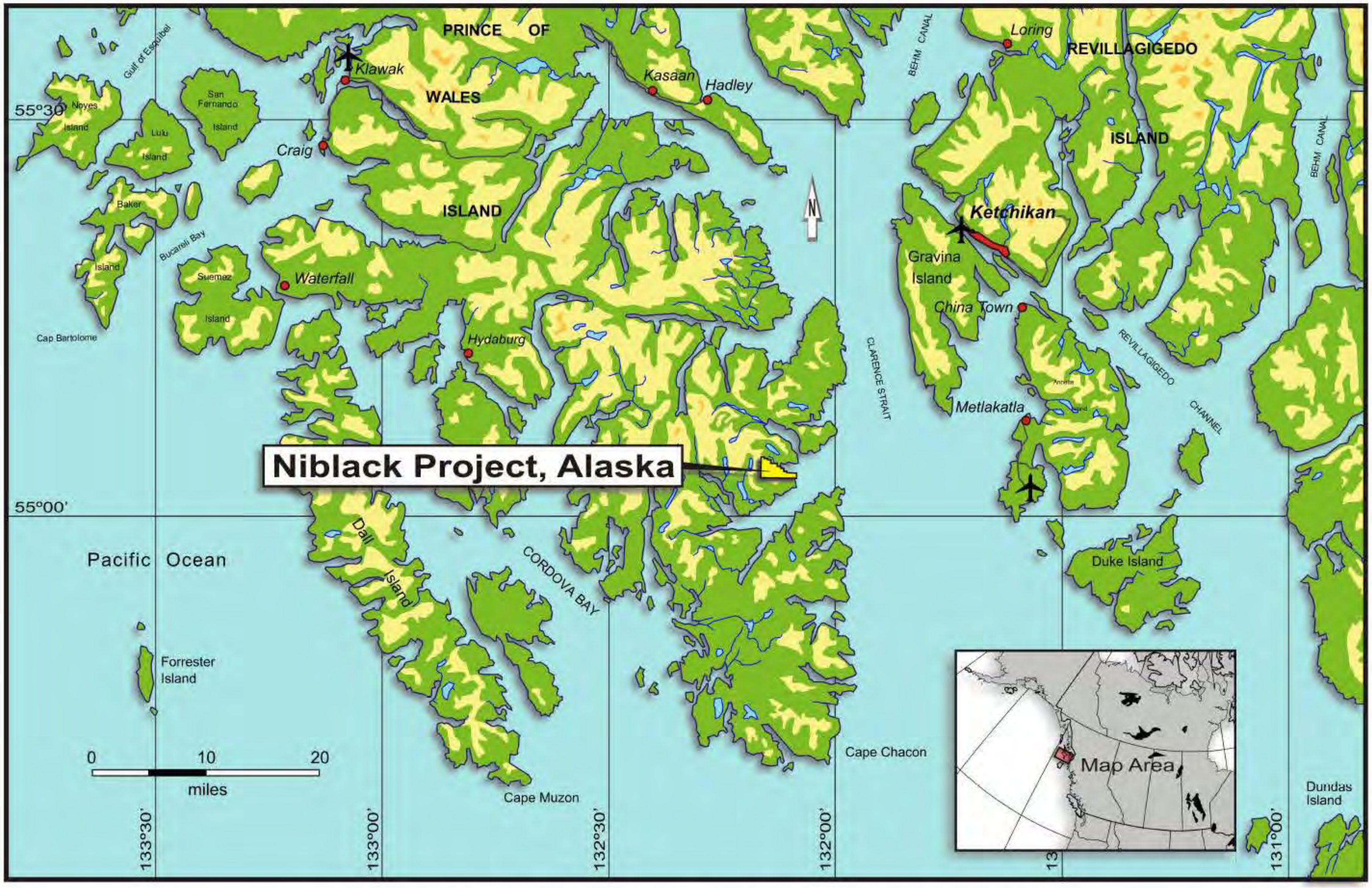
FIGURES



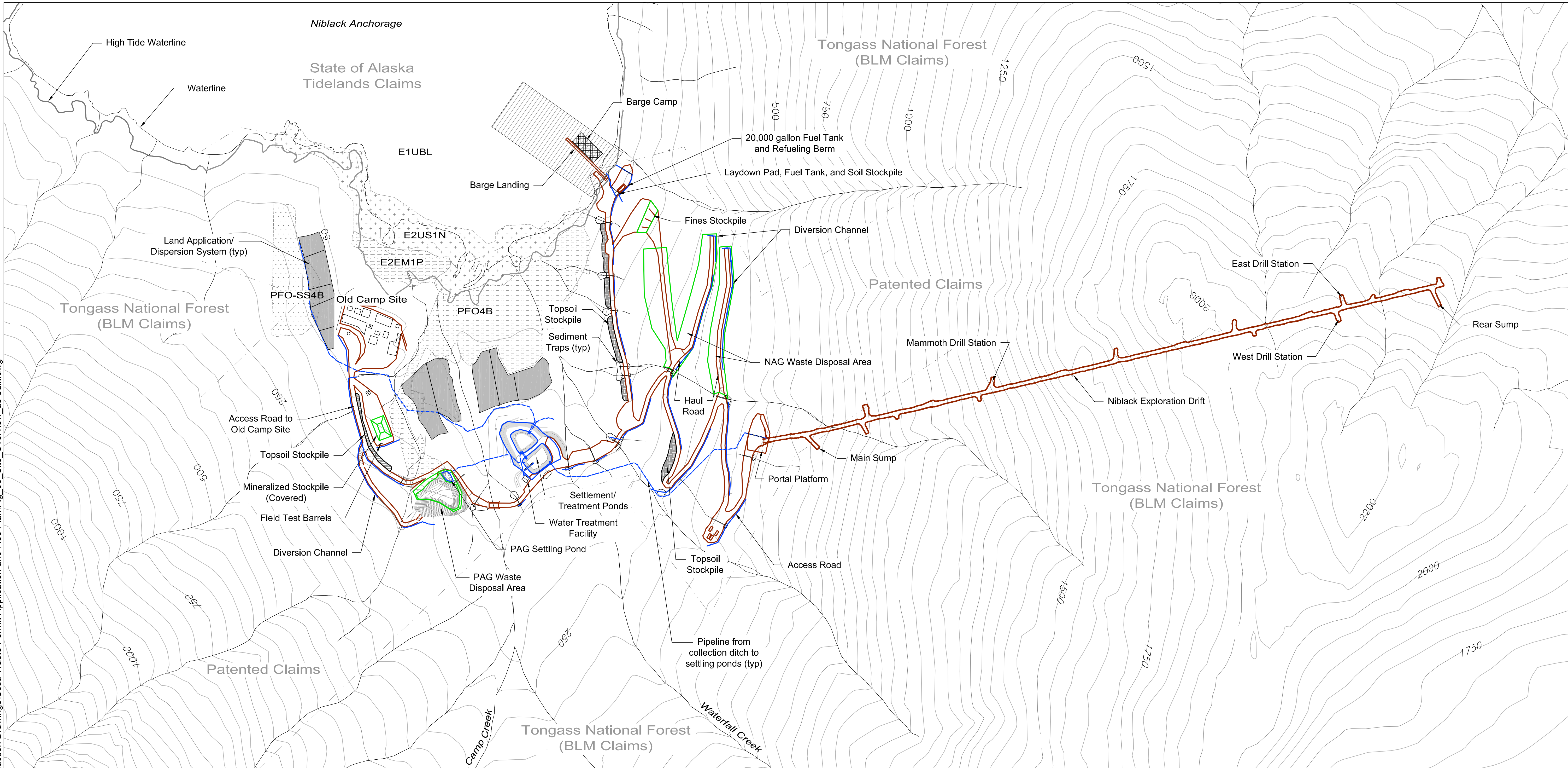
Niblack Project Location Map

May, 2006

NIBLACK PROJECT LLC

integral consulting inc.

Figure 1
Niblack Project Location Map
Niblack Water Quality Monitoring Plan
2012 Post-Construction Update



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LEGEND

- E1UBL Estuarine - Subtidal
- E2US1N Estuarine - Unvegetated Intertidal
- E2EM1P Estuarine - Emergent Intertidal
- PFO-SS4B - Needleleaf Forest/Scrub - Shrub Wetland
- PFO4B - Needleleaf Forest Wetland
- Land Application Areas
- Tideland Lease Area
- Property/Patented Claim Boundary
- Waste Rock Storage Facilities
- Water Management Features
- Roads and Exploration Access Drift

NOTE

1. All dimensions and elevations are in feet unless otherwise noted

SOURCES

1. As-built drawings provided by Niblack Project LLC (2011)
2. Land application area boundaries from Turner (2009, personal communication)

NIBLACK PROJECT LLC

integral consulting inc.

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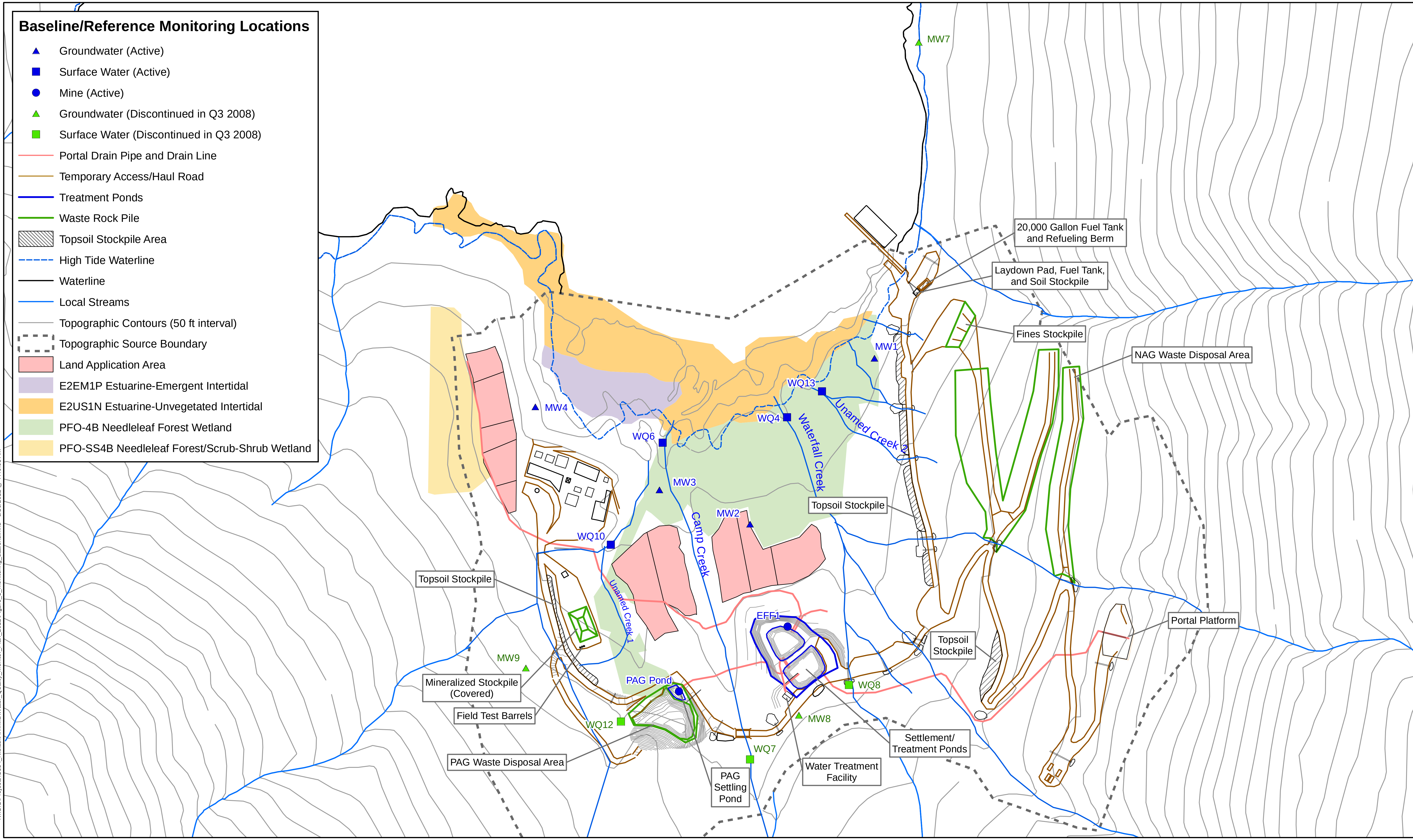
Figure 2
General Site Plan
Niblack Water Quality Monitoring Plan
2012 Post-Construction Update



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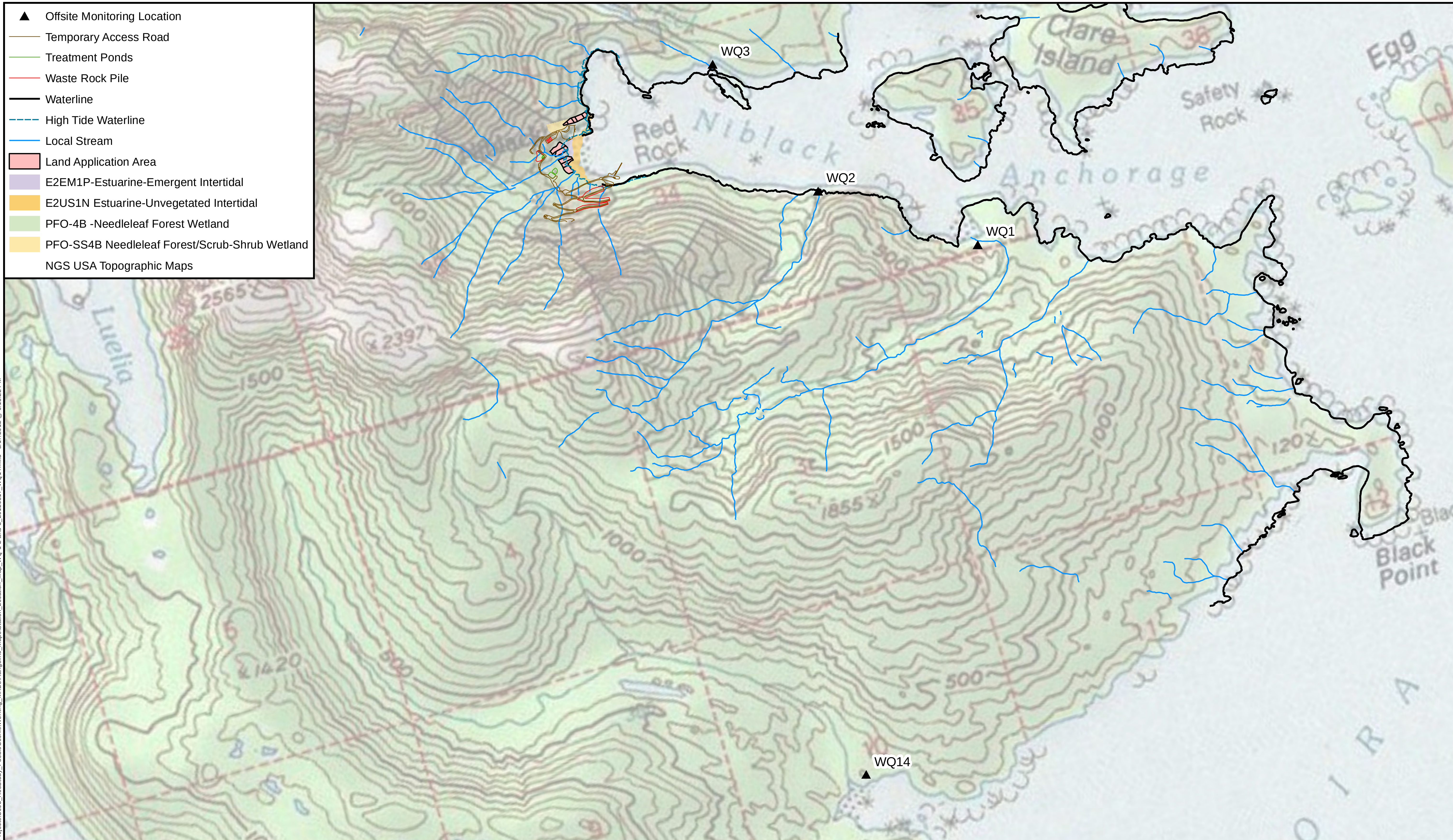
Feature Sources:
Base layers from Knight Piesold, 2007. Water Quality Baseline and Site Monitoring Plan.
Land Application Area from Turner, 2009. Personal communication.
Waste rock areas, portal drains, roads, and ground cover zones from Niblack Project LLC.

Figure 3
Water Quality Monitoring Stations
Niblack Water Quality Monitoring Plan
2012 Post-Construction Update



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Feature Sources:
Base layers from Knight Piésold, 2007. Water Quality Baseline and Site Monitoring Plan.
Land Application Area from Turner, 2009. Personal communication.
Waste rock areas, portal drains, roads, and ground cover zones from Niblack Project LLC.

Figure 4
Water Quality Monitoring Stations - Outlying Stations
Niblack Water Quality Monitoring Plan
2012 Post-Construction Update

TABLES

Table 1. Summary of Drilling at the Niblack Site, 1975 to 2011

Year	Company	# of Holes	Drilling Length (feet)
1975	Cominco	6	2,893
1978	Anaconda	1	1,132
1982-83	Noranda	18	8,536
1984-89	Lac	20	10,912
1992-93	Lac	14	15,712
1995	Abacus	19	12,755
1996	Abacus	45	34,612
1997	Abacus	37	36,373
2005	NMC	7	6,215
2006	NMC	32	27,369
2007	NMC	3	1,617
2008	CBG	25	19,765
2009	CBG	8	8,610
2009 - 2011	NPLLC	136	183,727

Source:

Drilling information from 1975 - 2006 reproduced from Table 2.2, Underground Exploration Plan of Operations (NMC 2007b)

Drilling information for 2007 from Niblack Underground Exploration Project Annual Report (Integral 2008)

Drilling information for 2008 - 2011 from Niblack Underground Exploration Project 2011 Annual Report (Integral 2012d)

Table 2. Minimum Information to be Recorded in Field Notes

Data to be collected each day of sampling:
- Project name and number
- Names of field crew
- Date
- Weather conditions
- Make and model of field equipment used that day
- QA/QC samples collected that day
- Deionized Water Blank/Filter Blank Samples (assign blind "dummy" IDs)
- Blind Duplicate Sample(s) (assign blind "dummy" IDs)

Data to be collected at each surface water quality sample site:
- Water quality station name
- Date and time
- Site location
    GPS coordinates (if station locaiton has changed from previous monitoring)
    Stream name
    Photographs of sample location, upstream, and downstream
- Description of site conditions
    Any unusual circumstances
- Sampling
    Type and number of samples collected
    Sampling method if varied from standard procedures
    QA/QC - Blind Duplicate Samples (if collected)
- In Situ Parameters:
    Temperature
    Specific conductance (SpC)
    pH
    Dissolved oxygen (DO)
    Others field measurements as appropriate

Additional information to be collected at groundwater sampling locations:
- Depth to water (from top of casing)
- Depth to bottom of well (from top of casing)
- Casing stick-up
- Purge volume (3 x the casing volume of water)
- Record the change of in situ parameters to determine that they have stabilized prior to sampling

Source:
Table modified from Niblack Project Water Quality Baseline and Site Monitoring Plan (Knight Piésold 2007b).

Table 3. Water Quality Parameters Monitored in Surface Water, Groundwater, and Effluent

Characteristic	Sample Type	Notes
Field Parameters		
Conductivity	Field test	
Dissolved oxygen	Field test	
pH	Field test	
Temperature	Field test	
Turbidity	Field test	
Sulfate	Hach field test	Parameter monitored at stations PAG Pond and EFF1, as well as the field barrels (HW1, LO1, LO2) as part of regular weekly field monitoring.
Conventional Analyses		
Hardness (as $CaCO_3$)	Grab	
Total dissolved solids (TDS)	Grab	
TDS cations/anions	Calculated value	
Total suspended solids	Grab	
Cations/Anions		
Alkalinity (as $CaCO_3$)	Grab	
Chloride	Grab	
Sulphate	Grab	
Ammonia	Grab	
Nitrogen (nitrate/nitrite)	Grab	
Metals (Total and Dissolved)		
Aluminum	Grab	
Arsenic	Grab	
Cadmium	Grab	
Calcium	Grab	
Chromium	Grab	Reported parameter for station EFF1 only
Copper	Grab	
Iron	Grab	
Lead	Grab	
Magnesium	Grab	
Mercury	Grab	
Nickel	Grab	
Sodium	Grab	
Potassium	Grab	
Selenium	Grab	
Silver	Grab	
Zinc	Grab	

Table 4. Laboratory Methods and Sample Hold Times for Water Quality Samples

Analysis	Analyte Included on Reduced Monitoring List	Sample Preparation		Quantitative Analysis		Recommended Sample Hold Times
		Protocol	Procedure	Protocol	Procedure	
Conventional Analyses						
Hardness as $CaCO_3$	X	--	--	SM 2340C	Titrimetric	6 months
Total dissolved solids	X	--	--	SM 2540C	Gravimetric	7 days
Total suspended solids	X	--	--	SM 2540D	Gravimetric	7 days
Cations/Anions						
Alkalinity as $CaCO_3$	X	--	--	SM 2320B	Titrimetric	14 days
Bromide, fluoride		--	--	EPA 300.0	Ion chromatography	28 days
Chloride, sulfate	X	--	--	EPA 300.0	Ion chromatography	28 days
Nitrate/nitrite as nitrogen	X	EPA 353.2	Cadmium reduction	EPA 353.2	Colorimetric	28 days
Ammonia as nitrogen	X	--	--	SM 4500-NH3E	Electrometric	28 days
o-Phosphate as phosphorus, dissolved			Persulfate digestion			48 hours
Phosphate as phosphorus, dissolved		EPA 365.3	Persulfate digestion and 0.45-mm filtration	EPA 365.3	Colorimetric	28 days
Phosphate as phosphorus, total			Persulfate digestion			28 days
Total/Dissolved Metals						
Antimony, barium, beryllium, bismuth, cobalt, manganese, molybdenum, thallium, uranium, vanadium		EPA 3020A	Nitric acid digestion	EPA 6020	ICP/MS	6 months
Aluminum, arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver, zinc	X	EPA 3020A	Nitric acid digestion	EPA 6020	ICP/MS	6 months
Boron, lithium, phosphorus, silicon, strontium, tin, titanium		EPA 3010A	Nitric/hydrochloric acid digestion	EPA 6010	ICP/AES	6 months
Calcium, iron, magnesium, potassium, sodium	X	EPA 3010A	Nitric/hydrochloric acid digestion	EPA 6010	ICP/AES	6 months
Mercury	X	EPA 7470A	Acid digestion/oxidation	EPA 7470A	CVAAS	28 days

Notes:
Field measurements collected for each event include dissolved oxygen, pH, temperature, conductivity, and turbidity.

-- = not applicable
CVAAS = cold vapor atomic absorption spectrometry
EPA = U.S. Environmental Protection Agency
ICP/AES = inductively-coupled plasma/atomic emission spectrometry
ICP/MS = inductively-coupled plasma/mass spectrometry
SM = Standard Method

Table 5. Alaska Water Quality Criteria and Analytical Method Detection Limits

Parameter	Units	Alaska Water Quality Criteria [a]	Analytical Method	MDL [b]	MRL [b]
Physical Tests					
Hardness (as $CaCO_3$)	mg/L	--	SM 2340C	0.8	2
Total Suspended Solids	mg/L	--	SM 2540D	5	5
Total Dissolved Solids	mg/L	--	SM 2540C	5	5
Anions and Nutrients					
Alkalinity, Total (as $CaCO_3$)	mg/L	--	SM 2320B	3	9
Ammonia as N	mg/L	--	SM 4500-NH3E	0.009	0.05
Bromide	mg/L	--	EPA 300.0	0.004	0.1
Chloride	mg/L	--	EPA 300.0	0.03	0.2
Fluoride	mg/L	--	EPA 300.0	0.003	0.2
Nitrate/nitrite as N	mg/L	--	EPA 353.2	0.009	0.05
Sulfate	mg/L	--	EPA 300.0	0.01	0.2
o -Phosphate as phosphorus, dissolved	mg/L	--	EPA 365.3	0.004	0.01
Phosphate as phosphorus, dissolved	mg/L	--	EPA 365.3	0.004	0.01
Phosphate as phosphorus, total	mg/L	--	EPA 365.3	0.004	0.01
Total and Dissolved Metals					
Aluminum	µg/L	87 - 750 [c]	EPA 6020	0.3	2
Antimony	µg/L	--	EPA 6020	0.02	0.05
Arsenic	µg/L	150	EPA 6020	0.1	0.5
Barium	µg/L	--	EPA 6020	0.02	0.05
Beryllium	µg/L	--	EPA 6020	0.006	0.02
Bismuth	µg/L	--	EPA 6020	0.02	0.1
Boron	µg/L	--	EPA 6010	2	50
Cadmium	µg/L	0.038 - 1.4 [d]	EPA 6020	0.005	0.02
Calcium	µg/L	--	EPA 6010	9	50
Chromium	µg/L	11	EPA 6020	0.04	0.2
Cobalt	µg/L	--	EPA 6020	0.006	0.02
Copper	µg/L	0.92 - 4.5 [d]	EPA 6020	0.02	0.1
Iron	µg/L	1000	EPA 6010	3	20
Lead	µg/L	0.13 - 1.0 [d]	EPA 6020	0.005	0.02
Lithium	µg/L	--	EPA 6010	2	10

Table 5. Alaska Water Quality Criteria and Analytical Method Detection Limits

Parameter	Units	Alaska Water Quality Criteria [a]	Analytical Method	MDL [b]	MRL [b]
Magnesium	µg/L	--	EPA 6010	0.4	20
Manganese	µg/L	--	EPA 6020	0.006	0.05
Mercury	µg/L	0.051 [e]	EPA 7470A	0.02	0.2
Molybdenum	µg/L	--	EPA 6020	0.008	0.05
Nickel	µg/L	5.5 - 26.4 [d]	EPA 6020	0.03	0.2
Phosphorus	µg/L	--	EPA 6010	60	200
Potassium	µg/L	--	EPA 6010	40	400
Selenium	µg/L	4.6	EPA 6020	0.3	1
Silicon	µg/L	--	EPA 6010	6	400
Silver	µg/L	--	EPA 6020	0.004	0.02
Sodium	µg/L	--	EPA 6010	20	200
Strontium	µg/L	--	EPA 6010	0.9	10
Thallium	µg/L	--	EPA 6020	0.005	0.02
Tin	µg/L	--	EPA 6010	9	50
Titanium	µg/L	--	EPA 6010	4	10
Uranium	µg/L	--	EPA 6020	0.003	0.02
Vanadium	µg/L	--	EPA 6020	0.03	0.2
Zinc	µg/L	12.4 - 60.1 [d]	EPA 6020	0.2	0.5

Notes:

EDD = electronic data deliverable
MDL = method detection limit
MRL = method reporting limit
QC = quality control
-- Value not included in *Alaska Water Quality Manual for Toxic and Other Deleterious Organic and Inorganic Substances.*

[a] Freshwater Chronic Aquatic Life Criteria from *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*, December 12, 2008.
[b] ALS periodically updates their MDLs and MRLs. Listed MDLs and MRLs are current as of May 3, 2012.
[c] Water quality criterion is pH and hardness dependent.
[d] Water quality criterion is hardness dependent. A range of values based on hardness measured at surface water stations from 2007 - 2012 is presented.
[e] Per discussion with ADEC Water Quality Officer James Gendron, the human health criterion for consumption of aquatic organisms is used for mercury.

Table 6. Water Quality Monitoring Stations

Monitoring Point	Location	Coordinates (NAD27, UTM Zone 8N)		Status	Purpose			
		Easting	Northing		Pre-project Reference Conditions	Compliance Location	Information Only	Post-closure Monitoring
Effluent								
EFF1	Settling ponds at point of discharge to LAD	682103.6	6105572.1	Active			X	
PAG	PAG leak detection system	--	--	Active (no water) [c]			X [c]	
PAG Pond	PAG leachate/runoff capture pond	682046.3	6105664.3	Active			X	
Surface Waters								
WQ1	Off-site at Deer Pasture Creek – downstream	684358.0	6104664.0	Inactive			X	
WQ2	Off-site at Lookout Creek – downstream	683575.0	6105162.0	Inactive			X	
WQ3	Off-site at Myrtle Creek – downstream	683179.0	6105980.0	Inactive			X	
WQ4	Waterfall Creek – downstream	682283.3	6105575.9	Active	X	X		X
WQ8	Waterfall Creek – upstream	682054.7	6105518.6	Active	X			
WQ5	Camp Creek – middle reach of creek	682054.7	6105518.6	Inactive	X			
WQ6	Camp Creek – downstream	682259.5	6105682.2	Active	X	X		
WQ7	Camp Creek – upstream	681989.1	6105602.1	Discontinued [a]	X			
WQ10	Unnamed Creek 1 – downstream	682171.0	6105725.0	Discontinued [a]	X	X		
WQ12	Unnamed Creek 1 – upstream	682019.5	6105713.6	Discontinued [a]	X			
Seep	Unnamed Creek 1 – upstream groundwater seep	682306.0	6105546.4	Inactive	X			
WQ13	Unnamed Creek 2 – downstream	682306.0	6105546.4	Active	X			X
WQ14	Unnamed Creek on South side of Lookout Mountain	682955.0	6101933.0	Discontinued [b]			X	X
Groundwater Wells								
MW1	Wetlands below NAG site	682335.3	6105502.0	Active	X	X [d]		X
MW2	Wetlands below settling ponds and LAD area	682191.0	6105606.0	Active	X	X [d]		X

Table 6. Water Quality Monitoring Stations

Monitoring Point	Location	Coordinates (NAD27, UTM Zone 8N)		Status	Purpose			
		Easting	Northing		Pre-project Reference Conditions	Compliance Location	Information Only	Post-closure Monitoring
MW3	Wetlands below PAG site and LAD area	682219.1	6105684.2	Active	X	X [d]		X
MW4	Wetlands below and LAD area	682288.0	6105792.0	Active	X	X [d]		X
MW7	Wetlands – offsite and to the east of the project	682607.0	6105469.0	Discontinued [a]	X			
MW8	Upgradient of LAD area and MW3	682028.0	6105561.0	Discontinued [a]			X [e]	
MW9	Upgradient of and LAD area and MW4	682064.0	6105796.0	Discontinued [a]			X [e]	
GW1	Pre-existing drill hole	682134.0	6105711.0	Inactive	X			
GW2	Upgradient of and LAD area and MW6	682178.0	6105640.0	Inactive	X			

Notes:

ADEC = Alaska Department of Environmental Conservation

LAD = land application/dispersion

NAG = non-acid generating

PAG = potentially acid-generating

[a] Removed from the water quality monitoring network subsequent to Q3 2008, as per agreement with ADEC.

[b] Monitoring at station WQ14 was discontinued following collection of 20 baseline samples in the second quarter of 2012.

[c] A visual monitoring station was established below the PAG waste disposal area as part of a leak detection system. No water is anticipated to collect at this point unless there is a breach in the liner

[d] MW1, MW2, MW3, and MW4 will be used to monitor changes to natural water quality in wetlands water when compared to historical values and remote wetland wells.

[e] MW8 and MW9 will be used to determine background groundwater quality for information purposes only.

Table 7. Summary of Water Quality Monitoring Conducted through Q1 2012 at Onsite Monitoring Stations

			Compliance Stations (Active)		Reference/Background Stations (Discontinued)				Mine Water and Waste Rock Monitoring (Active)		
Year	Quarter	Month	Surface Water (WQ4, WQ6, WQ10, WQ13)	Monitoring Wells (MW1, MW2, MW3, MW4)	Surface Water (WQ7, WQ8, WQ12)[a]	Surface Water (WQ14)	Monitoring Wells (MW7, MW8, MW9)	Monitoring Wells & Seep (GW1, GW2, SEEP)[c]	Settling Ponds (EFF1)	PAG Pond (PAG)	Kinetic Test Barrels (LO1, LO2, HW1)
2012	Q1	Jan	X	X					X	X	X
		Feb									
		Mar									
	Q2	Apr				X					
		May									
		Jun									
	Q3	Jul									
		Aug									
		Sep									
	Q4	Oct									
		Nov									
		Dec									
2011	Q1	Jan	X	X		X			X	X	
		Feb				X				X	
		Mar				X					
	Q2	Apr	X	X		X			X	X	X
		May				X				X	
		Jun				X				X	
	Q3	Jul	X	X		X			X	X	X
		Aug				X				X	
		Sep									
	Q4	Oct									
		Nov								X	X
		Dec	X	X					X		
2010	Q1	Jan	X	X		X			X	X	X
		Feb				X				X	X
		Mar				X				X	
	Q2	Apr	X	X		X			X	X	
		May				X				X	X
		Jun				X				X	
	Q3	Jul				X				X	X
		Aug	X	X		X			X	X	
		Sep				X				X	X
	Q4	Oct	X	X		X			X	X	X
		Nov				X					
		Dec				X				X	X

Table 7. Summary of Water Quality Monitoring Conducted through Q1 2012 at Onsite Monitoring Stations

			Compliance Stations (Active)		Reference/Background Stations (Discontinued)				Mine Water and Waste Rock Monitoring (Active)		
Year	Quarter	Month	Surface Water (WQ4, WQ6, WQ10, WQ13)	Monitoring Wells (MW1, MW2, MW3, MW4)	Surface Water (WQ7, WQ8, WQ12)[a]	Surface Water (WQ14)	Monitoring Wells (MW7, MW8, MW9)	Monitoring Wells & Seep (GW1, GW2, SEEP)[c]	Settling Ponds (EFF1)	PAG Pond (PAG)	Kinetic Test Barrels (LO1, LO2, HW1)
2009	Q1	Jan									
		Feb									
		Mar	X	X		X			X	X	
	Q2	Apr									
		May	X	X		X			X	X	X
		Jun								X	
	Q3	Jul	X	X		X			X	X	X
		Aug								X	
		Sep				X				X	
	Q4	Oct	X	X		X			X	X	X
		Nov									
		Dec				X				X	
2008	Q1	Jan	X	X	X		X		X		
		Feb	X	X	X		X		X		
		Mar	X	X	X		X		X		
	Q2	Apr	X	X	X		X		X		
		May	X	X	X		X		X		
		Jun	X	X	X		X		X		
	Q3	Jul	X	X	X		X[b]		X		X
		Aug		X					X	X	X
		Sep		X					X	X	X
	Q4	Oct	X	X					X	X	X
		Nov									
		Dec									
2007	Q1	Jan									
		Feb	X	X	X		X[b]				
		Mar									
	Q2	Apr	X	X	X		X[b]				
		May	X	X	X		X[b]				
		Jun	X	X	X		X[b]	X			
	Q3	Jul	X	X	X		X				
		Aug	X	X	X		X				
		Sep	X	X	X		X				
	Q4	Oct	X	X	X		X				
		Nov	X	X	X		X		X		
		Dec	X	X	X		X		X		

Notes:
Monitoring for full analyte list (does not include field parameter-only monitoring events)

[a] Surface Water station WQ5 (Camp Creek middle reach) was monitored 6 times from 1996 - 2006. No samples have been collected since 2006.
[b] Monitoring at MW7 only. Completion and monitoring of wells MW8 and MW9 began in July 2007.
[c] Preliminary Monitoring Wells GW1 and GW2 were also sampled in October and December 2006. The SEEP station was also monitored in August, October, and December 2006.

Table 8. Exploration Phase Water Quality Monitoring Stations and Schedule

Quarter	Month	Week	Compliance Stations				Mine Water and Waste Rock Monitoring					
			Surface Water (WQ4, WQ6, WQ10, WQ13)		Monitoring Wells (MW1, MW2, MW3, MW4)		Settling Ponds (EFF1)		PAG Pond		Kinetic Test Barrels (LO1, LO2, HW1)	
			Field Parameters	Analytical Chemistry	Field Parameters	Analytical Chemistry	Field Parameters	Analytical Chemistry	Field Parameters	Analytical Chemistry	Field Parameters	Analytical Chemistry
Q1	Jan	1	1 sample per quarter	1 sample per quarter	1 sample per quarter	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	Feb	1					X		X		X	
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	Mar	1					X		X		X	
		2					X		X			
		3					X		X		X	
		4					X		X		X	
Q2	Apr	1	1 sample per quarter	1 sample per quarter	1 sample per quarter	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	May	1					X		X		X	
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	Jun	1					X		X		X	
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
Q3	Jul	1	1 sample per quarter	1 sample per quarter	1 sample per quarter	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	Aug	1					X		X		X	
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	Sep	1					X		X		X	
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
Q4	Oct	1	1 sample per quarter	1 sample per quarter	1 sample per quarter	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter	X	1 sample per quarter
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	Nov	1					X		X		X	
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	
	Dec	1					X		X		X	
		2					X		X		X	
		3					X		X		X	
		4					X		X		X	

Notes:

The analytical chemistry analyte list includes the conventional analyses, cations/anions, and metals listed in Table 3.

Field parameters include conductivity, dissolved oxygen, pH, temperature, and turdbidity.
Sulfate is measured in the field at mine water and wate rock stations (EFF1, PAG pond, HW1, LO1, LO2).

Table 9. Post-Closure Water Quality Monitoring Stations and Schedule

Monitoring Stations		Year 1 (2 Monitoring Events)	Year 2 (2 Monitoring Events)	Year 5 (1 Monitoring Event)	Year 10 (1 Monitoring Event)	Year 20 (1 Monitoring Event)	Year 30 (1 Monitoring Event)
WQ4	Waterfall Creek – downstream	X	X	X	X	X	X
WQ13	Unnamed Creek 2 – downstream	X	X	X	X	X	X
MW1	Wetlands below NAG site	X	X	X	X	X	X
MW2	Wetlands below settling ponds and LAD area	X	X				
MW3	Wetlands below PAG site and LAD area	X	X				
MW4	Wetlands below LAD area	X	X				

Notes:
LAD = land application/dispersion
NAG = non-acid generating
PAG = potentially acid-generating

APPENDIX A

WATER QUALITY SAMPLING FIELD EQUIPMENT CHECKLIST

APPENDIX A

WATER SAMPLING FIELD EQUIPMENT CHECKLIST

Basic Equipment List

- Coolers with sufficient quantity of frozen ice packs
- Disposable powder-free sample gloves (at least a full box – 50 pairs)
- *In situ* water quality probe(s) for measuring pH, temperature, conductivity/specific conductance, dissolved oxygen and turbidity. Note that turbidity is optional.
- Waterproof field notebook or set data sheets and clipboard
- Pencils
- Indelible markers
- Knife and or sharp blade (for cutting PE tubing and string)
- Large Ziploc bags
- Camera
- GPS and site coordinates
- Maps
- Extra batteries for all electronic equipment
- Small multipurpose tool kit

Surface Water Sampling Equipment

- Surface water quality sample containers, which will include the following:
    - *Labeled* sample bottles for the following:
        - General chemistry containers (1 L plastic)
        - Total metals containers (250 mL plastic with HNO_3 preservative)
        - Dissolved metals containers (250 mL plastic with HNO_3 preservative)
            - Note – 2 sets are for QC samples, as follows:
            - Blind duplicate, and
            - Blank/filter blank sample (also submitted blind to the lab)
- Disposable in-line 0.45-µm groundwater filters
- Deionized water for blank/filter blank sample

Groundwater Sampling Equipment

- Groundwater quality sample containers, which will include the following:
  - *Labeled* sample bottles for the following:
    - General chemistry containers (1 L plastic)
    - Total metals containers (250 mL plastic with HNO_3 preservative)
    - Dissolved metals containers (250 mL plastic with HNO_3 preservative)
      - Note – 1 set is for a QC blind duplicate sample
- Water level meter
- Disposable in-line 0.45-µm groundwater filters
- Measuring tape (for measuring well stick-up)
- Extra high or low density polyethylene tubing (at least enough for one to two wells)

Personal Gear

- Waterproof jacket and pants
- Waterproof protective footwear (sufficient height for wading into shallow streams)
- Gloves and hats

Basic Safety Equipment

- First aid kit
- Radio and/or satellite phone
- Survival kit – if working alone at site
- Extra change of clothing
- Extra food and water

APPENDIX B

EXAMPLE CHAIN OF CUSTODY FORM

Columbia Analytical Services INC
An Employee-Owned Company

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222 • FAX (360) 636-1068

DATE__________ PAGE ______ OF ______

PROJECT NAME______________ #__________

PROJECT MANAGER ______________

COMPANY/ADDRESS ______________

______________ PHONE__________

SAMPLERS SIGNATURE ______________

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS	ANALYSIS REQUESTED																REMARKS

RELINQUISHED BY:	RECEIVED BY:	TURNAROUND REQUIREMENTS	REPORT REQUIREMENTS	INVOICE INFORMATION:	SAMPLE RECEIPT:
Signature Printed Name Firm Date/Time	Signature Printed Name Firm Date/Time	____ 24 hr ____ 48 hr. ____ 5 day ____ Standard (10-15 working days) ____ Provide Verbal Preliminary Results ____ Provide FAX preliminary Results Requested Report Date ______	____ I. Routine Report ____ II. Report (includes DUP,MS, MSD, as required, may be charged as samples) ____ III. Data Validation Report (includes All Raw Data) ____ IV. CLP Deliverable Report	P.O.# ______ Bill To ______	Shipping VIA: ______ Shipping #: ______ Condition: ______ Lab No: ______

RELINQUISHED BY:	RECEIVED BY:	SPECIAL INSTRUCTIONS/COMMENTS:
Signature Printed Name Firm Date/Time	Signature Printed Name Firm Date/Time	

DISTRIBUTION: WHITE - return to originator; YELLOW - lab; PINK - retained by originator

400-05

Figure B3-1.
Example of Chain-of-Custody Form

APPENDIX C

VISUAL INSPECTION FORM

NIBLACK

PROJECT LLC

VISUAL SITE INSPECTION FORM

Inspected by: _________________

Date of inspection: ____________

AREA	STATUS	OBSERVATIONS/COMMENTS
ROADS		
General Surface Condition		
Geotechnical Stability		
Settlement		
Erosion		
Channelization		
Thawing		
Frost Action		
PORTAL PAD/SHOP SITE		
General Surface Condition		
Ditches		
Settlement		
Erosion		
Thawing		
Frost Action		
SEDIMENT PONDS		
Liner Slippage / Damage		
Retaining Walls		
Erosion Control Structures		
Run-on Control Structures		
Diversion Structures		
Geotechnical Stability		
Settlement		
Erosion		
Frost Action		
Thawing		

NIBLACK
PROJECT LLC

VISUAL SITE INSPECTION FORM

Inspected by: _________________

Date of inspection: ____________

LAD SITE		
LAD Outflow Valves		
LAD Outflow Screen		
Stress to Vegetation		
Channelization/Ponding		
Leakage		
Freezing		
Active Zones		
Weather Conditions		
NAG SITE		
Settlement/Geotechnical Instability		
Erosion		
Sediment Ponds		
Blockages to Diversion Ditches		
Drainage Control		
Permit Condition Violations		
PAG SITE		
Visible signs of Damage to Liner		
Liner Slippage		
Damage to the Facility From:		
Settlement		
Erosion		
Operator Negligence		
Freezing		
Frost Action		
Permit Condition Violations		
Escaped Leachate		
Damage to or improper Operation of:		
Backwall		
Diversion berm/stormwater structures		
Containment structures		
Erosion control/run-on structures		