KENO HILL SILVER DISTRICT MINING OPERATIONS

SLUDGE MANAGEMENT PLAN

August 2024

Prepared by:

Hecla Yukon

Prepared for:

Alexco Keno Hill Mining Corp.

VERSION HISTORY

ISSUE DATE	CONCISE DESCRIPTION OF VERSION UPDATES
February 2008	ERDC Keno Hill Water Treatment Systems Sludge Management Plan issued as per requirement of WL QZ06-074 Clause 23 and includes Bellekeno 625, Galkeno 300, Galkeno 900, Silver King and Valley Tailings.
May 2009	ERDC Keno Hill Water Treatment Systems Sludge Management Plan issued as part of AKHM WL QZ09-92 application for Bellekeno Mine Development
February 2011	Initial AKHM Sludge Management Plan based on ERDC plan as per requirement of WL QZ09-092, Part H, Clauses79-80
September 2013	Revisions made as per requirement of WL QZ12-053, Part H, Clauses 84-85
September 2014	Revisions made as per requirement of WL QZ12-053, Part H, Clauses 84-85 to incorporate Flame & Moth Addition details on the water treatment process added, including chemicals used and ammonia treatment
March 2018	Revisions made as per requirement of WL QZ09-092-2, Part G, Clause 93 Updated Flame & Moth Water Management Figure
July 2018	Revisions made as per requirement of WL QZ09-092-2, Part G, Clause 93 to incorporate New Bermingham as part of WL18-044 application
October 2020	Revisions made as per requirement of WL QZ18-044, Part F, Clause 42 to incorporate New Bermingham
June 2022	Format updated to improve ease of use for site operations
November 2023	Updated with removal of tailings being placed into DSTF
August 2024	Updated to incorporate comments received from EMR, received on 5/10/2024. See Document Revisions table

DOCUMENT REVISIONS

SECTION	SUMMARY OF CHANGES
Version History	Updated
Document Revisions	Updated
Section 1	Reorganized and updated to reflect current management plan template
Section 2.2	Staff and Contractors role removed, and responsibility for documenting sludge volumes in the Vacuum Truck Operator's Logbook added to Site Services Shifters role Role of Environmental Staff added. Responsibility for collection of sludge samples, physical inspections and reporting assigned to Environmental Staff
Section 3.1	Sludge generation at Bellekeno WTP in current flooded conditions described. Reader directed to Section 3.5 for information on the *in situ* treatment system being commissioned
Section 3.2	Reference to water being pumped to surface at Bellekeno WTP removed Use of P-AML waste rock storage facilities consolidated into Section 3.4
Section 3.3	Use of unlined dewatering areas removed Use of lined sludge containment areas added Freeboard requirements for ponds added
Section 3.4	WTP and District Mill ponds sludge disposal update
Section 4	Sampling frequency and parameters analyzed added
Section 5	Updated
Section 6	Physical inspection requirements added and groundwater monitoring requirements expanded on. Monthly reporting added.

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List of Acronyms and Abbreviations

ABA	Acid Base Accounting
AKHM	Alexco Keno Hill Mining Corp.
Alexco	Alexco Resource Corp.
DSTF	Dry Stack Tailings Facility
ERDC	Elsa Reclamation and Development Company
FNNND	First Nation of Na-Cho Nyak Dun
KHSD	Keno Hill Silver District
P-AML	Potentially-Acid Metal Leaching
QML	Quartz Mining Licence
TSS	Total Suspended Solids
VTBSSA	Valley Tailings Bellekeno Sludge Storage Area
WL	Water Licence
WTP	Water Treatment Plant

1 INTRODUCTION

1.1 PURPOSE OF PLAN

This Sludge Management Plan describes how new sludge produced as a by-product of the water treatment plants (WTPs) at the Keno Hill Silver District (KHSD) Mine Operations will be managed.

1.2 SITE DESCRIPTION

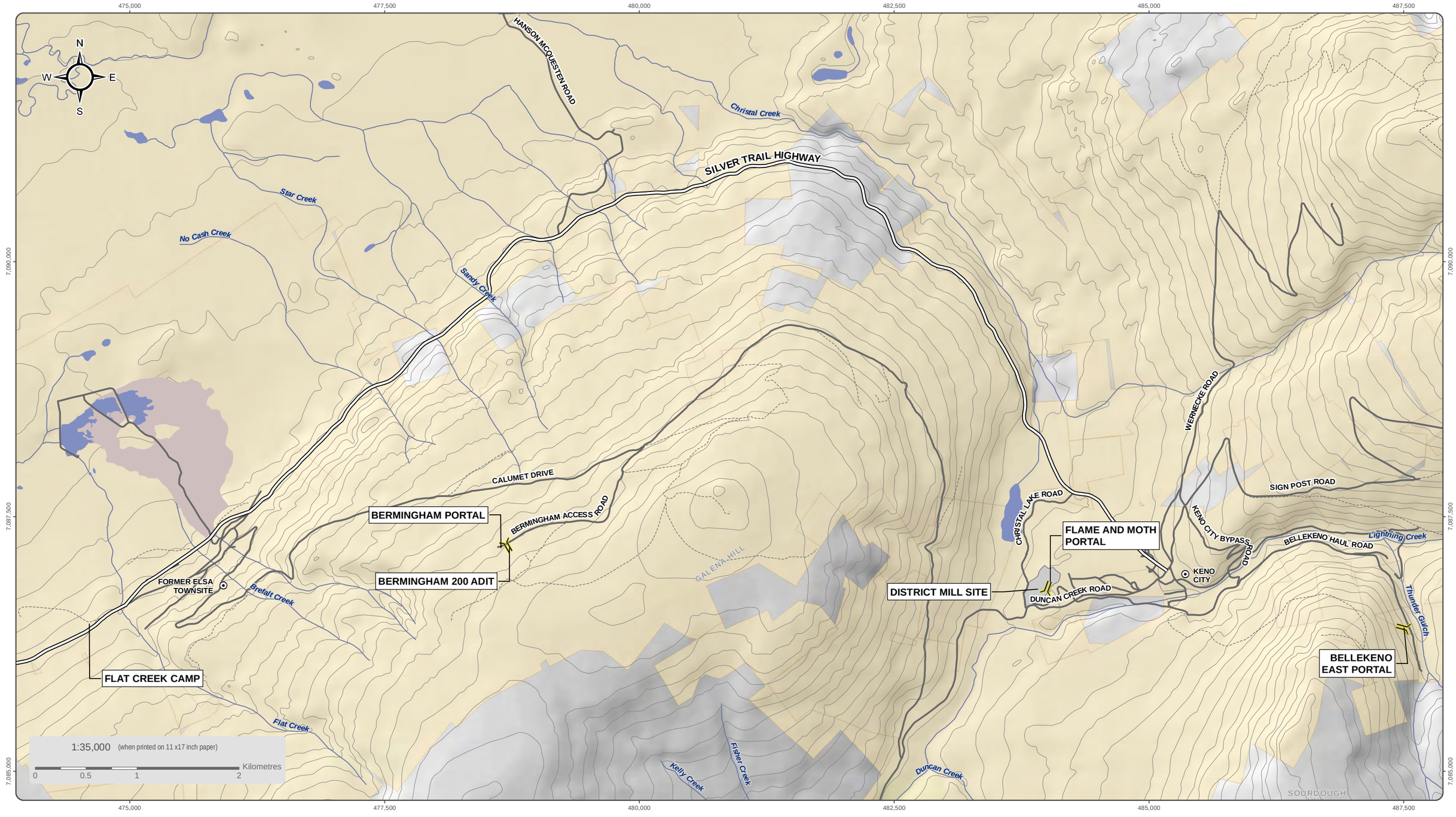
The site is 354 km due north of Whitehorse, in the vicinity of Keno City in central Yukon. Alexco Keno Hill Mining Corp. (AKHM) owns and operates a series of small underground silver/lead/zinc mines with a centralized mill, as described in Table 1-1. The locations of the mines and the mill described in the plan are shown on Figure 1-1. Alexco Resource Corp. (doing business as Hecla Yukon), the parent company of AKHM, was acquired by Hecla Mining Company in September 2022.

Table 1-1: Keno Hill Silver District Mining Operations overview

MINES / ORE DEPOSITS	Bellekeno (production 2010 – 2013, suspended 2013 – 2020, production 2020, temporary closure 2021) Flame & Moth (development 2018, suspended 2018 – 2020, development and production 2020 - present) New Bermingham (advanced exploration 2017 – 2018, development and production 2020 - present) Lucky Queen, Onek 990 (advanced exploration 2013, not active)
MILL	District Mill located in Flame & Moth Mine area (Constructed 2010) Conventional floatation process producing separate lead/silver concentrate and zinc concentrate Tailings placed in Dry Stack Tailings Facility (Established 2010) or underground as backfill
WORK FORCE	~ Camp capacity of 250 employees and contractors during active mine and reclamation operations (as per *Yukon Environmental and Socio-economic Assessment Act* (YESAA) file # 2018-0169 Decision Document)
AIRSTRIP	Village of Mayo, YT
CAMP FACILITIES	Flat Creek camp facilities include a trailer camp, kitchen facility, welcoming center, and fitness facility Four refurbished houses and a bunkhouse located nearby in the townsite of Elsa
POWER	Hydro grid power Yukon Energy, diesel power backup
WATER SUPPLY AND USE	Fresh water supply from Flat Creek and adjacent well Water treatment plants at Bellekeno 625, Flame & Moth, and New Bermingham for mine effluent Process water is recycled from the mill pond to the plant
FIRST NATIONS	First Nation of Na-Cho Nyak Dun (FNNND)

The Keno Hill mining camp has a long mining history and is a brownfields site. AKHM develops the mineral resources, operates the KHSD mines and undertakes receiving environmental monitoring and treatment of mine discharge waters. Hecla Yukon's wholly owned subsidiary Elsa Reclamation and Development Company Ltd. (ERDC) undertakes care and maintenance, environmental monitoring and water treatment of historic adit drainages, district-wide closure planning, studies, and remediation of the historic environmental liabilities.

Sludge produced as a by-product of the water treatment system at the legacy sites is managed in accordance ERDC Type B Water Licence QZ21-022.



Datum: NAD 83; Map Projection: UTM Zone 8N

- Place of Interest
- Adit
- Alexco/ERDC Quartz Claims
- Tailings Area
- Waterbody
- Watercourse
- Silver Trail Highway
- Road
- Limited-Use Road

ALEXCO KENO HILL MINING CORP.

FIGURE 1-1
KENO HILL SILVER DISTRICT MINING OPERATIONS OVERVIEW

OCTOBER 2020

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1.3 REGULATORY CONTEXT

AKHM has all permits and authorizations in place for development and production of KHSD mines Bellekeno, Flame & Moth, and New Bermingham and operation of the District Mill. Approvals, permits, and licences associated with sludge management are listed in Table 1-2.

Table 1-2: Assessments and regulatory approvals

PURPOSE	YESAA APPROVAL	QUARTZ MINING ACT APPROVAL	WATER USE LICENCE
Bellekeno Mine Production	Project #2009-0030 Decision Document	Quartz Mining Licence (QML-0009, Amendment 2, expires 2037) [1,2]	Type A Water Use Licence QZ18-044, expires 2037 [3]
Onek 990 and Lucky Queen Mine Production	Project#2011-0315 Decision Document	Quartz Mining Licence (QML-0009, Amendment 2, expires 2037) [1,2]	Use of water and the deposit of waste into water is not authorized
Flame & Moth Mine Production	Project #2013-0161 Decision Document	Quartz Mining Licence (QML-0009, Amendment 2, expires 2037) [1,2]	Type A Water Use Licence QZ18-044, expires 2037 [3]
New Bermingham Mine Production	Project#2017-0176 Decision Document	Quartz Mining Licence (QML-0009, Amendment 2, expires 2037) [1,2]	Type A Water Use Licence QZ18-044 issued, expires 2037 [3]

Notes:

1. *https://emr-ftp.gov.yk.ca/emrweb/COMM/major-mines/keno-hill/mml-keno-qml-0009-nov2019.pdf*
2. *QML-0009, Schedule C as amended from time to time (December 29, 2023)*
3. *http://www.yukonwaterboard.ca/waterline/*

Terms and conditions listed assessments and regulatory approvals are addressed in this plan as listed in the concordance tables. All references to documents on the Yukon Environmental and Socio-economic Assessment Board (YESAB) Online Registry can be found by searching for the Project and document number on the YOR.

1.4 LINKAGES TO OTHER OPERATIONAL MANAGEMENT PROGRAMS

Operational management plans to guide activities and monitoring associated with waste rock handling are listed in Table 1-3. This plan should be read in conjunction with these documents.

Table 1-3: Related Operational Management Plans

MANAGEMENT PLANS [1]	Adaptive Management Plan Groundwater Monitoring Plan Hydrogeology Monitoring Plan Mill Development and Operations Plan Mine Development and Operations Plan Monitoring, Surveillance and Reporting Plan	Physical Inspection and Reporting Plan Reclamation and Closure Plan Spill Contingency Plan Tailing Characterization Plan Tailings Management Plan Water Management Plan

Note:

1. *Management Plans listed above are not required by all authorizations listed in Table 1-1.*

2 SLUDGE MANAGEMENT PLAN APPROACH

2.1 OBJECTIVES

The objectives of the Sludge Management Plan are to:

1) Define roles and responsibilities to personnel assigned to manage sludge;
2) Outline appropriate sludge management measures to ensure environmental protection; and
3) Describe procedures required to meet regulatory obligations.

This Sludge Management Plan is intended to be an operational document that will require periodic updates as modifications and improvements are made to the water treatment systems and sludge management.

2.2 ROLES AND RESPONSIBILITIES

2.2.1 Site Services Shifters

Site Services Shifters have a responsibility to ensure that staff and contractors have been trained in sludge management procedures, where relevant. Additional responsibilities include:

- Ensuring site-, task- and material-specific training is provided to all site services staff engaged in sludge management activities;
- Ensuring that the Vacuum Truck Operator's Logbook records the volume of each load of sludge pulled from the water treatment retention ponds, and disposal location;
- Recording the movement of sludge volume from the WTPs, and their disposal location in the Sludge Tracking Log as described in Section 6 Monitoring and Reporting;
- Conducting corrective action planning and implementation in a timely manner that supports maintaining ongoing site compliance; and
- Maintaining records regarding personnel training and equipment maintenance, and sludge transport.

2.2.2 Water Treatment Operators

Water Treatment Operators have a responsibility to ensure that the WTPs are managed in accordance with current permits, licences and water treatment system operating manuals including:

- Conducting daily visual monitoring of sludge bags and sludge bag containment areas to ensure that the bags and containment are working properly; and
- Supporting Site Services Shifters and the Process Manager in conducting corrective action planning and implementation in a timely manner that supports maintaining ongoing site compliance.

2.2.3 Process Manager

The Process Manager, is responsible for ensuring there are appropriate and sufficient supplies, staff and equipment on site to support compliant sludge management.

2.2.4 Environmental Staff

Environmental staff support the water treatment plant process and assist with the implementation of the Sludge Management Plan. Specifically, these responsibilities include:

- Collecting and submitting sludge samples for geochemical analysis as described in Section 4 Sludge Characteristics;
- Conducting and reporting on weekly inspections as part of the physical inspection program as described in Section 6 Monitoring and Reporting;
- Obtaining reports by qualified professionals on the geochemical analyses;
- Reporting on sludge management in AKHM's annual reports under the water licence and quartz mining license; and
- Reviewing the plan annually and updating the plan as needed to ensure alignment with WTP operations and amendments to licence and permit terms and conditions.

3 SLUDGE MANAGEMENT

3.1 SLUDGE GENERATION

Water is collected underground in sumps located in the Flame & Moth and New Bermingham mines at various elevations and operating areas. The underground sumps settle solids before the water is pumped to surface for treatment in the water treatment plants. The system of sumps and pumping underground advance with mine development. Lime solution is added to the underground mine collected waters and a zinc hydroxide precipitate (sludge) is formed.

The Bellekeno Mine stopped operations in 2021 and the underground workings began flooding. Flow from the underground workings to the surface began in 2023. There is no activity within the mine, thus limited solids are being incorporated into the mine water. Lime solution is added to the underground mine collected waters in the Bellekeno WTP and a zinc hydroxide precipitate (sludge) is formed. The volume of sludge generated is less than experienced during operations. The existing treatment system will be retained during the commissioning of the *in situ* treatment system as described in Section 3.5.

The WTPs can be adjusted both automatically and manually by the operators to modify setpoints to achieve target pH, turbidity readings, reagent dosing rates and, at Flame & Moth and New Bermingham, sludge discharge rates. Additional details on the water treatment process are available in the Operations and Maintenance Manual for the Flame & Moth Mine (AKHM, 2018), and Bermingham Water Treatment Facility Operations Manual (AKHM, 2021).

3.2 OPERATIONAL SLUDGE MANAGEMENT FACILITIES

At the Flame & Moth and New Bermingham WTP's a lamella clarifier is the primary liquid/solids separation equipment for removal of the solids, including the zinc (metal) hydroxide precipitate.

- The lamella clarifier is an inclined-plate clarifier. The inlet stream is stilled upon entry into the clarifier. Solid particles begin to settle on the plates and accumulate in collection hoppers at the bottom of the clarifier unit and the underflow. The sludge solution (underflow) is drawn off at the bottom of these hoppers through an automatic electronic control valve and the clarified liquid exits the unit at the top by a weir.

- Underflow from the clarifier is gravity fed through pipelines to a series of geotextile filter bags (sludge bags). A valve manifold allows the underflow from the clarifier to be directed to one or more of the sludge bags and flow to each sludge bag can be adjusted according to the overall sludge management requirements.

- The pipelines are insulated, and heat traced to assure that even in extreme cold that sludge will continue to be handled.

- The high surface area sludge bags dewater the underflow solution by passive gravity settling. The geotextile holds back the larger particles and releases treated water to a lined pond.

- The sludge bags are installed within a HDPE lined area to collect the filtered water that seeps from the bags and direct it to a HDPE lined pond.

- The sludge bags are a single use item. Once a bag is full, the pipeline from the clarifier is disconnected and the sludge within the bag dries and densifies over time. The clarifier underflow is directed to a different bag in the series.

- The sludge bag areas are configured to allow access by a skid steer or front loader for placement and removal of the bags.

- When a dewatered sludge bag is removed for disposal and a new sludge bag is installed and the piping reconnected to it.

At the Bellekeno WTP, the water that flows to the surface reports to a circular rapid mix tank and mixer located underneath a treatment shed that ensures proper mixing of the water as reagents are added to the tank. From the rapid mix tank, the water passes to the first of two lined ponds. It is in the first pond that the majority of metal (zinc) hydroxides settle out in the form of a grey sludge that collects at the bottom.

In addition to the two lined settling ponds at Bellekeno, there are HDPE lined ponds at Flame & Moth, New Bermingham and the Mill Pond which accumulate sludge that must be managed.

3.3 POND DESLUDGING

Sludge removal and disposal from the first Bellekeno WTP pond to ensure that adequate retention time is available to properly settle the solids or can typically be accomplished without additional drying and densification; a vacuum truck is used to pull sludge from the pond. Over time the fine-grained clay sized content in the sludge builds up making normal pond desludging difficult and a desludging campaign involving the use of the dredge pump and sludge bag system is undertaken.

Periodically the other WTP and District Mill ponds also require a desludging campaign be implemented to remove excess solids that have accumulated in the ponds to reduce the TSS in the ponds and to maintain optimal recycled water flow for mill operation. Sludge that accumulates in the WTP ponds and the District Mill Pond are removed using a vacuum truck or dredge.

When sludge bags are used to desludge a pond, a dredge is used to pump the sludge solution to a sludge bag located within a HDPE lined area adjacent to the ponds as illustrated in Figure 3-1. The filtered water that seeps from the sludge bag is directed by gravity flow back to the pond. The sludge bag is then disconnected from the pump and the sludge dewaters and densifies prior to being removed for disposal.

Lined sludge containment areas are periodically utilized to dry the sludge that accumulates in the ponds prior to final disposal.

To maintain effluent discharge water quality during a desludging campaign of the first Bellekeno pond flow from the treatment plant is piped directly to the second pond, bypassing the first pond while it is being desludged. Once the first pond is desludged, flow to the first pond resumes. To maintain effluent discharge water quality while the second pond is desludged the campaign is undertaken while the water level in the second pond is below the discharge elevation. To achieve this state treated water is utilized for dust control on

the roads and if required a bypass pipeline installed from the first pond outlet to direct the treated water to the final discharge site.

To maintain effluent discharge water quality during a desludging campaign at the Flame & Moth and District Mill ponds the work can be conducted while there is no discharge to the environment. The use of silt curtains or filter cloth may be required in the Bermingham pond. Water levels within each of the ponds are lowered prior to beginning the desludging campaign and pond freeboard is monitored during the campaign to ensure that the freeboard is kept at or below the 0.5-meter limit.

3.4 SLUDGE DISPOSAL

Dewatered sludge from the Flame & Moth WTP is blended with waste rock and disposed of underground. The lined potentially acid metal leaching (P-AML) waste rock storage facility is periodically used to store dewatered sludge where it is blended with the P-AML waste rock prior to final disposal.

At the New Bermingham WTP, the densified sludge bag is hauled by truck on average once a month to the historic Bermingham Southwest open pit for final disposal. The pit is located approximately 500 m upgradient of the New Bermingham mine as Figure 3-3.

Up until 2021, sludge from the Bellekeno WTP was stored in a dedicated cell at the Valley Tailings area, the Valley Tailings Bellekeno Sludge Storage Area (Figure 3-2). The Valley Tailings sludge storage area is not lined to allow water to exfiltrate. Since 2021, the Bellekeno sludge has been transported underground for disposal.

Sludge from the other WTP and District Mill ponds is transported for disposal underground or in the Bermingham Southwest open pit.

Sludge stored in P-AML waste rock storage areas will be deposited and blended in accordance with the Waste Rock Management Plan, and sludge relocated underground in accordance with the Mine Development and Operating Plan. These plans specify measures to be taken to comply with WL QZ18-044 and QML-0009 requirements.

AKHM plans to explore options related to the sludge disposal in the DSTF and realizes that additional testing and review is required prior to placement within the facility.

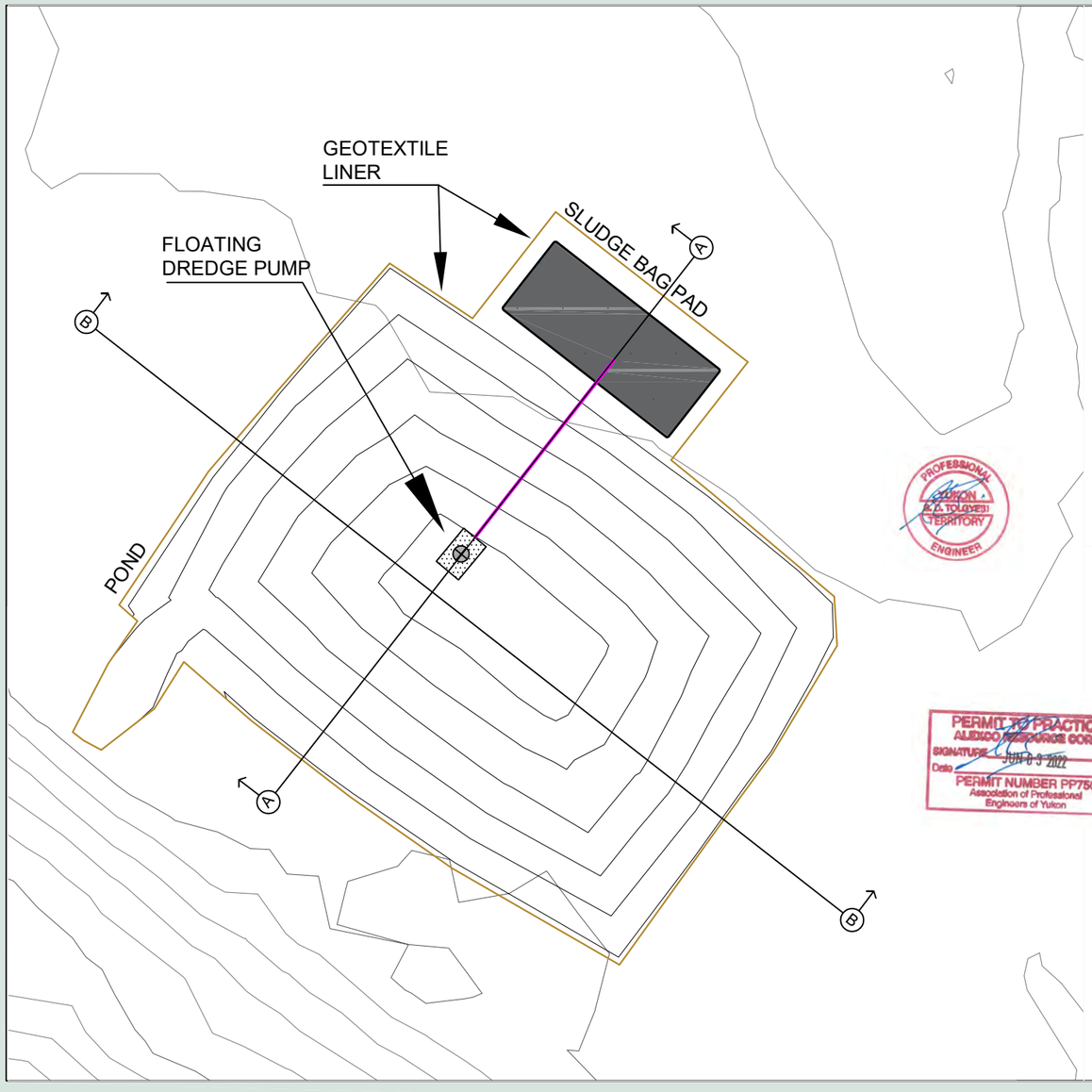
3.5 IN SITU TREATMENT

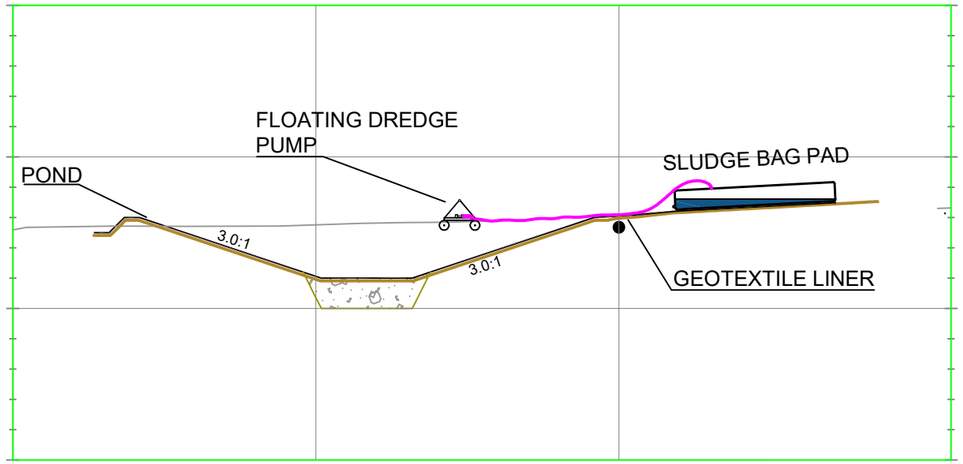
A semi-passive water treatment system will be operated at the Bellekeno Mine after completion of mining and mine water meets EQS as described in the site Reclamation and Closure Plan. The *in-situ* process will generate metal sulphide precipitates as a by-product within the mine workings. These sludges will settle and remain within the underground mine workings. The operating and maintenance plan, *Keno Hill Silver District Mining Operations, Keno Hill In Situ System Operations and Maintenance Plan* (Ensero and AKHM, 2020a) provides a description of the treatment process, safety and emergency preparedness measures, along with operation and maintenance procedures.

The existing settling ponds at the Bellekeno WTP will be converted to use as temporary secondary treatment as a bioreactor. This secondary treatment process is discussed further in the *Keno Hill Silver District Mining Operations, Bioreactor Design and Operation Plan* (Ensero and AKHM, 2020b). The existing conventional

Bellekeno WTP system will be retained while the *in-situ* treatment system is being commissioned. Once treatment is established underground and the site moves into post closure, the setting ponds will be converted to a bioreactor treatment system, to allow for a more passive final polishing step. This process will generate hydroxide sludges that will be deposited in the settling ponds. Solids that build up in the ponds will be removed periodically and hauled to the underground workings.

The design of other *in situ* treatment systems is being advanced as part of the reclamation and closure planning.





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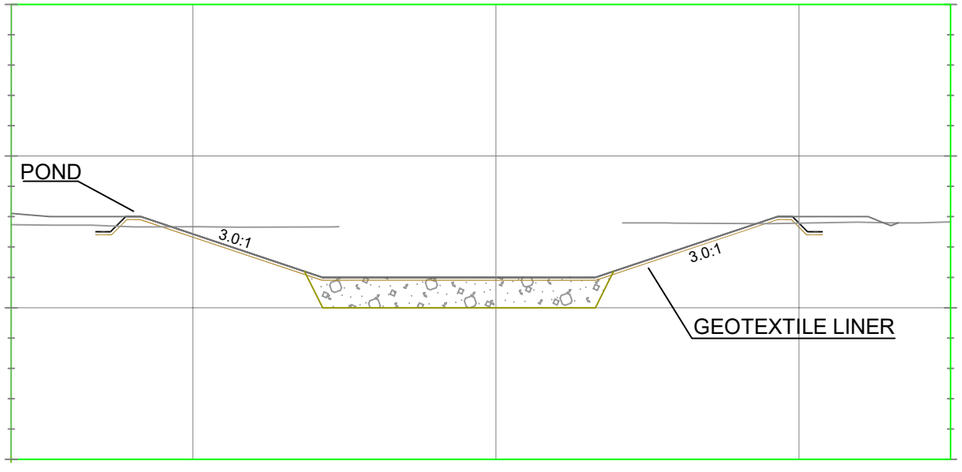


Section B

Hecla YUKON

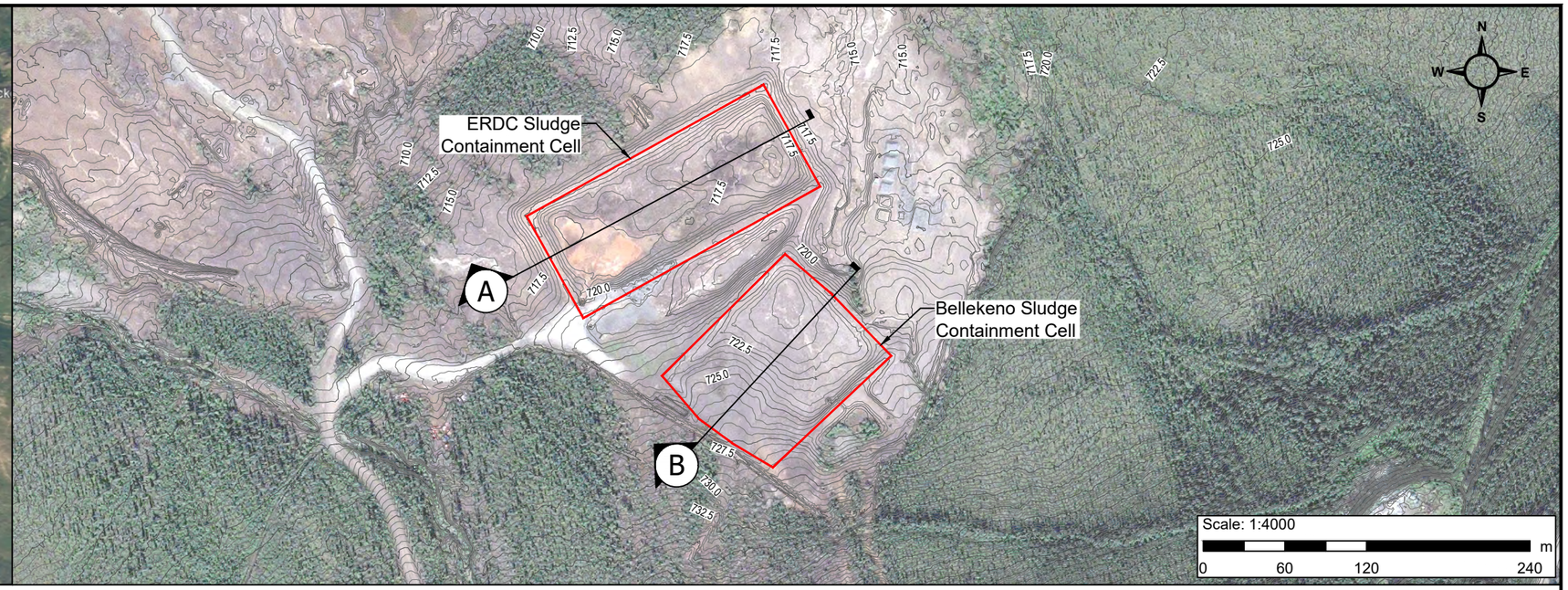
SLUDGE BAG GENERAL ARRANGEMENT
FOR DREDGING
June 3, 2022

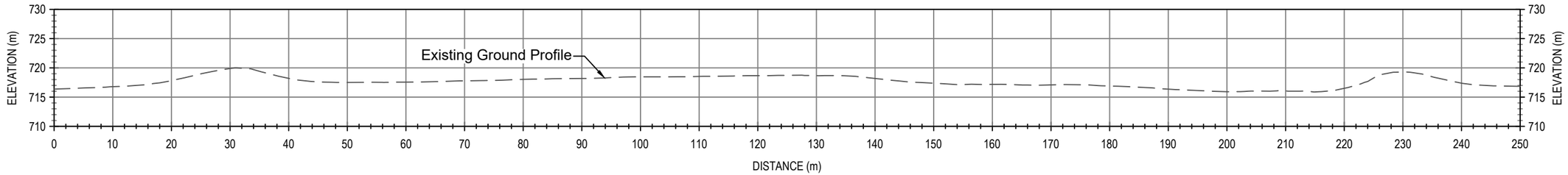
REVISIONS

NO.	BY	DATE	DESCRIPTION
A	B.G	2022/06/02	Draft for review
B	B.G	2022/06/02	Draft for review
C	B.G	2022/06/03	Sludge pump and liner configuration correction

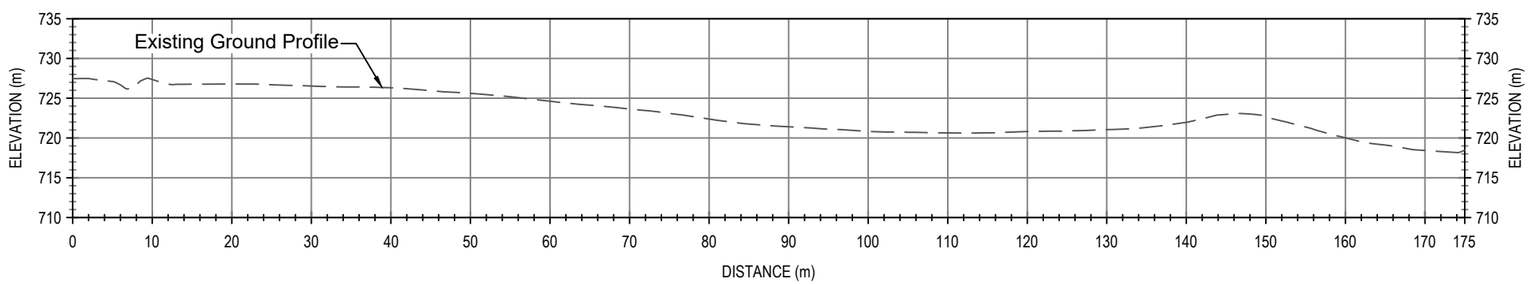
Contact: SD Tolgyesi
Phone: 867-995-3113

ERDC-002-7-GENERAL





Section A



Section B

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2. Topographic contours and profiles derived from LiDAR data acquired by Eagle Mapping Ltd., September 25th, 2014

ENSERO solutions

Keno QZ18-044 Management Plans
Sludge Containment

Figure 3-2

Valley Tailings
Sludge Containment Area

PROJECT No.: ECA20YT00030-223		2020-10-22
DRAWN BY: KB	DESIGNED BY: KW	REVIEWED BY: KW

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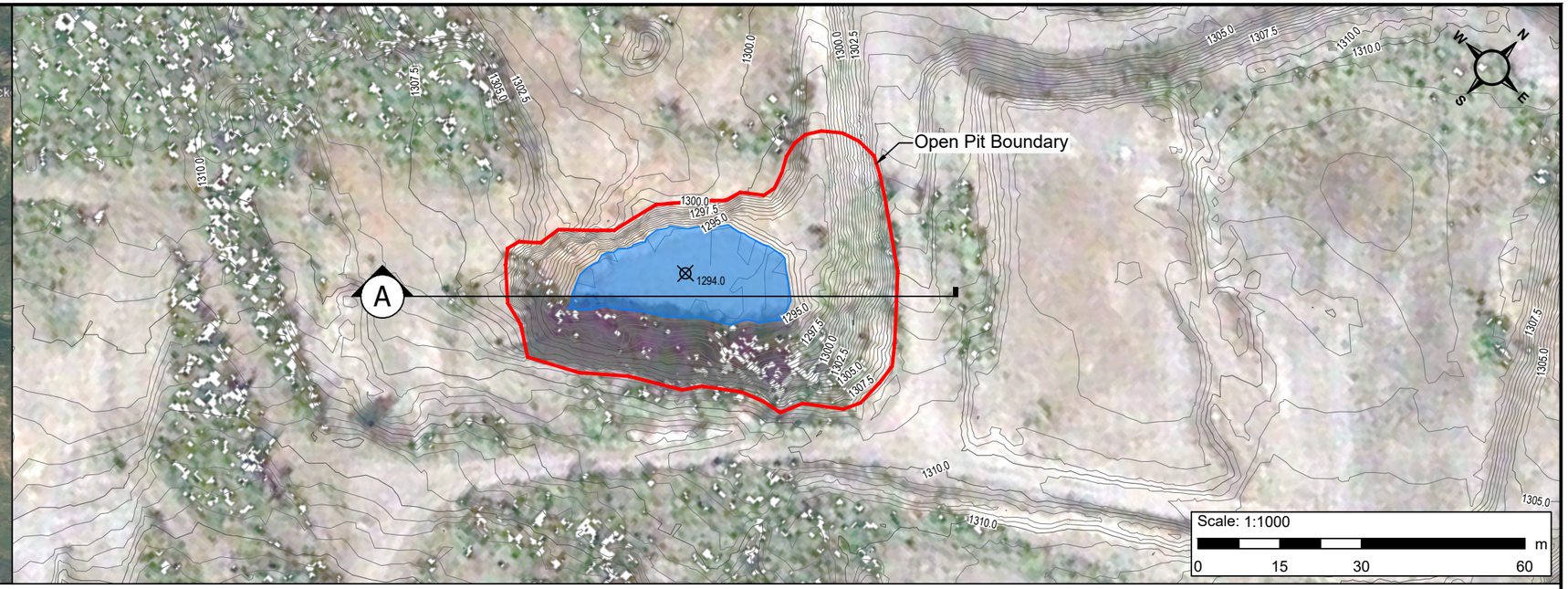

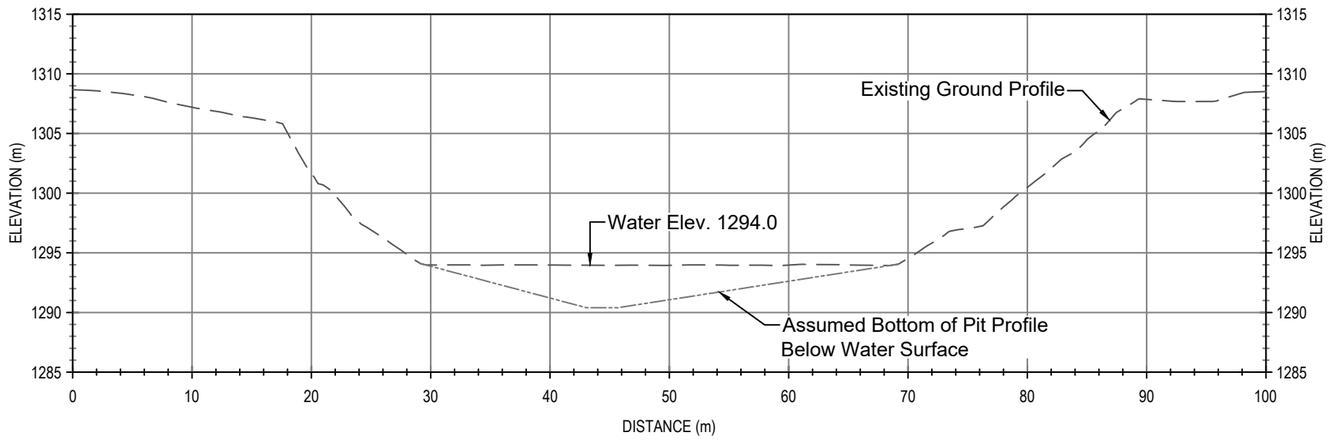

Section A

Scale: 1:500

0 7.5 15 30 m

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2. Topographic contours and profiles derived from LiDAR data acquired by Eagle Mapping Ltd., September 25th, 2014

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Keno QZ18-044 Management Plans
Sludge Containment

Figure 3-3

Bermingham SW
Sludge Containment Area

PROJECT No.: ECA20YT00030-223		2020-10-22
DRAWN BY: KB	DESIGNED BY: KW	REVIEWED BY: KW

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4 SLUDGE CHARACTERIZATION

Sludge samples are collected annually and analyzed for geochemical analysis, moisture content, and particle size distribution. The geochemical analysis is as follows:

- ABA including: paste pH, total inorganic carbon, bulk neutralization potential by the Modified;
- Sobek neutralization potential method, and sulphur speciation with the sulphide sulphur determined by difference between total sulphur (Leco) and sulphate sulphur (HCl extraction);
- Ultra trace elemental analysis by aqua regia digestion followed by inductively coupled plasma mass spectrometry (ICP-MS); and
- Shake Flask Extraction (MEND SFE) test at 3:1 water-solid ratio.

A memorandum summarizing the results of ABA, trace metal content, leachable metals, moisture content and particle size distribution analysis on sludge samples collected from the Bellekeno, Flame & Moth, and New Bermingham WTPs is included in Appendix A. The results of similar geochemical tests conducted on sludge samples collected from the same mines in 2018, 2019, 2020, 2021, and 2022 are compared. The sludge disposal in the underground workings, and open-pit disposal combined with the elevated neutralization potential of the sludge are expected to prevent the onset of metal re-mobilizing or acidic conditions.

5 SLUDGE MANAGEMENT AT CLOSURE

The KHSD Reclamation and Closure Plan is updated every two years in accordance with QML-0009 and WL QZ18-044. Specific measures for sludge management at closure are described in the Reclamation and Closure Plan. In summary, closure measures included in Revision 8 of the Reclamation and Closure Plan for sludge management include the following:

- Reclamation tasks include removal of pond sludges, removal and burial of the pond liners, pipelines, rip rap discharge channels, pond recontouring, revegetation and remediation of any contaminated soils.

- At mine closure, the sludge disposed of in the Bermingham Southwest pit will be covered with waste rock and till material.

The Bellekeno WTP will be decommissioned, and the lined ponds and tanks used for the construction of the underground *in situ* treatment system. As a contingency treatment system, the Bellekeno treatment pond is planned to be converted into a biological treatment cell, in addition to the in-situ treatment of the mine pool.

6 MONITORING AND REPORTING

The following measures will be implemented during the duration of water treatment and sludge generation at Bellekeno, Flame & Moth and New Bermingham WTPs:

- Sludge removal from the WTPs and ponds will be recorded; and
- Sludge samples will be collected annually and tested for grain size, metals and ABA.

An example template used for sludge disposal tracking is included for reference in Appendix B.

Weekly inspections of the WTPs, District Mill Pond and sludge management facilities are conducted as outlined in the KHSD Environmental Monitoring, Surveillance and Reporting Plan and include the following.

- General inspection of pond is checked visually for pond freeboard and leaks.
- Water conveyance structures are inspected for seepage, diversion is clear, spillway is clear, no loose or exposed liner, and no signs of failure.
- Piping is inspected for visible signs of leaks and signs of deformation.
- Photos taken from designated photo hubs (physical locations where photos are repeatedly taken).

Physical inspection reports are submitted as part of the Type A Water License QZ18-044 monthly report.

Groundwater is monitored to collect information on potential impacts from the use of the Bermingham Southwest open pit for sludge disposal as outlined in the KHSD Environmental Monitoring, Surveillance and Reporting Plan. Monitoring wells KV-122 and KV-123 are located downgradient of the pit and monitoring well KV-124 is upgradient. Monthly sampling is conducted at any new monitoring well until a minimum of one year of data points are available; after which the sample frequency becomes quarterly.

Groundwater monitoring data are compared to groundwater quality action level triggers as outlined in the KHSD Adaptive Management Plan. Monitoring results are uploaded weekly into an EQWin database where set point triggers and trends are programmed to be flagged for notification and action. Adaptive management triggers are reported as part of the Type A Water License QZ18-044 monthly report.

Sludge stored in P-AML waste rock storage areas will be evaluated by waste rock management programs, and sludge relocated underground in accordance with the mines operating plan.

Annual reports are submitted as part of WL QZ18-044 and QML-009. The annual WL reports will include a summary of the volume of sludge removed from each WTP and the disposal destination, sludge testing results, surface and groundwater monitoring details, and an updated water balance that considers any disposal of sludge with the mine workings.

All monthly and annual reports are provided to the FNNND.

7 REFERENCES

Ensero and AKHM, 2020a. *Keno Hill Silver District Mining Operations, Keno Hill In Situ System Operations and Maintenance Plan.* October 2020.

Ensero and AKHM, 2020b. *Keno Hill Silver District Mining Operations, Bioreactor Design and Operation Plan*. October 2020.

APPENDIX A:

SLUDGE CHARACTERIZATION MEMO

Memorandum

To: Arlene Stearman and Kevin Eppers, Hecla Yukon

From: Collin Burelle and Andrew Gault, Ensero Solutions Canada, Inc.

CC: Kai Woloshyn, Ensero Solutions Canada, Inc.

Date: March 28, 2023

Re: Geochemical Assessment of AKHM Water Treatment Sludge – 2022 Update

Attachments: Appendix A: Laboratory Analysis Reports

1 INTRODUCTION

Alexco Keno Hill Mining Corp. (AKHM) currently operates and maintains water treatment plants (WTPs) under Type A Water Licence QZ18-044 at the Bellekeno, Flame & Moth, and New Bermingham mines. The treatment systems operated comprise one or more of the following processes:

- Metals removal with the addition of air, lime for pH adjustment, flocculant, coagulant; and
- Particle removal via a multimedia filter, clarifier/thickener, and/or settling pond.

The Sludge Management Plan for the Keno Hill Silver District (KHSD) Mining Operations (AKHM, 2022) stipulates that the measures listed below will be implemented during the duration of water treatment and sludge generation at the Bellekeno, New Bermingham, and Flame & Moth WTPs:

- Recording of the volume of each load of sludge pulled from the water treatment retention ponds in the Operator's Log Book;
- Collection and testing of sludge samples annually. The tests will at least include acid-base accounting (ABA) and elemental analysis; and
- Provision of the information above in AKHM's Annual Report to the Yukon Water Board.

This memorandum summarizes the results of static testing on sludge samples collected in November 2022. The results of samples collected in previous years from AKHM WTPs are also provided, and a comparative assessment done, where appropriate. The memorandum includes results for the 2022 sludge samples collected from the Flame & Moth (November 1) and New Bermingham (November 14) WTPs. Sludge samples were not collected for the Bellekeno WTP in 2022 since mining halted at Bellekeno in 2021. Following the end of mining operations, dewatering of the Bellekeno workings ended and the mine was allowed to flood. As such, no mine water was pumped or

discharge from Bellekeno in 2022; therefore, the Bellekeno WTP did not operate and produce sludge in 2022. Nevertheless, historical data is referenced in this memorandum for each site where appropriate.

2 SAMPLING AND LABORATORY TESTING

Sludge samples collected in 2022 from the clarifier underflow at the Flame & Moth and New Bermingham WTPs were sent to ALS laboratories in Vancouver, BC, for testing (Table 2-1). The geochemical laboratory tests were based on methods outlined in Price (2009) and consisted of:

- ABA including: paste pH, total inorganic carbon, bulk neutralization potential by the Modified Sobek neutralization potential method, and sulphur speciation with the sulphide sulphur determined by difference between total sulphur (Leco) and sulphate sulphur (HCl extraction);
- Ultra trace elemental analysis by aqua regia digestion followed by inductively coupled plasma mass spectrometry (ICP-MS); and
- Shake Flask Extraction (MEND SFE) test at 3:1 water-solid ratio.

Other tests performed on the samples included moisture content and particle size distribution.

Table 2-1: Description of Water Treatment Plant Sludge Samples

Sample ID	Location	Sample Weight (kg)	Laboratory Test
F&M_2022	Flame & Moth	3.22	ABA, Elemental Analysis, Moisture Content and Particle Size Distribution
BH 2022	New Bermingham	0.52	ABA, Elemental Analysis, Moisture Content and Particle Size Distribution

ABA – acid base accounting.

3 RESULTS

The results of laboratory test results are summarized in Table 3-1 to Table 3-4 and laboratory reports are provided in Appendix A. For comparison purposes, the results of similar geochemical tests conducted on sludge samples collected from the same WTPs between 2018 and 2021 and reported in AEG (2019 and 2020) and Ensero (2021 and 2022) are also provided.

3.1 PARTICLE SIZE DISTRIBUTION

The results of particle size distribution (PSD) showed that the 2022 New Bermingham and Flame & Moth WTP sludge samples primarily comprised silt-sized material (80-82%), supplemented by a finer-grained clay fraction (17-18%) and trace sand (2%; Table 3-1).

Table 3-1: Results of Particle Size Distribution Test of Water Treatment Plant Sludge Samples

Grain Size	Units	Detection Limit	F&M	BH
Clay (<0.00 4mm)	%	1.0	18.4	16.5
Silt (0.063 mm - 0.004 mm)	%	1.0	79.6	81.7
Sand (0.2 mm - 0.063 mm)	%	1.0	-	-

Grain Size	Units	Detection Limit	F&M	BH
Sand (2.0 mm - 0.2 mm)	%	1.0	-	-
Sand (2.0 mm - 0.063 mm)	%	1.0	2	1.8
Gravel (>2 mm)	%	1.0	<1.0	<1.0

Notes: F&M: Flame & Moth; BH: New Bermingham

3.2 ACID BASE ACCOUNTING

ABA provides an indication of the acid generation and neutralization potentials of geologic materials by determining the content and ratio of potentially acid producing and consuming minerals in a sample. The results of the ABA testing of the 2022 sludge samples are presented in Table 3-2 along with the results of the 2018, 2019, 2020, and 2021 tests. This was done to provide context for the other WTP (Bellekeno) while also reporting the updated ABA values for the Flame & Moth and New Bermingham WTPs.

The 2022 results show that the samples had neutral paste pH (8.3), consistent with the mildly alkaline paste pH observed in previous years (8.0 to 8.6 for Flame & Moth and 8.9 for New Bermingham).

A marked continuous decrease of carbonate-NP (from 870 to 113 kg $CaCO_3$/t) was observed in the Flame & Moth WTP sludge from 2019 to 2022. Similar decreases in carbonate-NP can also be noted in the New Bermingham sludge (from 201 to 111 kg $CaCO_3$/t) from 2021 to 2022. This is likely due to lower lime addition over the years at both WTPs. The carbonate-NP remained the main contributor to the bulk neutralization potential for all samples (2018-2022), suggesting that most NP is from reactive carbonates.

The sulphate content (reported as HCl extractable sulphur) of the Flame & Moth sludge was much lower in 2021 than in 2019 and 2020 and only represented 4% of total sulphur compared to 66% in 2020 and 100% in 2019 (Ensero, 2022). This was likely due to lower addition of lime (i.e., less precipitation of the calcium sulphate mineral gypsum that forms as calcium from the lime reacts with sulphate in the mine water). Total sulphur also exhibited a decrease in 2021 (0.47 wt.%), but rebounded in 2022 (0.72 wt.%), The 2022 sludge sample from the Flame & Moth WTP also had low sulphate-sulphur content (0.06 wt.%). Both the 2021 and 2022 New Bermingham sludge samples had low sulphate sulphur content (less than 0.01 and 0.02 wt.%, respectively).

The elevated carbonate-NP coupled with a very low acid generation potential (acid potential of 22.5 kg $CaCO_3$/t and 10.9 kg $CaCO_3$/t, respectively) for the 2022 Flame & Moth and New Bermingham sludge suggests that the potential for acid generation from both sludge samples is low. The carbonate neutralization potential ratio (NPR) was calculated conservatively as a ratio of carbonate-NP to acid potential and confirmed a low potential for acid generation (i.e., NPR greater than 2). Sludge samples from all WTPs had an NPR greater than 2 and were classified as non-potentially acid generating (non-PAG).

Table 3-2: Results of Acid Base Accounting of Water Treatment Plant Sludge Samples

Parameter	Units	Detection Limit	BK				F&M				BH	
			2018	2019	2020	2021	2019	2020	2021	2022	2021	2022
Paste pH	pH unit	0.1	9.0	8.5	8.6	8.8	8.3	8.0	8.6	8.3	8.9	8.3
Inorganic Carbon (C)	wt.%	0.05	10.05	9.91	8.39	7.38	10.4	6.62	2.41	1.4	2.41	1.32
Inorganic Carbon Dioxide (CO_2)	wt.%	0.2	36.7	36.3	30.8	27	38.2	24.2	8.8	5.1	8.9	4.9
Total Sulphur	wt.%	0.01	1.01	1.11	1.22	1.67	0.75	0.68	0.47	0.72	0.46	0.35
HCl Extractable Sulphur	wt.%	0.01	0.98	1.09	0.72	0.64	0.77	0.45	0.02	0.06	<0.01	0.02
Sulphide Sulphur (by diff.)	wt.%	0.01	0.03	0.02	0.5	1.03	<0.01	0.23	0.45	0.66	0.46	0.33
Carbonate Equivalent Neutralization Potential (NP)	kg $CaCO_3$/t	1	835	826	700	615	869	550	201	113	201	111
Acid Generation Potential (AP)	kg $CaCO_3$/t	0.3	0.9	0.6	15.6	32.2	0.3	7.2	14.1	22.5	14.4	10.9
Modified Sobek Neutralization Potential (NP)	kg $CaCO_3$/t	1	837	868	695	600	902	520	195	91	202	100
Neutralization Potential Ratio (NPR)	NA	0.1	890	1321	45	19	2780	77	14	5.02	14	10.15
Acid Rock Drainage Classification	NA	-	non-PAG	non-PAG	non-PAG	non-PAG	non-PAG	non-PAG	non-PAG	non-PAG	non-PAG	non-PAG

BK: Bellekeno 625; F&M: Flame & Moth; BH: New Bermingham
NP: neutralization potential
NA: not available

3.3 METAL CONTENT

The bulk metal concentration of an element provides a preliminary indication of constituents that could be solubilized and remobilized when exposed to leaching, depending on the speciation of the metal. However, the enrichment (or depletion) of a constituent in a sample is not a direct measure of its potential mobility or bioavailability because several factors including hydrogeology, biogeochemistry, climate, pH, and redox conditions which together ultimately determine the mobility and bioavailability of an element in the environment. In the case of sludge, climate, pH, and redox conditions are the primary controls on the potential elemental mobility.

The historical trace elemental concentrations for the WTP sludge samples are presented in Table 3-3. The discussion herein is focused on the metal(loid)s related to the KHSD mineralization such as arsenic, cadmium, copper, lead, nickel, manganese, iron, silver, and zinc. The results of the elemental analysis showed high metal(loid) concentrations in the sludges as expected from a treatment system (Table 3-3). The metalloid content of the Bellekeno sludge largely reflected the metal(loid) load supplied by the adit discharge to the WTP. The elevated manganese (7,800 ppm), lead (>10,000 ppm), and zinc (>10,000 ppm) concentrations in the Bellekeno sludge compared to the Flame & Moth and New Bermingham sludge in 2021 reflected the high loading of these metal(loid)s supplied by the adit (Table 3-3). The New Bermingham sludge sample in 2021 also contained elevated silver, arsenic, cadmium, manganese, and lead. The high acid buffering capacity of the sludges create favorable conditions for the precipitation of metal oxyhydroxides that scavenge and coprecipitate these metals(loids), limiting their solubility and mobility in the environment. The concentrations of some metals (e.g., silver, copper, nickel, lead) in the Flame & Moth sludge also increased modestly in 2021 compared to 2019 and 2020 (Table 3-3), while arsenic and manganese decreased. The concentrations of many metal(loids) including arsenic, cadmium, copper, lead, silver, and zinc in the sludge samples increased significantly from 2019 to 2021 at each site (Table 3-3).

The elemental analysis data collected in 2022 showed some variation in concentration of metal(loid)s at each WTP (Table 3-3).

In 2022, the Flame & Moth sludge exhibited approximately one order of magnitude increased concentrations for arsenic, cadmium, silver, and zinc and an approximately doubling of lead, nickel, manganese, and iron concentrations compared to the 2021 sample (Table 3-3). This reflects the marked increase in constituent concentrations in the Flame & Moth adit discharge in 2022 compared to 2021, likely related to increased mine development activity including greater excavation of mineralized rock in the Flame & Moth workings in 2022.

The 2022 New Bermingham sample showed some increases in the concentrations for metal(loids) of focus (cadmium, iron, lead, zinc) but also showed decreases in concentrations for other metal(loids) (arsenic, copper, nickel, manganese, silver).

Table 3-3: Results of Elemental Analysis of WTP Sludge Samples

Parameter	Units	BK				F&M					BH	
		2018	2019	2020	2021	2018	2019	2020	2021	2022	2021	2022
Silver (Ag)	ppm	0.86	0.46	102	>100	0.99	0.06	1.21	4.18	33.7	>100	67.9
Aluminum (Al)	%	0.03	0.03	0.18	0.18	0.67	0.03	0.68	0.73	1.19	0.83	1.08
Arsenic (As)	ppm	36.3	21.9	242	308	38.6	89.2	73	30.8	321	248	121
Boron (B)	ppm	10	<10	<10	<10	<10	<10	<10	10	<10	10	<10
Barium (Ba)	ppm	20	20	30	30	70	10	40	120	420	90	90
Beryllium (Be)	ppm	<0.05	<0.05	0.06	0.11	0.59	<0.05	0.24	0.45	0.30	0.64	0.58
Bismuth (Bi)	ppm	0.03	0.02	1.75	3.32	0.34	0.01	0.36	0.74	4.54	0.18	0.38
Calcium (Ca)	%	>25.0	>25.0	>25.0	22.7	12.9	>25.0	22.6	7.96	4.05	8.04	4.46
Cadmium (Cd)	ppm	21.9	10.25	100.5	140.5	0.67	0.13	2.24	2.81	29.4	21.1	24.6
Cobalt (Co)	ppm	19.2	13.1	12.1	11.6	3.8	3.1	3.2	5.1	12	8.1	10.3
Chromium (Cr)	ppm	6	<1	4	5	19	2	15	19	20	18	22
Copper (Cu)	ppm	12.1	2.8	109	210	16	3	15.1	33	133	55.3	47.1
Iron (Fe)	%	2.46	1.86	2.72	2.89	1.6	1.31	1.94	1.71	3.17	2.36	3.02
Mercury (Hg)	ppm	0.01	<0.01	0.14	0.25	0.02	<0.01	0.04	0.05	.13	0.09	0.11
Potassium (K)	%	0.01	0.01	0.03	0.02	0.04	<0.01	0.04	0.04	0.06	0.06	0.06
Lithium (Li)	ppm	1.3	1.5	1.5	2.3	9.9	1.4	8	14	34.6	11.4	15.6
Magnesium (Mg)	%	1.13	0.6	0.77	0.49	0.67	0.37	0.44	0.5	0.81	0.44	0.47
Manganese (Mn)	ppm	7130	4980	7030	7800	759	1220	1150	595	1315	4280	3320
Molybdenum (Mo)	ppm	1.07	0.12	0.95	1.57	1.96	0.12	0.86	4.84	8.08	3.07	4.44
Sodium (Na)	%	0.03	0.02	0.02	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01
Nickel (Ni)	ppm	68.1	46.4	44.3	34.2	20.6	8.9	16.2	25.4	46.5	30.6	40.7
Phosphorus (P)	ppm	50	40	160	180	640	40	510	500	470	660	700
Lead (Pb)	ppm	111	52.1	9750	>10000	50.4	7.7	116	523	962	1815	1850
Sulfur (S)	%	1.07	1.14	1.38	1.73	0.69	0.78	0.79	0.49	0.67	0.48	0.36
Antimony (Sb)	ppm	2.14	1.06	95.4	174	3.44	2.83	4.57	4.68	31.6	66.1	36

Parameter	Units	BK				F&M					BH	
		2018	2019	2020	2021	2018	2019	2020	2021	2022	2021	2022
Selenium (Se)	ppm	0.4	0.7	1.3	1.4	0.5	0.4	0.7	0.9	1.0	0.7	1
Tin (Sn)	ppm	1	<0.2	8.9	14.8	2.2	9.5	1.9	2.2	29.8	3.5	2.7
Strontium (Sr)	ppm	758	683	655	520	310	730	578	188	106	129	75.5
Thallium (Tl)	ppm	0.13	0.04	0.14	0.15	0.06	0.02	0.21	0.1	0.10	0.2	0.16
Uranium (U)	ppm	13.7	12.65	10.2	7.07	5.71	7.86	5.3	3.56	3.17	2.17	1.75
Vanadium (V)	ppm	8	9	31	15	11	7	15	13	18	18	27
Zinc (Zn)	ppm	8380	5150	>10000	>10000	133	169	361	331	3090	1500	1670
Zinc (Zn)*	%	-	-	1.195	-	-	-	-	-	-	-	-

Notes: BK: Bellekeno 625; F&M: Flame & Moth; BH: New Bermingham
**: ore grade aqua regia*

3.4 LEACHABLE METALS

The results of the SFE conducted on the Flame & Moth and New Bermingham 2022 sludge samples are provided in Table 3-4. The results show that 41% (Flame & Moth) and 30% (New Bermingham) of constituents in the leach solution were below the detection limit. Leachable sulphate was moderate (398 and 201 mg/L for Flame & Moth and New Bermingham, respectively). The SFE leachate concentrations for both 2022 samples were lower than the effluent quality standards (EQS) for the parameters with an established EQS (arsenic, cadmium, copper, lead, nickel, silver, zinc).

Table 3-4: Results of Shake Flask Extraction on Flame & Moth and New Bermingham Sludge

Parameter	Detection Limit	Units	Flame & Moth EQS for KV-104L (flow <10 L/s)	New Bermingham EQS	Flame & Moth (2022)	New Bermingham (2022)
pH	0.1	pH units	6.5 to 9.5	6.5 to 9.5	7.42	7.41
Sulphate	0.5	mg/L			398	201
Dissolved hardness (as $CaCO_3$)	0.6	mg/L			426	225
Aluminum	0.005	mg/L			0.0204	0.03
Antimony	0.0001	mg/L			0.0676	0.117
Arsenic	0.001	mg/L	0.035	0.061	0.0054	0.0091
Barium	0.001	mg/L			0.0444	0.0316
Beryllium	0.0005	mg/L			<0.00050	<0.00050
Bismuth	0.0005	mg/L			<0.00050	<0.00050
Boron	0.01	mg/L			0.050	0.095
Cadmium	0.00005	mg/L	0.0012	0.01	0.000177	0.00022
Calcium	0.1	mg/L			104	51.8
Chromium	0.0005	mg/L			<0.00050	<0.00050
Cobalt	0.0001	mg/L			<0.00010	0.00018
Copper	0.001	mg/L	0.043	0.024	<0.0010	<0.0010
Iron	0.03	mg/L			<0.030	<0.030
Lead	0.0001	mg/L	0.036	0.048	0.00094	0.00093
Lithium	0.005	mg/L			0.0205	0.0291
Magnesium	0.05	mg/L			40.5	23.3
Manganese	0.0005	mg/L			0.0345	0.138
Mercury	0.00005	mg/L			<0.000050	<0.00050
Molybdenum	0.0001	mg/L			0.0187	0.0200
Nickel	0.0005	mg/L	0.5	0.37	0.00075	0.0015
Phosphorus	0.3	mg/L			<0.30	<0.30
Potassium	0.05	mg/L			5.27	4.58

Parameter	Detection Limit	Units	Flame & Moth EQS for KV-104L (flow <10 L/s)	New Bermingham EQS	Flame & Moth (2022)	New Bermingham (2022)
Selenium	0.0005	mg/L			0.00083	0.00225
Silicon	0.05	mg/L			2.62	5.18
Silver	0.00005	mg/L	0.0029	0.00062	<0.000050	0.000214
Sodium	0.05	mg/L			10.7	9.66
Strontium	0.0005	mg/L			0.887	0.367
Sulphur	0.5	mg/L			146	78.7
Thallium	0.0001	mg/L			0.00017	<0.00010
Tin	0.0005	mg/L			<0.00050	<0.00050
Titanium	0.01	mg/L			<0.10	<0.010
Uranium	0.00001	mg/L			0.000661	0.00104
Vanadium	0.001	mg/L			<0.0010	0.0012
Zinc	0.01	mg/L	0.23	0.5	<0.010	<0.010

Notes: DL: detection limit

4 SUMMARY

The results of past static tests on KHSD sludge samples from Bellekeno, Flame & Moth, and New Bermingham WTPs indicated that the sludges had low potential for long-term acid generation due to their high carbonate buffering capacity and low sulphide sulphur contents. Flame & Moth and New Bermingham 2022 sludge analyses confirm the continued high carbonate buffering capacity and low sulphide sulphur content at both WTPs, indicating low potential for long-term acid generation. Furthermore, while the sludge exhibited increases in bulk trace element concentrations (Flame & Moth), the SFE leachate test demonstrated low potential for re-mobilization of the metal(loids) of concern.

Tessier Sequential Extraction testing was conducted in 2018 on Bellekeno and Flame & Moth sludge samples(AEG, 2019) and showed that the precipitated metal(loid)s were largely bound to the residual and reducible phases. The precipitated metal(loid)s were predominantly in stable forms and unlikely to be re-mobilized unless exposed to acidic or reducing conditions. The sludge management practices outlined in the sludge management plan (Ensero, 2020 and AKHM, 2022), including underground disposal, co-disposal with dry stack tailings, and in open-pit disposal, combined with the elevated NP are expected to prevent the onset of metal re-mobilizing conditions.

5 REFERENCES

AEG (Alexco Environmental Group Inc.). (2019). Geochemical Assessment of KHSD Water Treatment Sludge Keno Hill Silver District Mining Operations, Yukon. Report prepared for Alexco Keno Hill Mining Corp. March 2019.

AEG (Alexco Environmental Group Inc.). (2020). Geochemical Assessment of KHSD Water Treatment Sludge Keno Hill Silver District Mining Operations, Yukon. Report prepared for Alexco Keno Hill Mining Corp. March 2020.

AKHM (Alexco Keno Hill Mining Corp.). (2022). Keno Hill Silver District Mining Operations Sludge Management Plan. June 2022.

ERDC (Elsa Reclamation and Development Company Ltd.). (2013). *Keno Hill Water Treatment Systems Sludge Management Plan QZ12-057, Revision 4*. September 2013.

Ensero (Ensero Solutions Canada, Inc.). (2020). *Sludge Management Plan, Keno Hill Silver District Mining Operations, Yukon*. Report prepared for Alexco Keno Hill Mining Corp. October 2020.

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Ensero (Ensero Solutions Canada, Inc.). (2022). *Geochemical Assessment of KHSD Water Treatment Sludge -2021 Update*. Memorandum prepared for Alexco Keno Hill Mining Corp. March 28, 2022.

Price, W.A. (2009). Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. MEND Report 1.20.1. CANMET – Mining and Mineral Science Laboratories, Smithers, BC.

APPENDIX A:
LABORATORY ANALYSIS REPORTS

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **WR2201485**	Page	: 1 of 6
Client	: **Alexco Keno Hill Mining Corp**	Laboratory	: Whitehorse - Environmental
Contact	: YK Environment	Account Manager	: Heather McKenzie
Address	: Suite 1225, Two Bentall Centre 555 Burrard Street, Box 216 Vancouver BC Canada V7X 1M9	Address	: #12 151 Industrial Road Whitehorse YT Canada Y1A 2V3
Telephone	: ----	Telephone	: +1 867 668 6689
Project	: Type A WL Tx	Date Samples Received	: 16-Nov-2022 16:20
PO	: 05562	Date Analysis Commenced	: 23-Nov-2022
C-O-C number	: ----	Issue Date	: 30-Jan-2023 15:27
Sampler	: ----		
Site	: AKHM		
Quote number	: WR22-AKHM100-04 (Keno/Hecla)		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Paolo Obillo	Account Manager Assistant	Internal Subcontracting, North Vancouver, British Columbia
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.
Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
%	percent
µS/cm	microsiemens per centimetre
kg	kilograms
mg/L	milligrams per litre
pH units	pH units
ppm (w/w)	parts per million (weight/weight)
tCaCO□/kt	tons CaCO□ per kiloton

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	*Comment*
WR2201485-001	BH	Sample(s) F1: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Analytical Results

Sub-Matrix: **Sludge**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: BH	----	----	----	----
					Client sampling date / time: 14-Nov-2022 15:00	----	----	----	----
					WR2201485-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
Conductivity, leachable	----	E103	2.0	µS/cm	522	----	----	----	----
Moisture	----	E144	0.25	%	77.6	----	----	----	----
pH	----	E116	0.10	pH units	7.41	----	----	----	----
Particle Size									
Clay (<0.004mm)	----	EC184E	1.0	%	16.5	----	----	----	----
Silt (0.063mm - 0.004mm)	----	EC184E	1.0	%	81.7	----	----	----	----
Sand (2.0mm - 0.063mm)	----	EC184E	1.0	%	1.8	----	----	----	----
Gravel (>2mm)	----	EC184E	1.0	%	<1.0	----	----	----	----
Acid Base Accounting									
Carbon dioxide	124-38-9	C-GAS05	0.2	%	4.9	----	----	----	----
Carbon, total inorganic [TIC]	----	C-GAS05	0.05	%	1.32	----	----	----	----
Fizz rating	----	OA-VOL08m	1	-	3	----	----	----	----
Maximum potential acidity [MPA]	----	OA-VOL08m	0.3	tCaCO□/kt	10.9	----	----	----	----
Net neutralization potential [NNP]	----	OA-VOL08m	1	tCaCO□/kt	100	----	----	----	----
Neutralization potential [NP]	----	OA-VOL08m	1	tCaCO□/kt	111	----	----	----	----
Neutralization potential ratio [NPR], (NP/MPA)	----	OA-VOL08m	0.01	-	10.15	----	----	----	----
pH (1:1 soil:water)	----	OA-ELE07	0.10	pH units	8.30	----	----	----	----
Sulfate (as S), HCl leach	14808-79-8	S-GRA06A	0.01	%	0.02	----	----	----	----
Sulfide (as S), total minus HCl leach	18496-25-8	S-CAL06a	0.01	%	0.33	----	----	----	----
Sulfur, total	7704-34-9	S-IR08	0.01	%	0.35	----	----	----	----
Weight, sample received	n/a	WEI-21	0.02	kg	0.52	----	----	----	----
Metals									
Aluminum	7429-90-5	ME-MS41	0.01	%	1.08	----	----	----	----
Antimony	7440-36-0	ME-MS41	0.05	ppm (w/w)	36.0	----	----	----	----
Arsenic	7440-38-2	ME-MS41	0.1	ppm (w/w)	121.0	----	----	----	----
Barium	7440-39-3	ME-MS41	10	ppm (w/w)	90	----	----	----	----
Beryllium	7440-41-7	ME-MS41	0.05	ppm (w/w)	0.58	----	----	----	----
Bismuth	7440-69-9	ME-MS41	0.01	ppm (w/w)	0.38	----	----	----	----
Boron	7440-42-8	ME-MS41	10	ppm (w/w)	<10	----	----	----	----

Analytical Results

Sub-Matrix: Sludge (Matrix: Soil/Solid)					Client sample ID	BH	----	----	----	----
					Client sampling date / time	14-Nov-2022 15:00	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		WR2201485-001	--------	--------	--------	--------
						Result	----	----	----	----
Metals										
Cadmium	7440-43-9	ME-MS41	0.01	ppm (w/w)		24.6	----	----	----	----
Calcium	7440-70-2	ME-MS41	0.01	%		4.46	----	----	----	----
Cerium	7440-45-1	ME-MS41	0.02	ppm (w/w)		23.4	----	----	----	----
Cesium	7440-46-2	ME-MS41	0.05	ppm (w/w)		1.55	----	----	----	----
Chromium	7440-47-3	ME-MS41	1	ppm (w/w)		22	----	----	----	----
Cobalt	7440-48-4	ME-MS41	0.1	ppm (w/w)		10.3	----	----	----	----
Copper	7440-50-8	ME-MS41	0.2	ppm (w/w)		47.1	----	----	----	----
Gallium	7440-55-3	ME-MS41	0.05	ppm (w/w)		3.12	----	----	----	----
Germanium	7440-56-4	ME-MS41	0.05	ppm (w/w)		0.06	----	----	----	----
Gold	7440-57-5	ME-MS41	0.02	ppm (w/w)		<0.02	----	----	----	----
Hafnium	7440-58-6	ME-MS41	0.02	ppm (w/w)		0.15	----	----	----	----
Indium	7440-74-6	ME-MS41	0.005	ppm (w/w)		0.267	----	----	----	----
Iron	7439-89-6	ME-MS41	0.01	%		3.02	----	----	----	----
Lanthanum	7439-91-0	ME-MS41	0.2	ppm (w/w)		11.8	----	----	----	----
Lead	7439-92-1	ME-MS41	0.2	ppm (w/w)		1850	----	----	----	----
Lithium	7439-93-2	ME-MS41	0.1	ppm (w/w)		15.6	----	----	----	----
Magnesium	7439-95-4	ME-MS41	0.01	%		0.47	----	----	----	----
Manganese	7439-96-5	ME-MS41	5	ppm (w/w)		3320	----	----	----	----
Mercury	7439-97-6	ME-MS41	0.01	ppm (w/w)		0.11	----	----	----	----
Molybdenum	7439-98-7	ME-MS41	0.05	ppm (w/w)		4.44	----	----	----	----
Nickel	7440-02-0	ME-MS41	0.2	ppm (w/w)		40.7	----	----	----	----
Niobium	7440-03-1	ME-MS41	0.05	ppm (w/w)		0.14	----	----	----	----
Phosphorus	7723-14-0	ME-MS41	10	ppm (w/w)		700	----	----	----	----
Potassium	7440-09-7	ME-MS41	0.01	%		0.06	----	----	----	----
Rhenium	7440-15-5	ME-MS41	0.001	ppm (w/w)		0.004	----	----	----	----
Rubidium	7440-17-7	ME-MS41	0.1	ppm (w/w)		4.9	----	----	----	----
Scandium	7440-20-2	ME-MS41	0.1	ppm (w/w)		3.0	----	----	----	----
Selenium	7782-49-2	ME-MS41	0.2	ppm (w/w)		1.0	----	----	----	----
Silver	7440-22-4	ME-MS41	0.01	ppm (w/w)		67.9	----	----	----	----
Sodium	7440-23-5	ME-MS41	0.01	%		0.01	----	----	----	----

Analytical Results

Sub-Matrix: Sludge (Matrix: Soil/Solid)					Client sample ID	BH	----	----	----	----
					Client sampling date / time	14-Nov-2022 15:00	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		WR2201485-001	--------	--------	--------	--------
						Result	----	----	----	----
Metals										
Strontium	7440-24-6	ME-MS41	0.2	ppm (w/w)		75.5	----	----	----	----
Sulfur	7704-34-9	ME-MS41	0.01	%		0.36	----	----	----	----
Tantalum	7440-25-7	ME-MS41	0.01	ppm (w/w)		0.01	----	----	----	----
Tellurium	13494-80-9	ME-MS41	0.01	ppm (w/w)		0.03	----	----	----	----
Thallium	7440-28-0	ME-MS41	0.02	ppm (w/w)		0.16	----	----	----	----
Thorium	7440-29-1	ME-MS41	0.2	ppm (w/w)		9.8	----	----	----	----
Tin	7440-31-5	ME-MS41	0.2	ppm (w/w)		2.7	----	----	----	----
Titanium	7440-32-6	ME-MS41	0.005	%		<0.005	----	----	----	----
Tungsten	7440-33-7	ME-MS41	0.05	ppm (w/w)		1.73	----	----	----	----
Uranium	7440-61-1	ME-MS41	0.05	ppm (w/w)		1.75	----	----	----	----
Vanadium	7440-62-2	ME-MS41	1	ppm (w/w)		27	----	----	----	----
Yttrium	7440-65-5	ME-MS41	0.05	ppm (w/w)		5.80	----	----	----	----
Zinc	7440-66-6	ME-MS41	2	ppm (w/w)		1670	----	----	----	----
Zirconium	7440-67-7	ME-MS41	0.5	ppm (w/w)		8.5	----	----	----	----
Leachable Anions & Nutrients										
Sulfate, leachable	14808-79-8	E243.SO4	0.50	mg/L		201	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E446	0.0050	mg/L		0.0300	----	----	----	----
Antimony, leachable	7440-36-0	E446	0.00010	mg/L		0.117	----	----	----	----
Arsenic, leachable	7440-38-2	E446	0.0010	mg/L		0.0091	----	----	----	----
Barium, leachable	7440-39-3	E446	0.0010	mg/L		0.0316	----	----	----	----
Beryllium, leachable	7440-41-7	E446	0.00050	mg/L		<0.00050	----	----	----	----
Bismuth, leachable	7440-69-9	E446	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E446	0.010	mg/L		0.095	----	----	----	----
Cadmium, leachable	7440-43-9	E446	0.000050	mg/L		0.000220	----	----	----	----
Calcium, leachable	7440-70-2	E446	0.10	mg/L		51.8	----	----	----	----
Chromium, leachable	7440-47-3	E446	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E446	0.00010	mg/L		0.00018	----	----	----	----
Copper, leachable	7440-50-8	E446	0.0010	mg/L		<0.0010	----	----	----	----
Hardness (as CaCO3), dissolved	----	E446	0.60	mg/L		225	----	----	----	----

Analytical Results

Sub-Matrix: Sludge (Matrix: Soil/Solid)					Client sample ID	BH	----	----	----	----
					Client sampling date / time	14-Nov-2022 15:00	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		WR2201485-001	--------	--------	--------	--------
						Result	----	----	----	----
Leachable Metals										
Iron, leachable	7439-89-6	E446	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E446	0.00010	mg/L		0.00093	----	----	----	----
Lithium, leachable	7439-93-2	E446	0.0050	mg/L		0.0291	----	----	----	----
Magnesium, leachable	7439-95-4	E446	0.050	mg/L		23.3	----	----	----	----
Manganese, leachable	7439-96-5	E446	0.00050	mg/L		0.138	----	----	----	----
Mercury, leachable	7439-97-6	E515	0.000050	mg/L		<0.000050	----	----	----	----
Molybdenum, leachable	7439-98-7	E446	0.00010	mg/L		0.0200	----	----	----	----
Nickel, leachable	7440-02-0	E446	0.00050	mg/L		0.00150	----	----	----	----
Phosphorus, leachable	7723-14-0	E446	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E446	0.050	mg/L		4.58	----	----	----	----
Selenium, leachable	7782-49-2	E446	0.00050	mg/L		0.00225	----	----	----	----
Silicon, leachable	7440-21-3	E446	0.050	mg/L		5.18	----	----	----	----
Silver, leachable	7440-22-4	E446	0.000050	mg/L		0.000214	----	----	----	----
Sodium, leachable	7440-23-5	E446	0.050	mg/L		9.66	----	----	----	----
Strontium, leachable	7440-24-6	E446	0.00050	mg/L		0.367	----	----	----	----
Sulfur, leachable	7704-34-9	E446	0.50	mg/L		78.7	----	----	----	----
Thallium, leachable	7440-28-0	E446	0.00010	mg/L		<0.00010	----	----	----	----
Tin, leachable	7440-31-5	E446	0.00050	mg/L		<0.00050	----	----	----	----
Titanium, leachable	7440-32-6	E446	0.010	mg/L		<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E446	0.000010	mg/L		0.00104	----	----	----	----
Vanadium, leachable	7440-62-2	E446	0.0010	mg/L		0.0012	----	----	----	----
Zinc, leachable	7440-66-6	E446	0.010	mg/L		<0.010	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WR2201485**	Page	: 1 of 10
Client	: Alexco Keno Hill Mining Corp	Laboratory	: Whitehorse - Environmental
Contact	: YK Environment	Account Manager	: Heather McKenzie
Address	: Suite 1225, Two Bentall Centre 555 Burrard Street, Box 216 Vancouver BC Canada V7X 1M9	Address	: #12 151 Industrial Road Whitehorse, Yukon Canada Y1A 2V3
Telephone	:	Telephone	: +1 867 668 6689
Project	: Type A WL Tx	Date Samples Received	: 16-Nov-2022 16:20
PO	: 05562	Date Analysis Commenced	: 23-Nov-2022
C-O-C number	: ----	Issue Date	: 30-Jan-2023 15:27
Sampler	: ---- ----		
Site	: AKHM		
Quote number	: WR22-AKHM100-04 (Keno/Hecla)		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Vancouver Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Paolo Obillo	Account Manager Assistant	ALS Minerals (Vancouver) Internal Subcontracting, North Vancouver, British Columbia
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 758913)											
FJ2203292-001	Anonymous	Moisture	----	E144	0.25	%	1.82	1.86	0.03	Diff <2x LOR	----
Physical Tests (QC Lot: 768734)											
VA22C9472-001	Anonymous	pH	----	E116	0.10	pH units	8.65	8.64	0.116%	5%	----
Leachable Anions & Nutrients (QC Lot: 768725)											
VA22C9472-001	Anonymous	Sulfate, leachable	14808-79-8	E243.SO4	0.50	mg/L	1.87	1.92	0.04	Diff <2x LOR	----
Leachable Metals (QC Lot: 768732)											
VA22C9472-001	Anonymous	Aluminum, leachable	7429-90-5	E446	0.0050	mg/L	23.5	15.6	40.6%	30%	DUP-H
		Antimony, leachable	7440-36-0	E446	0.00010	mg/L	0.00070	0.00065	7.14%	30%	----
		Arsenic, leachable	7440-38-2	E446	0.0010	mg/L	0.0115	0.0096	18.0%	30%	----
		Barium, leachable	7440-39-3	E446	0.0010	mg/L	0.0179	0.0108	49.7%	30%	DUP-H
		Beryllium, leachable	7440-41-7	E446	0.00050	mg/L	0.0120	0.00632	62.1%	30%	DUP-H
		Bismuth, leachable	7440-69-9	E446	0.00050	mg/L	0.00166	0.00078	0.00087	Diff <2x LOR	----
		Boron, leachable	7440-42-8	E446	0.010	mg/L	0.306	0.235	26.3%	30%	----
		Cadmium, leachable	7440-43-9	E446	0.000050	mg/L	0.00202	0.00120	51.2%	30%	DUP-H
		Calcium, leachable	7440-70-2	E446	0.10	mg/L	1.17	0.63	59.8%	30%	DUP-H
		Chromium, leachable	7440-47-3	E446	0.00050	mg/L	0.00354	0.00288	0.00066	Diff <2x LOR	----
		Cobalt, leachable	7440-48-4	E446	0.00010	mg/L	0.00227	0.00111	68.4%	30%	DUP-H
		Copper, leachable	7440-50-8	E446	0.0010	mg/L	0.117	0.0612	63.0%	30%	DUP-H
		Iron, leachable	7439-89-6	E446	0.030	mg/L	3.90	2.20	55.7%	40%	DUP-H
		Lead, leachable	7439-92-1	E446	0.00010	mg/L	0.378	0.176	72.7%	30%	DUP-H
		Lithium, leachable	7439-93-2	E446	0.0050	mg/L	0.0380	# 0.0256	0.0124	Diff <2x LOR	DUP-H
		Magnesium, leachable	7439-95-4	E446	0.050	mg/L	4.02	2.58	43.8%	30%	DUP-H
		Manganese, leachable	7439-96-5	E446	0.00050	mg/L	0.125	0.0659	62.3%	30%	DUP-H
		Molybdenum, leachable	7439-98-7	E446	0.00010	mg/L	0.869	0.874	0.647%	30%	----
		Nickel, leachable	7440-02-0	E446	0.00050	mg/L	0.00089	<0.00050	0.00039	Diff <2x LOR	----
		Phosphorus, leachable	7723-14-0	E446	0.30	mg/L	<0.30	<0.30	0	Diff <2x LOR	----
		Potassium, leachable	7440-09-7	E446	0.050	mg/L	27.1	22.8	17.6%	30%	----
		Selenium, leachable	7782-49-2	E446	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Silicon, leachable	7440-21-3	E446	0.050	mg/L	76.4	47.5	46.5%	40%	DUP-H
		Silver, leachable	7440-22-4	E446	0.000050	mg/L	0.00216	0.00121	56.1%	30%	DUP-H

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Leachable Metals (QC Lot: 768732) - continued											
VA22C9472-001	Anonymous	Sodium, leachable	7440-23-5	E446	0.050	mg/L	18.2	17.7	2.84%	30%	----
		Strontium, leachable	7440-24-6	E446	0.00050	mg/L	0.00712	0.00355	66.8%	30%	DUP-H
		Sulfur, leachable	7704-34-9	E446	0.50	mg/L	0.60	0.50	0.10	Diff <2x LOR	----
		Thallium, leachable	7440-28-0	E446	0.00010	mg/L	0.00053	# 0.00030	0.00023	Diff <2x LOR	DUP-H
		Tin, leachable	7440-31-5	E446	0.00050	mg/L	0.00687	0.00437	44.4%	30%	DUP-H
		Titanium, leachable	7440-32-6	E446	0.010	mg/L	0.103	0.061	50.6%	40%	DUP-H
		Uranium, leachable	7440-61-1	E446	0.000010	mg/L	0.0857	0.0528	47.4%	30%	DUP-H
		Vanadium, leachable	7440-62-2	E446	0.0010	mg/L	0.0230	0.0196	16.1%	30%	----
		Zinc, leachable	7440-66-6	E446	0.010	mg/L	0.588	0.311	61.6%	30%	DUP-H
Leachable Metals (QC Lot: 768733)											
VA22C9472-001	Anonymous	Mercury, leachable	7439-97-6	E515	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 758913)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 768735)						
Conductivity, leachable	----	E103	2	µS/cm	<2.0	----
Leachable Anions & Nutrients (QCLot: 768725)						
Sulfate, leachable	14808-79-8	E243.SO4	0.5	mg/L	<0.50	----
Leachable Metals (QCLot: 768732)						
Aluminum, leachable	7429-90-5	E446	0.005	mg/L	<0.0050	----
Antimony, leachable	7440-36-0	E446	0.0001	mg/L	<0.00010	----
Arsenic, leachable	7440-38-2	E446	0.001	mg/L	<0.0010	----
Barium, leachable	7440-39-3	E446	0.001	mg/L	<0.0010	----
Beryllium, leachable	7440-41-7	E446	0.0005	mg/L	<0.00050	----
Bismuth, leachable	7440-69-9	E446	0.0005	mg/L	<0.00050	----
Boron, leachable	7440-42-8	E446	0.01	mg/L	<0.010	----
Cadmium, leachable	7440-43-9	E446	0.00005	mg/L	<0.000050	----
Calcium, leachable	7440-70-2	E446	0.1	mg/L	<0.10	----
Chromium, leachable	7440-47-3	E446	0.0005	mg/L	<0.00050	----
Cobalt, leachable	7440-48-4	E446	0.0001	mg/L	<0.00010	----
Copper, leachable	7440-50-8	E446	0.001	mg/L	<0.0010	----
Iron, leachable	7439-89-6	E446	0.03	mg/L	<0.030	----
Lead, leachable	7439-92-1	E446	0.0001	mg/L	<0.00010	----
Lithium, leachable	7439-93-2	E446	0.005	mg/L	<0.0050	----
Magnesium, leachable	7439-95-4	E446	0.05	mg/L	<0.050	----
Manganese, leachable	7439-96-5	E446	0.0005	mg/L	<0.00050	----
Molybdenum, leachable	7439-98-7	E446	0.0001	mg/L	<0.00010	----
Nickel, leachable	7440-02-0	E446	0.0005	mg/L	<0.00050	----
Phosphorus, leachable	7723-14-0	E446	0.3	mg/L	<0.30	----
Potassium, leachable	7440-09-7	E446	0.05	mg/L	<0.050	----
Selenium, leachable	7782-49-2	E446	0.0005	mg/L	<0.00050	----
Silicon, leachable	7440-21-3	E446	0.05	mg/L	<0.050	----
Silver, leachable	7440-22-4	E446	0.00005	mg/L	<0.000050	----
Sodium, leachable	7440-23-5	E446	0.05	mg/L	<0.050	----
Strontium, leachable	7440-24-6	E446	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Metals (QCLot: 768732) - continued						
Sulfur, leachable	7704-34-9	E446	0.5	mg/L	<0.50	----
Thallium, leachable	7440-28-0	E446	0.0001	mg/L	<0.00010	----
Tin, leachable	7440-31-5	E446	0.0005	mg/L	<0.00050	----
Titanium, leachable	7440-32-6	E446	0.01	mg/L	<0.010	----
Uranium, leachable	7440-61-1	E446	0.00001	mg/L	<0.000010	----
Vanadium, leachable	7440-62-2	E446	0.001	mg/L	<0.0010	----
Zinc, leachable	7440-66-6	E446	0.01	mg/L	<0.010	----
Leachable Metals (QCLot: 768733)						
Mercury, leachable	7439-97-6	E515	0.00005	mg/L	<0.000050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 758913)									
Moisture	----	E144	0.25	%	50 %	99.5	90.0	110	----
Physical Tests (QCLot: 768734)									
pH	----	E116	----	pH units	7.04 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 768735)									
Conductivity, leachable	----	E103	2	µS/cm	146.9 µS/cm	98.9	90.0	110	----
Leachable Anions & Nutrients (QCLot: 768725)									
Sulfate, leachable	14808-79-8	E243.SO4	0.5	mg/L	25 mg/L	102	70.0	130	----
Leachable Metals (QCLot: 768732)									
Aluminum, leachable	7429-90-5	E446	0.005	mg/L	0.2 mg/L	96.6	70.0	130	----
Antimony, leachable	7440-36-0	E446	0.0001	mg/L	0.1 mg/L	96.3	70.0	130	----
Arsenic, leachable	7440-38-2	E446	0.001	mg/L	0.1 mg/L	102	70.0	130	----
Barium, leachable	7440-39-3	E446	0.001	mg/L	0.025 mg/L	90.8	70.0	130	----
Beryllium, leachable	7440-41-7	E446	0.0005	mg/L	0.01 mg/L	97.6	70.0	130	----
Bismuth, leachable	7440-69-9	E446	0.0005	mg/L	0.1 mg/L	90.4	50.0	130	----
Boron, leachable	7440-42-8	E446	0.01	mg/L	0.1 mg/L	91.7	70.0	130	----
Cadmium, leachable	7440-43-9	E446	0.00005	mg/L	0.01 mg/L	95.8	70.0	130	----
Calcium, leachable	7440-70-2	E446	0.1	mg/L	5 mg/L	90.9	70.0	130	----
Chromium, leachable	7440-47-3	E446	0.0005	mg/L	0.025 mg/L	94.6	70.0	130	----
Cobalt, leachable	7440-48-4	E446	0.0001	mg/L	0.025 mg/L	93.2	70.0	130	----
Copper, leachable	7440-50-8	E446	0.001	mg/L	0.025 mg/L	94.0	70.0	130	----
Iron, leachable	7439-89-6	E446	0.03	mg/L	0.1 mg/L	91.3	70.0	130	----
Lead, leachable	7439-92-1	E446	0.0001	mg/L	0.05 mg/L	98.4	70.0	130	----
Lithium, leachable	7439-93-2	E446	0.005	mg/L	0.025 mg/L	102	70.0	130	----
Magnesium, leachable	7439-95-4	E446	0.05	mg/L	5 mg/L	102	70.0	130	----
Manganese, leachable	7439-96-5	E446	0.0005	mg/L	0.025 mg/L	96.0	70.0	130	----
Molybdenum, leachable	7439-98-7	E446	0.0001	mg/L	0.025 mg/L	97.3	70.0	130	----
Nickel, leachable	7440-02-0	E446	0.0005	mg/L	0.05 mg/L	96.0	70.0	130	----
Phosphorus, leachable	7723-14-0	E446	0.3	mg/L	1 mg/L	105	70.0	130	----
Potassium, leachable	7440-09-7	E446	0.05	mg/L	5 mg/L	103	70.0	130	----
Selenium, leachable	7782-49-2	E446	0.0005	mg/L	0.1 mg/L	95.0	70.0	130	----
Silicon, leachable	7440-21-3	E446	0.05	mg/L	1 mg/L	98.4	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Leachable Metals (QCLot: 768732) - continued									
Silver, leachable	7440-22-4	E446	0.00005	mg/L	0.01 mg/L	85.6	50.0	130	----
Sodium, leachable	7440-23-5	E446	0.05	mg/L	5 mg/L	96.9	70.0	130	----
Strontium, leachable	7440-24-6	E446	0.0005	mg/L	0.025 mg/L	94.7	70.0	130	----
Sulfur, leachable	7704-34-9	E446	0.5	mg/L	5 mg/L	96.0	70.0	130	----
Thallium, leachable	7440-28-0	E446	0.0001	mg/L	0.11 mg/L	87.4	70.0	130	----
Tin, leachable	7440-31-5	E446	0.0005	mg/L	0.05 mg/L	92.5	50.0	130	----
Titanium, leachable	7440-32-6	E446	0.01	mg/L	0.025 mg/L	91.6	50.0	130	----
Uranium, leachable	7440-61-1	E446	0.00001	mg/L	0.0005 mg/L	97.1	70.0	130	----
Vanadium, leachable	7440-62-2	E446	0.001	mg/L	0.05 mg/L	97.4	70.0	130	----
Zinc, leachable	7440-66-6	E446	0.01	mg/L	0.05 mg/L	96.0	70.0	130	----
Leachable Metals (QCLot: 768733)									
Mercury, leachable	7439-97-6	E515	0.00005	mg/L	0.0005 mg/L	89.6	50.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Leachable Anions & Nutrients (QCLot: 768725)										
VA22C9472-002	Anonymous	Sulfate, leachable	14808-79-8	E243.SO4	103 mg/L	100 mg/L	103	60.0	140	----
Leachable Metals (QCLot: 768732)										
VA22C9472-002	Anonymous	Aluminum, leachable	7429-90-5	E446	ND mg/L	0.2 mg/L	ND	70.0	130	----
		Antimony, leachable	7440-36-0	E446	0.0408 mg/L	0.04 mg/L	102	70.0	130	----
		Arsenic, leachable	7440-38-2	E446	0.0393 mg/L	0.04 mg/L	98.4	70.0	130	----
		Barium, leachable	7440-39-3	E446	ND mg/L	0.02 mg/L	ND	70.0	130	----
		Beryllium, leachable	7440-41-7	E446	0.0778 mg/L	0.08 mg/L	97.3	70.0	130	----
		Bismuth, leachable	7440-69-9	E446	0.0196 mg/L	0.02 mg/L	98.1	70.0	130	----
		Boron, leachable	7440-42-8	E446	ND mg/L	0.1 mg/L	ND	70.0	130	----
		Cadmium, leachable	7440-43-9	E446	0.00779 mg/L	0.008 mg/L	97.3	70.0	130	----
		Calcium, leachable	7440-70-2	E446	ND mg/L	4 mg/L	ND	70.0	130	----
		Chromium, leachable	7440-47-3	E446	ND mg/L	0.04 mg/L	ND	70.0	130	----
		Cobalt, leachable	7440-48-4	E446	0.0384 mg/L	0.04 mg/L	96.1	70.0	130	----
		Copper, leachable	7440-50-8	E446	0.0384 mg/L	0.04 mg/L	96.0	70.0	130	----
		Iron, leachable	7439-89-6	E446	ND mg/L	2 mg/L	ND	70.0	130	----
		Lead, leachable	7439-92-1	E446	ND mg/L	0.02 mg/L	ND	70.0	130	----
		Lithium, leachable	7439-93-2	E446	0.193 mg/L	0.2 mg/L	96.5	70.0	130	----
		Magnesium, leachable	7439-95-4	E446	ND mg/L	1 mg/L	ND	70.0	130	----
		Manganese, leachable	7439-96-5	E446	ND mg/L	0.02 mg/L	ND	70.0	130	----
		Molybdenum, leachable	7439-98-7	E446	ND mg/L	0.02 mg/L	ND	70.0	130	----
		Nickel, leachable	7440-02-0	E446	0.0789 mg/L	0.08 mg/L	98.6	70.0	130	----
		Phosphorus, leachable	7723-14-0	E446	20.2 mg/L	20 mg/L	101	70.0	130	----
		Potassium, leachable	7440-09-7	E446	ND mg/L	4 mg/L	ND	70.0	130	----
		Selenium, leachable	7782-49-2	E446	0.0774 mg/L	0.08 mg/L	96.7	70.0	130	----
		Silicon, leachable	7440-21-3	E446	ND mg/L	10 mg/L	ND	70.0	130	----
		Silver, leachable	7440-22-4	E446	0.00773 mg/L	0.008 mg/L	96.6	70.0	130	----
		Sodium, leachable	7440-23-5	E446	ND mg/L	2 mg/L	ND	70.0	130	----
		Strontium, leachable	7440-24-6	E446	0.0427 mg/L	0.04 mg/L	107	70.0	130	----
		Sulfur, leachable	7704-34-9	E446	38.7 mg/L	40 mg/L	96.7	70.0	130	----
		Thallium, leachable	7440-28-0	E446	0.00726 mg/L	0.008 mg/L	90.7	70.0	130	----
		Tin, leachable	7440-31-5	E446	0.0392 mg/L	0.04 mg/L	97.9	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Leachable Metals (QCLot: 768732) - continued										
VA22C9472-002	Anonymous	Titanium, leachable	7440-32-6	E446	ND mg/L	0.04 mg/L	ND	70.0	130	----
		Uranium, leachable	7440-61-1	E446	ND mg/L	0.004 mg/L	ND	70.0	130	----
		Vanadium, leachable	7440-62-2	E446	0.203 mg/L	0.2 mg/L	101	70.0	130	----
		Zinc, leachable	7440-66-6	E446	0.763 mg/L	0.8 mg/L	95.3	70.0	130	----
Leachable Metals (QCLot: 768733)										
VA22C9472-002	Anonymous	Mercury, leachable	7439-97-6	E515	0.000090 mg/L	0.0001 mg/L	89.6	70.0	130	----

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WR2201485**	Page	: 1 of 10
Client	: **Alexco Keno Hill Mining Corp**	Laboratory	: Whitehorse - Environmental
Contact	: YK Environment	Account Manager	: Heather McKenzie
Address	: Suite 1225, Two Bentall Centre 555 Burrard Street, Box 216 Vancouver BC Canada V7X 1M9	Address	: #12 151 Industrial Road Whitehorse, Yukon Canada Y1A 2V3
Telephone	: ----	Telephone	: +1 867 668 6689
Project	: Type A WL Tx	Date Samples Received	: 16-Nov-2022 16:20
PO	: 05562	Issue Date	: 30-Jan-2023 15:27
C-O-C number	: ----		
Sampler	: ----		
Site	: AKHM		
Quote number	: WR22-AKHM100-04 (Keno/Hecla)		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Leachable Metals	Anonymous	Anonymous	Aluminum, leachable	7429-90-5	E446	40.6 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Barium, leachable	7440-39-3	E446	49.7 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Beryllium, leachable	7440-41-7	E446	62.1 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Cadmium, leachable	7440-43-9	E446	51.2 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Calcium, leachable	7440-70-2	E446	59.8 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Cobalt, leachable	7440-48-4	E446	68.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Copper, leachable	7440-50-8	E446	63.0 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Iron, leachable	7439-89-6	E446	55.7 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Lead, leachable	7439-92-1	E446	72.7 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Lithium, leachable	7439-93-2	E446	0.0124 % DUP-H	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).
Leachable Metals	Anonymous	Anonymous	Magnesium, leachable	7439-95-4	E446	43.8 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Manganese, leachable	7439-96-5	E446	62.3 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Silicon, leachable	7440-21-3	E446	46.5 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Silver, leachable	7440-22-4	E446	56.1 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Strontium, leachable	7440-24-6	E446	66.8 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Thallium, leachable	7440-28-0	E446	0.00023 % DUP-H	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).
Leachable Metals	Anonymous	Anonymous	Tin, leachable	7440-31-5	E446	44.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs - Continued								
Leachable Metals	Anonymous	Anonymous	Titanium, leachable	7440-32-6	E446	50.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Uranium, leachable	7440-61-1	E446	47.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Leachable Metals	Anonymous	Anonymous	Zinc, leachable	7440-66-6	E446	61.6 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Acid Base Accounting : Acid Base Accounting (Modified Sobek)										
Glass soil jar/Teflon lined cap										
BH	OA-VOL08m	14-Nov-2022	----	----	----		22-Jan-2023	----	----	
Acid Base Accounting : Inorganic Carbon by Coulometer										
Glass soil jar/Teflon lined cap										
BH	C-GAS05	14-Nov-2022	----	----	----		22-Jan-2023	----	----	
Acid Base Accounting : Received Sample Weight										
Glass soil jar/Teflon lined cap										
BH	WEI-21	14-Nov-2022	----	----	----		22-Jan-2023	180 days	69 days	✓
Acid Base Accounting : Saturated Paste pH										
Glass soil jar/Teflon lined cap										
BH	OA-ELE07	14-Nov-2022	----	----	----		22-Jan-2023	----	----	
Acid Base Accounting : Sulfates by HCl Leaching and Gravimetry										
Glass soil jar/Teflon lined cap										
BH	S-GRA06A	14-Nov-2022	----	----	----		22-Jan-2023	----	----	
Acid Base Accounting : Sulfide S (as S) Calc. (Total-S - SO4-S)										
Glass soil jar/Teflon lined cap										
BH	S-CAL06a	14-Nov-2022	----	----	----		22-Jan-2023	----	----	
Acid Base Accounting : Total Sulfur by Combustion and IR										
Glass soil jar/Teflon lined cap										
BH	S-IR08	14-Nov-2022	----	----	----		22-Jan-2023	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Sulfate by IC (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap										
BH	E243.SO4	14-Nov-2022	06-Dec-2022	----	----		07-Dec-2022	28 days	23 days	✓
Leachable Metals : Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap										
BH	E515	14-Nov-2022	06-Dec-2022	----	----		07-Dec-2022	28 days	23 days	✓
Leachable Metals : Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap										
BH	E446	14-Nov-2022	06-Dec-2022	----	----		08-Dec-2022	180 days	24 days	✓
Metals : 51 Elements by Aqua Regia digestion and ICP-AES/MS										
Glass soil jar/Teflon lined cap										
BH	ME-MS41	14-Nov-2022	----	----	----		22-Jan-2023	----	----	
Physical Tests : Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap										
BH	E103	14-Nov-2022	06-Dec-2022	----	----		07-Dec-2022	28 days	23 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
BH	E144	14-Nov-2022	----	----	----		26-Nov-2022	----	----	
Physical Tests : pH by Electrode (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap										
BH	E116	14-Nov-2022	06-Dec-2022	----	----		07-Dec-2022	30 days	23 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	768733	1	20	5.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	768732	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	758913	1	14	7.1	5.0	✓
pH by Electrode (Shakeflask, 3:1 Ratio with Water)	E116	768734	1	20	5.0	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	768725	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)	E103	768735	1	20	5.0	5.0	✓
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	768733	1	20	5.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	768732	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	758913	1	14	7.1	5.0	✓
pH by Electrode (Shakeflask, 3:1 Ratio with Water)	E116	768734	1	20	5.0	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	768725	1	20	5.0	5.0	✓
Method Blanks (MB)							
Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)	E103	768735	1	20	5.0	5.0	✓
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	768733	1	20	5.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	768732	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	758913	1	14	7.1	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	768725	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	768733	1	20	5.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	768732	1	20	5.0	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	768725	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Inorganic Carbon by Coulometer	C-GAS05 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals C-GAS05	Determine Total Inorganic Carbon (TIC) by using diluted perchloric acid to react with metal carbonate and yield carbon dioxide. Concentration of CO_2 is determined by coulometer.
Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)	E103 Vancouver - Environmental	Soil/Solid	MEND (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into an extract from a soil sample that has been added in a 3:1 ratio of deionized water to soil, then leached and the extract filtered prior to analysis. Conductivity measurements are temperature-compensated to 25°C.
pH by Electrode (Shakeflask, 3:1 Ratio with Water)	E116 Vancouver - Environmental	Soil/Solid	MEND (mod)/APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on an extract from a soil sample that has been added in a 3:1 ratio of deionized water to soil, then leached and the extract filtered prior to analysis. The pH is then measured by a standard pH probe. .
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4 Vancouver - Environmental	Soil/Solid	MEND (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining an extract from a soil sample that has been added in a 3:1 ratio of deionized water to soil, then leached and the extract filtered prior to analysis, which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446 Vancouver - Environmental	Soil/Solid	BC MINISTRY OF ENERGY AND MINES/EPA 6020B (mod)	A sample is extracted with water at a 3:1 liquid to solid ratio for 24 hours, then filtered through a 0.45 micron membrane filter. Analysis is by Collision/Reaction Cell ICPMS. This extraction is an empirical procedure with pre-defined characteristics. Recovery of some elements (Ag, Bi, and Sn) by this method can be variable due to the neutral pH of the extraction fluid, and therefore the LCS DQOs has been established at 50-130% for these elements.
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515 Vancouver - Environmental	Soil/Solid	BC MINISTRY OF ENERGY AND MINES/EPA 1631E (mod)	A sample is extracted with water at a 3:1 liquid to solid ratio for 24 hours, then filtered through a 0.45 micron membrane filter. Analysis is by CVAAS. This extraction is an empirical procedure with pre-defined characteristics. Recovery of mercury can be variable due to the neutral pH of the extraction fluid, and therefore the LCS DQO has been established at 50-130%.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Particle Size Analysis (Pipette) - MMER Classification	EC184E Saskatoon - Environmental	Soil/Solid	Metal Mining Technical Guidance for Environmental Effects Monitoring (2012)	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Metal Mining Effluent Regulations (MMER) classification system for Environmental Effects Monitoring.
51 Elements by Aqua Regia digestion and ICP-AES/MS	ME-MS41 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals ME-MS41	A prepared sample is digested with aqua regia in a graphite heating block. After cooling, the resulting solution is diluted to with deionized water, mixed and analyzed by ICP-AES. Samples are then analyzed by ICP-MS for the remaining suite of elements.
Saturated Paste pH	OA-ELE07 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals OA-ELE07	Sample mix with water in 1:1 ratio to make a paste, pH is then determined.
Acid Base Accounting (Modified Sobek)	OA-VOL08m ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals OA-VOL08m	Determine the acid generation power of a sample as tonne $CaCO_3$ per kilo-tonne using modified Sobek method
Sulfide S (as S) Calc. (Total-S - SO4-S)	S-CAL06a ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals:S-CAL06a	Sulfide Sulfur (as S) is calculated by subtracting the HCL Leachable Sulfate Sulfur (as S) from the Total Sulfur (as S) obtained from combustion.
Sulfates by HCl Leaching and Gravimetry	S-GRA06A ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals S-GRA06A	A prepared sample is heated with dilute HCl and then filtered. The sulfate in the filtrate is precipitated with $BaCl_2$ in a dilute HCl. The $BaSO_4$ precipitate is filtered, ignited, weighed and the Sulfate Sulfur is determined (as S).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total Sulfur by Combustion and IR	S-IR08 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals S-IR08	A prepared sample is heated to approximately 1350°C in an induction furnace with oxygen stream. Sulfur dioxide released from the sample are measured by IR (Leco analyzer) and the Total Sulfur result is provided.
Received Sample Weight	WEI-21 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals WEI-21	Weigh out sample received.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Shakeflask Leachate Preparation (3:1 Ratio with Water)	EP446 Vancouver - Environmental	Soil/Solid	BC MINISTRY OF ENERGY AND MINES	A sample is extracted with water at a 3:1 liquid to solids ratio for 24 hours, then filtered through a 0.45 micron membrane filter.
Dry and Grind in Soil/Solid <60°C	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 1 of 1

Report To		**Report Format / Distribution**				**Service Requested** (Rush for routine analysis subject to availability)
Company:	Alexco Keno Hill Mining	☑ Standard	☐ Other			◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Environment Department	☑ PDF	☑ Excel	☐ Digital	☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	Suite 1225 - 555 Burrard Street Vancouver BC V7X 1M9	Email 1:	YK-Environment@hecla.com			○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
		Email 2:	nspeiss@ensero.com			○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	867-995-3113 X5960 Fax:	Email 3:	kwoloshyn@ensero.com			**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**				
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	**Type A WL Tx**			
Company:	Alexco Keno Hill Mining	PO / AFE:	PO#05562			
Contact:	Derek Meneghin; YK-AccountsPayable@hecla.com	LSD:	**AKHM**			
Address:	Suite 1225 - 555 Burrard Street Vancouver BC V7X 1M9					
Phone:	604.633.4888 Fax: 604.633.4887	Quote #:				
Lab Work Order # (lab use only)		**ALS Contact:**	Heather McKenzie	**Sampler:**	TF	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	time	Sample Type	ABA w modified Sobek	Aqua regia digestion w ICP	Shakeflask metals ICPMS	Shakeflask sulphate, pH, EC	Grain size >2mm, pipette	mber of Containers
	BH	14-Nov-22	16:00	Other	X	X	X	X	X	

Environmental Division
Whitehorse
Work Order Reference
WR2201485

Telephone : +1 867 668 6689

Yukon EQWin and ACC200 digital formats. General A: pH, EC, TSS (low) **General B:** pH, EC, TSS (low), anions-all
General C: pH, EC, TSS (low), anions-all, ion balance, alkalinity **General D:** pH, EC, TSS (low), SO4, ion balance, alkalinity **Other:** Samples are sludge.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
TF	15-Nov-22	12:00	HA	11/17	9:40	1.5 °C				

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **WR2201414**	Page	: 1 of 6
Client	: **Alexco Keno Hill Mining Corp**	Laboratory	: Whitehorse - Environmental
Contact	: Environment	Account Manager	: Heather McKenzie
Address	: #2 Calcite Business Centre - 151 Industrial Road Whitehorse YT Canada Y1A 2V3	Address	: #12 151 Industrial Road Whitehorse YT Canada Y1A 2V3
Telephone	: ----	Telephone	: +1 867 668 6689
Project	: Type A WL Tx	Date Samples Received	: 02-Nov-2022 10:20
PO	: 05562	Date Analysis Commenced	: 08-Nov-2022
C-O-C number	: ----	Issue Date	: 07-Feb-2023 12:18
Sampler	: TF		
Site	: AKHM		
Quote number	: WR22-AKHM100-04 (Keno/Hecla)		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Kaitlyn Gardner	Account Manager Assistant	Internal Subcontracting, North Vancouver, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
%	percent
µS/cm	microsiemens per centimetre
kg	kilograms
mg/L	milligrams per litre
pH units	pH units
ppm (w/w)	parts per million (weight/weight)
tCaCO□/kt	tons CaCO□ per kiloton

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Sludge**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID: F&M	----	----	----	----
					Client sampling date / time: 01-Nov-2022 09:30	----	----	----	----
					WR2201414-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
Conductivity, leachable	----	E103	2.0	µS/cm	789	----	----	----	----
Moisture	----	E144	0.25	%	66.6	----	----	----	----
pH	----	E116	0.10	pH units	7.42	----	----	----	----
Particle Size									
Clay (<0.004mm)	----	EC184E	1.0	%	18.4	----	----	----	----
Silt (0.063mm - 0.004mm)	----	EC184E	1.0	%	79.6	----	----	----	----
Sand (2.0mm - 0.063mm)	----	EC184E	1.0	%	2.0	----	----	----	----
Gravel (>2mm)	----	EC184E	1.0	%	<1.0	----	----	----	----
Acid Base Accounting									
Carbon dioxide	124-38-9	C-GAS05	0.2	%	5.1	----	----	----	----
Carbon, total inorganic [TIC]	----	C-GAS05	0.05	%	1.40	----	----	----	----
Fizz rating	----	OA-VOL08m	1	-	3	----	----	----	----
Maximum potential acidity [MPA]	----	OA-VOL08m	0.3	tCaCO□/kt	22.5	----	----	----	----
Net neutralization potential [NNP]	----	OA-VOL08m	1	tCaCO□/kt	91	----	----	----	----
Neutralization potential [NP]	----	OA-VOL08m	1	tCaCO□/kt	113	----	----	----	----
Neutralization potential ratio [NPR], (NP/MPA)	----	OA-VOL08m	0.01	-	5.02	----	----	----	----
pH (1:1 soil:water)	----	OA-ELE07	0.10	pH units	8.30	----	----	----	----
Sulfate (as S), HCl leach	14808-79-8	S-GRA06A	0.01	%	0.06	----	----	----	----
Sulfide (as S), total minus HCl leach	18496-25-8	S-CAL06a	0.01	%	0.66	----	----	----	----
Sulfur, total	7704-34-9	S-IR08	0.01	%	0.72	----	----	----	----
Weight, sample received	n/a	WEI-21	0.02	kg	3.22	----	----	----	----
Metals									
Aluminum	7429-90-5	ME-MS41	0.01	%	1.19	----	----	----	----
Antimony	7440-36-0	ME-MS41	0.05	ppm (w/w)	31.6	----	----	----	----
Arsenic	7440-38-2	ME-MS41	0.1	ppm (w/w)	321	----	----	----	----
Barium	7440-39-3	ME-MS41	10	ppm (w/w)	420	----	----	----	----
Beryllium	7440-41-7	ME-MS41	0.05	ppm (w/w)	0.30	----	----	----	----
Bismuth	7440-69-9	ME-MS41	0.01	ppm (w/w)	4.54	----	----	----	----
Boron	7440-42-8	ME-MS41	10	ppm (w/w)	<10	----	----	----	----

Analytical Results

Sub-Matrix: Sludge (Matrix: Soil/Solid)					Client sample ID	F&M	----	----	----	----
					Client sampling date / time	01-Nov-2022 09:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		WR2201414-001	--------	--------	--------	--------
						Result	----	----	----	----
Metals										
Cadmium	7440-43-9	ME-MS41	0.01	ppm (w/w)		29.4	----	----	----	----
Calcium	7440-70-2	ME-MS41	0.01	%		4.05	----	----	----	----
Cerium	7440-45-1	ME-MS41	0.02	ppm (w/w)		22.0	----	----	----	----
Cesium	7440-46-2	ME-MS41	0.05	ppm (w/w)		1.93	----	----	----	----
Chromium	7440-47-3	ME-MS41	1	ppm (w/w)		20	----	----	----	----
Cobalt	7440-48-4	ME-MS41	0.1	ppm (w/w)		12.0	----	----	----	----
Copper	7440-50-8	ME-MS41	0.2	ppm (w/w)		133.0	----	----	----	----
Gallium	7440-55-3	ME-MS41	0.05	ppm (w/w)		3.63	----	----	----	----
Germanium	7440-56-4	ME-MS41	0.05	ppm (w/w)		0.06	----	----	----	----
Gold	7440-57-5	ME-MS41	0.02	ppm (w/w)		<0.02	----	----	----	----
Hafnium	7440-58-6	ME-MS41	0.02	ppm (w/w)		0.19	----	----	----	----
Indium	7440-74-6	ME-MS41	0.005	ppm (w/w)		5.15	----	----	----	----
Iron	7439-89-6	ME-MS41	0.01	%		3.17	----	----	----	----
Lanthanum	7439-91-0	ME-MS41	0.2	ppm (w/w)		10.4	----	----	----	----
Lead	7439-92-1	ME-MS41	0.2	ppm (w/w)		962	----	----	----	----
Lithium	7439-93-2	ME-MS41	0.1	ppm (w/w)		34.6	----	----	----	----
Magnesium	7439-95-4	ME-MS41	0.01	%		0.81	----	----	----	----
Manganese	7439-96-5	ME-MS41	5	ppm (w/w)		1315	----	----	----	----
Mercury	7439-97-6	ME-MS41	0.01	ppm (w/w)		0.13	----	----	----	----
Molybdenum	7439-98-7	ME-MS41	0.05	ppm (w/w)		8.08	----	----	----	----
Nickel	7440-02-0	ME-MS41	0.2	ppm (w/w)		46.5	----	----	----	----
Niobium	7440-03-1	ME-MS41	0.05	ppm (w/w)		<0.05	----	----	----	----
Phosphorus	7723-14-0	ME-MS41	10	ppm (w/w)		470	----	----	----	----
Potassium	7440-09-7	ME-MS41	0.01	%		0.06	----	----	----	----
Rhenium	7440-15-5	ME-MS41	0.001	ppm (w/w)		0.003	----	----	----	----
Rubidium	7440-17-7	ME-MS41	0.1	ppm (w/w)		4.7	----	----	----	----
Scandium	7440-20-2	ME-MS41	0.1	ppm (w/w)		2.4	----	----	----	----
Selenium	7782-49-2	ME-MS41	0.2	ppm (w/w)		1.0	----	----	----	----
Silver	7440-22-4	ME-MS41	0.01	ppm (w/w)		33.7	----	----	----	----
Sodium	7440-23-5	ME-MS41	0.01	%		0.02	----	----	----	----

Analytical Results

Sub-Matrix: Sludge (Matrix: Soil/Solid)					Client sample ID	F&M	----	----	----	----
					Client sampling date / time	01-Nov-2022 09:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		WR2201414-001	--------	--------	--------	--------
						Result	----	----	----	----
Metals										
Strontium	7440-24-6	ME-MS41	0.2	ppm (w/w)		106.0	----	----	----	----
Sulfur	7704-34-9	ME-MS41	0.01	%		0.67	----	----	----	----
Tantalum	7440-25-7	ME-MS41	0.01	ppm (w/w)		<0.01	----	----	----	----
Tellurium	13494-80-9	ME-MS41	0.01	ppm (w/w)		0.06	----	----	----	----
Thallium	7440-28-0	ME-MS41	0.02	ppm (w/w)		0.10	----	----	----	----
Thorium	7440-29-1	ME-MS41	0.2	ppm (w/w)		7.4	----	----	----	----
Tin	7440-31-5	ME-MS41	0.2	ppm (w/w)		29.8	----	----	----	----
Titanium	7440-32-6	ME-MS41	0.005	%		<0.005	----	----	----	----
Tungsten	7440-33-7	ME-MS41	0.05	ppm (w/w)		2.35	----	----	----	----
Uranium	7440-61-1	ME-MS41	0.05	ppm (w/w)		3.17	----	----	----	----
Vanadium	7440-62-2	ME-MS41	1	ppm (w/w)		18	----	----	----	----
Yttrium	7440-65-5	ME-MS41	0.05	ppm (w/w)		4.35	----	----	----	----
Zinc	7440-66-6	ME-MS41	2	ppm (w/w)		3090	----	----	----	----
Zirconium	7440-67-7	ME-MS41	0.5	ppm (w/w)		10.4	----	----	----	----
Leachable Anions & Nutrients										
Sulfate, leachable	14808-79-8	E243.SO4	0.50	mg/L		398	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E446	0.0050	mg/L		0.0204	----	----	----	----
Antimony, leachable	7440-36-0	E446	0.00010	mg/L		0.0676	----	----	----	----
Arsenic, leachable	7440-38-2	E446	0.0010	mg/L		0.0054	----	----	----	----
Barium, leachable	7440-39-3	E446	0.0010	mg/L		0.0444	----	----	----	----
Beryllium, leachable	7440-41-7	E446	0.00050	mg/L		<0.00050	----	----	----	----
Bismuth, leachable	7440-69-9	E446	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E446	0.010	mg/L		0.050	----	----	----	----
Cadmium, leachable	7440-43-9	E446	0.000050	mg/L		0.000177	----	----	----	----
Calcium, leachable	7440-70-2	E446	0.10	mg/L		104	----	----	----	----
Chromium, leachable	7440-47-3	E446	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E446	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E446	0.0010	mg/L		<0.0010	----	----	----	----
Hardness (as CaCO3), dissolved	----	E446	0.60	mg/L		426	----	----	----	----

Analytical Results

Sub-Matrix: Sludge (Matrix: Soil/Solid)					Client sample ID	F&M	----	----	----	----
					Client sampling date / time	01-Nov-2022 09:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		WR2201414-001	--------	--------	--------	--------
						Result	----	----	----	----
Leachable Metals										
Iron, leachable	7439-89-6	E446	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E446	0.00010	mg/L		0.00094	----	----	----	----
Lithium, leachable	7439-93-2	E446	0.0050	mg/L		0.0205	----	----	----	----
Magnesium, leachable	7439-95-4	E446	0.050	mg/L		40.5	----	----	----	----
Manganese, leachable	7439-96-5	E446	0.00050	mg/L		0.0345	----	----	----	----
Mercury, leachable	7439-97-6	E515	0.000050	mg/L		<0.000050	----	----	----	----
Molybdenum, leachable	7439-98-7	E446	0.00010	mg/L		0.0187	----	----	----	----
Nickel, leachable	7440-02-0	E446	0.00050	mg/L		0.00075	----	----	----	----
Phosphorus, leachable	7723-14-0	E446	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E446	0.050	mg/L		5.27	----	----	----	----
Selenium, leachable	7782-49-2	E446	0.00050	mg/L		0.00083	----	----	----	----
Silicon, leachable	7440-21-3	E446	0.050	mg/L		2.62	----	----	----	----
Silver, leachable	7440-22-4	E446	0.000050	mg/L		<0.000050	----	----	----	----
Sodium, leachable	7440-23-5	E446	0.050	mg/L		10.7	----	----	----	----
Strontium, leachable	7440-24-6	E446	0.00050	mg/L		0.887	----	----	----	----
Sulfur, leachable	7704-34-9	E446	0.50	mg/L		146	----	----	----	----
Thallium, leachable	7440-28-0	E446	0.00010	mg/L		0.00017	----	----	----	----
Tin, leachable	7440-31-5	E446	0.00050	mg/L		<0.00050	----	----	----	----
Titanium, leachable	7440-32-6	E446	0.010	mg/L		<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E446	0.000010	mg/L		0.000661	----	----	----	----
Vanadium, leachable	7440-62-2	E446	0.0010	mg/L		<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E446	0.010	mg/L		<0.010	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WR2201414**	Page	: 1 of 10
Client	: Alexco Keno Hill Mining Corp	Laboratory	: Whitehorse - Environmental
Contact	: Environment	Account Manager	: Heather McKenzie
Address	: #2 Calcite Business Centre - 151 Industrial Road Whitehorse YT Canada Y1A 2V3	Address	: #12 151 Industrial Road Whitehorse, Yukon Canada Y1A 2V3
Telephone	:	Telephone	: +1 867 668 6689
Project	: Type A WL Tx	Date Samples Received	: 02-Nov-2022 10:20
PO	: 05562	Date Analysis Commenced	: 08-Nov-2022
C-O-C number	: ----	Issue Date	: 07-Feb-2023 12:18
Sampler	: TF ----		
Site	: AKHM		
Quote number	: WR22-AKHM100-04 (Keno/Hecla)		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caitlin Macey	Team Leader - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
Kaitlyn Gardner	Account Manager Assistant	ALS Minerals (Vancouver) Internal Subcontracting, North Vancouver, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Vancouver Organics, Burnaby, British Columbia
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 734959)											
VA22C7017-005	Anonymous	Moisture	----	E144	0.25	%	10.5	11.7	10.6%	20%	----
Physical Tests (QC Lot: 735591)											
WR2201414-001	F&M	pH	----	E116	0.10	pH units	7.42	7.48	0.806%	5%	----
Leachable Anions & Nutrients (QC Lot: 735594)											
WR2201414-001	F&M	Sulfate, leachable	14808-79-8	E243.SO4	0.50	mg/L	398	411	3.15%	30%	----
Leachable Metals (QC Lot: 735590)											
WR2201414-001	F&M	Mercury, leachable	7439-97-6	E515	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
Leachable Metals (QC Lot: 735592)											
WR2201414-001	F&M	Aluminum, leachable	7429-90-5	E446	0.0050	mg/L	0.0204	0.0200	0.0004	Diff <2x LOR	----
		Antimony, leachable	7440-36-0	E446	0.00010	mg/L	0.0676	0.0655	3.23%	30%	----
		Arsenic, leachable	7440-38-2	E446	0.0010	mg/L	0.0054	0.0053	0.00007	Diff <2x LOR	----
		Barium, leachable	7440-39-3	E446	0.0010	mg/L	0.0444	0.0437	1.61%	30%	----
		Beryllium, leachable	7440-41-7	E446	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Bismuth, leachable	7440-69-9	E446	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Boron, leachable	7440-42-8	E446	0.010	mg/L	0.050	0.050	0.000009	Diff <2x LOR	----
		Cadmium, leachable	7440-43-9	E446	0.000050	mg/L	0.000177	0.000149	0.000028	Diff <2x LOR	----
		Calcium, leachable	7440-70-2	E446	0.10	mg/L	104	100	3.96%	30%	----
		Chromium, leachable	7440-47-3	E446	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Cobalt, leachable	7440-48-4	E446	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Copper, leachable	7440-50-8	E446	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		Iron, leachable	7439-89-6	E446	0.030	mg/L	<0.030	<0.030	0	Diff <2x LOR	----
		Lead, leachable	7439-92-1	E446	0.00010	mg/L	0.00094	0.00096	2.26%	30%	----
		Lithium, leachable	7439-93-2	E446	0.0050	mg/L	0.0205	0.0205	0.00002	Diff <2x LOR	----
		Magnesium, leachable	7439-95-4	E446	0.050	mg/L	40.5	38.2	5.63%	30%	----
		Manganese, leachable	7439-96-5	E446	0.00050	mg/L	0.0345	0.0325	5.88%	30%	----
		Molybdenum, leachable	7439-98-7	E446	0.00010	mg/L	0.0187	0.0182	2.82%	30%	----
		Nickel, leachable	7440-02-0	E446	0.00050	mg/L	0.00075	0.00071	0.00004	Diff <2x LOR	----
		Phosphorus, leachable	7723-14-0	E446	0.30	mg/L	<0.30	<0.30	0	Diff <2x LOR	----
		Potassium, leachable	7440-09-7	E446	0.050	mg/L	5.27	5.03	4.53%	30%	----
		Selenium, leachable	7782-49-2	E446	0.00050	mg/L	0.00083	0.00074	0.00009	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Leachable Metals (QC Lot: 735592) - continued											
WR2201414-001	F&M	Silicon, leachable	7440-21-3	E446	0.050	mg/L	2.62	2.42	7.69%	40%	----
		Silver, leachable	7440-22-4	E446	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Sodium, leachable	7440-23-5	E446	0.050	mg/L	10.7	10.4	3.44%	30%	----
		Strontium, leachable	7440-24-6	E446	0.00050	mg/L	0.887	0.844	4.94%	30%	----
		Sulfur, leachable	7704-34-9	E446	0.50	mg/L	146	138	5.55%	30%	----
		Thallium, leachable	7440-28-0	E446	0.00010	mg/L	0.00017	0.00016	0.000006	Diff <2x LOR	----
		Tin, leachable	7440-31-5	E446	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Titanium, leachable	7440-32-6	E446	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		Uranium, leachable	7440-61-1	E446	0.000010	mg/L	0.000661	0.000612	7.73%	30%	----
		Vanadium, leachable	7440-62-2	E446	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		Zinc, leachable	7440-66-6	E446	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 734959)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 735593)						
Conductivity, leachable	----	E103	2	µS/cm	<2.0	----
Leachable Anions & Nutrients (QCLot: 735594)						
Sulfate, leachable	14808-79-8	E243.SO4	0.5	mg/L	<0.50	----
Leachable Metals (QCLot: 735590)						
Mercury, leachable	7439-97-6	E515	0.00005	mg/L	<0.000050	----
Leachable Metals (QCLot: 735592)						
Aluminum, leachable	7429-90-5	E446	0.005	mg/L	<0.0050	----
Antimony, leachable	7440-36-0	E446	0.0001	mg/L	<0.00010	----
Arsenic, leachable	7440-38-2	E446	0.001	mg/L	<0.0010	----
Barium, leachable	7440-39-3	E446	0.001	mg/L	<0.0010	----
Beryllium, leachable	7440-41-7	E446	0.0005	mg/L	<0.00050	----
Bismuth, leachable	7440-69-9	E446	0.0005	mg/L	<0.00050	----
Boron, leachable	7440-42-8	E446	0.01	mg/L	<0.010	----
Cadmium, leachable	7440-43-9	E446	0.00005	mg/L	<0.000050	----
Calcium, leachable	7440-70-2	E446	0.1	mg/L	<0.10	----
Chromium, leachable	7440-47-3	E446	0.0005	mg/L	<0.00050	----
Cobalt, leachable	7440-48-4	E446	0.0001	mg/L	<0.00010	----
Copper, leachable	7440-50-8	E446	0.001	mg/L	<0.0010	----
Iron, leachable	7439-89-6	E446	0.03	mg/L	<0.030	----
Lead, leachable	7439-92-1	E446	0.0001	mg/L	<0.00010	----
Lithium, leachable	7439-93-2	E446	0.005	mg/L	<0.0050	----
Magnesium, leachable	7439-95-4	E446	0.05	mg/L	<0.050	----
Manganese, leachable	7439-96-5	E446	0.0005	mg/L	<0.00050	----
Molybdenum, leachable	7439-98-7	E446	0.0001	mg/L	<0.00010	----
Nickel, leachable	7440-02-0	E446	0.0005	mg/L	<0.00050	----
Phosphorus, leachable	7723-14-0	E446	0.3	mg/L	<0.30	----
Potassium, leachable	7440-09-7	E446	0.05	mg/L	<0.050	----
Selenium, leachable	7782-49-2	E446	0.0005	mg/L	<0.00050	----
Silicon, leachable	7440-21-3	E446	0.05	mg/L	<0.050	----
Silver, leachable	7440-22-4	E446	0.00005	mg/L	<0.000050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Metals (QCLot: 735592) - continued						
Sodium, leachable	7440-23-5	E446	0.05	mg/L	<0.050	----
Strontium, leachable	7440-24-6	E446	0.0005	mg/L	<0.00050	----
Sulfur, leachable	7704-34-9	E446	0.5	mg/L	<0.50	----
Thallium, leachable	7440-28-0	E446	0.0001	mg/L	<0.00010	----
Tin, leachable	7440-31-5	E446	0.0005	mg/L	<0.00050	----
Titanium, leachable	7440-32-6	E446	0.01	mg/L	<0.010	----
Uranium, leachable	7440-61-1	E446	0.00001	mg/L	<0.000010	----
Vanadium, leachable	7440-62-2	E446	0.001	mg/L	<0.0010	----
Zinc, leachable	7440-66-6	E446	0.01	mg/L	<0.010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 734959)									
Moisture	----	E144	0.25	%	50 %	99.8	90.0	110	----
Physical Tests (QCLot: 735591)									
pH	----	E116	----	pH units	7.04 pH units	99.1	95.0	105	----
Physical Tests (QCLot: 735593)									
Conductivity, leachable	----	E103	2	µS/cm	146.9 µS/cm	95.1	90.0	110	----
Leachable Anions & Nutrients (QCLot: 735594)									
Sulfate, leachable	14808-79-8	E243.SO4	0.5	mg/L	25 mg/L	99.2	70.0	130	----
Leachable Metals (QCLot: 735590)									
Mercury, leachable	7439-97-6	E515	0.00005	mg/L	0.0005 mg/L	92.5	50.0	130	----
Leachable Metals (QCLot: 735592)									
Aluminum, leachable	7429-90-5	E446	0.005	mg/L	0.2 mg/L	96.4	70.0	130	----
Antimony, leachable	7440-36-0	E446	0.0001	mg/L	0.1 mg/L	106	70.0	130	----
Arsenic, leachable	7440-38-2	E446	0.001	mg/L	0.1 mg/L	98.9	70.0	130	----
Barium, leachable	7440-39-3	E446	0.001	mg/L	0.025 mg/L	96.8	70.0	130	----
Beryllium, leachable	7440-41-7	E446	0.0005	mg/L	0.01 mg/L	98.0	70.0	130	----
Bismuth, leachable	7440-69-9	E446	0.0005	mg/L	0.1 mg/L	97.2	50.0	130	----
Boron, leachable	7440-42-8	E446	0.01	mg/L	0.1 mg/L	90.6	70.0	130	----
Cadmium, leachable	7440-43-9	E446	0.00005	mg/L	0.01 mg/L	96.2	70.0	130	----
Calcium, leachable	7440-70-2	E446	0.1	mg/L	5 mg/L	100	70.0	130	----
Chromium, leachable	7440-47-3	E446	0.0005	mg/L	0.025 mg/L	94.3	70.0	130	----
Cobalt, leachable	7440-48-4	E446	0.0001	mg/L	0.025 mg/L	93.9	70.0	130	----
Copper, leachable	7440-50-8	E446	0.001	mg/L	0.025 mg/L	93.7	70.0	130	----
Iron, leachable	7439-89-6	E446	0.03	mg/L	0.1 mg/L	96.9	70.0	130	----
Lead, leachable	7439-92-1	E446	0.0001	mg/L	0.05 mg/L	100.0	70.0	130	----
Lithium, leachable	7439-93-2	E446	0.005	mg/L	0.025 mg/L	89.9	70.0	130	----
Magnesium, leachable	7439-95-4	E446	0.05	mg/L	5 mg/L	99.1	70.0	130	----
Manganese, leachable	7439-96-5	E446	0.0005	mg/L	0.025 mg/L	94.8	70.0	130	----
Molybdenum, leachable	7439-98-7	E446	0.0001	mg/L	0.025 mg/L	107	70.0	130	----
Nickel, leachable	7440-02-0	E446	0.0005	mg/L	0.05 mg/L	93.4	70.0	130	----
Phosphorus, leachable	7723-14-0	E446	0.3	mg/L	1 mg/L	90.8	70.0	130	----
Potassium, leachable	7440-09-7	E446	0.05	mg/L	5 mg/L	92.3	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Leachable Metals (QCLot: 735592) - continued									
Selenium, leachable	7782-49-2	E446	0.0005	mg/L	0.1 mg/L	100	70.0	130	----
Silicon, leachable	7440-21-3	E446	0.05	mg/L	1 mg/L	100	70.0	130	----
Silver, leachable	7440-22-4	E446	0.00005	mg/L	0.01 mg/L	93.9	50.0	130	----
Sodium, leachable	7440-23-5	E446	0.05	mg/L	5 mg/L	95.1	70.0	130	----
Strontium, leachable	7440-24-6	E446	0.0005	mg/L	0.025 mg/L	102	70.0	130	----
Sulfur, leachable	7704-34-9	E446	0.5	mg/L	5 mg/L	101	70.0	130	----
Thallium, leachable	7440-28-0	E446	0.0001	mg/L	0.11 mg/L	89.5	70.0	130	----
Tin, leachable	7440-31-5	E446	0.0005	mg/L	0.05 mg/L	98.2	50.0	130	----
Titanium, leachable	7440-32-6	E446	0.01	mg/L	0.025 mg/L	93.1	50.0	130	----
Uranium, leachable	7440-61-1	E446	0.00001	mg/L	0.0005 mg/L	107	70.0	130	----
Vanadium, leachable	7440-62-2	E446	0.001	mg/L	0.05 mg/L	95.9	70.0	130	----
Zinc, leachable	7440-66-6	E446	0.01	mg/L	0.05 mg/L	90.5	70.0	130	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Leachable Metals (QCLot: 735590)										
VA22C5131-002	Anonymous	Mercury, leachable	7439-97-6	E515	0.000096 mg/L	0.0001 mg/L	96.5	70.0	130	----
Leachable Metals (QCLot: 735592)										
VA22C5131-002	Anonymous	Aluminum, leachable	7429-90-5	E446	ND mg/L	0.2 mg/L	ND	70.0	130	----
		Antimony, leachable	7440-36-0	E446	0.0210 mg/L	0.02 mg/L	105	70.0	130	----
		Arsenic, leachable	7440-38-2	E446	0.0192 mg/L	0.02 mg/L	95.8	70.0	130	----
		Barium, leachable	7440-39-3	E446	0.0190 mg/L	0.02 mg/L	95.0	70.0	130	----
		Beryllium, leachable	7440-41-7	E446	0.0394 mg/L	0.04 mg/L	98.5	70.0	130	----
		Bismuth, leachable	7440-69-9	E446	0.00963 mg/L	0.01 mg/L	96.3	70.0	130	----
		Boron, leachable	7440-42-8	E446	0.094 mg/L	0.1 mg/L	94.4	70.0	130	----
		Cadmium, leachable	7440-43-9	E446	0.00386 mg/L	0.004 mg/L	96.5	70.0	130	----
		Calcium, leachable	7440-70-2	E446	4.02 mg/L	4 mg/L	100	70.0	130	----
		Chromium, leachable	7440-47-3	E446	0.0382 mg/L	0.04 mg/L	95.4	70.0	130	----
		Cobalt, leachable	7440-48-4	E446	0.0192 mg/L	0.02 mg/L	96.1	70.0	130	----
		Copper, leachable	7440-50-8	E446	0.0194 mg/L	0.02 mg/L	96.9	70.0	130	----
		Iron, leachable	7439-89-6	E446	1.91 mg/L	2 mg/L	95.6	70.0	130	----
		Lead, leachable	7439-92-1	E446	0.0203 mg/L	0.02 mg/L	101	70.0	130	----
		Lithium, leachable	7439-93-2	E446	0.0655 mg/L	0.1 mg/L	65.5	70.0	130	MES
		Magnesium, leachable	7439-95-4	E446	0.996 mg/L	1 mg/L	99.6	70.0	130	----
		Manganese, leachable	7439-96-5	E446	0.0194 mg/L	0.02 mg/L	97.0	70.0	130	----
		Molybdenum, leachable	7439-98-7	E446	0.0209 mg/L	0.02 mg/L	104	70.0	130	----
		Nickel, leachable	7440-02-0	E446	0.0382 mg/L	0.04 mg/L	95.4	70.0	130	----
		Phosphorus, leachable	7723-14-0	E446	9.24 mg/L	10 mg/L	92.4	70.0	130	----
		Potassium, leachable	7440-09-7	E446	3.73 mg/L	4 mg/L	93.2	70.0	130	----
		Selenium, leachable	7782-49-2	E446	0.0396 mg/L	0.04 mg/L	99.1	70.0	130	----
		Silicon, leachable	7440-21-3	E446	10.3 mg/L	10 mg/L	103	70.0	130	----
		Silver, leachable	7440-22-4	E446	0.00414 mg/L	0.004 mg/L	104	70.0	130	----
		Sodium, leachable	7440-23-5	E446	ND mg/L	2 mg/L	ND	70.0	130	----
		Strontium, leachable	7440-24-6	E446	0.0201 mg/L	0.02 mg/L	100	70.0	130	----
		Sulfur, leachable	7704-34-9	E446	20.2 mg/L	20 mg/L	101	70.0	130	----
		Thallium, leachable	7440-28-0	E446	0.00391 mg/L	0.004 mg/L	97.8	70.0	130	----
		Tin, leachable	7440-31-5	E446	0.0194 mg/L	0.02 mg/L	97.1	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Leachable Metals (QCLot: 735592) - continued										
VA22C5131-002	Anonymous	Titanium, leachable	7440-32-6	E446	0.039 mg/L	0.04 mg/L	97.4	70.0	130	----
		Uranium, leachable	7440-61-1	E446	0.00400 mg/L	0.004 mg/L	100.0	70.0	130	----
		Vanadium, leachable	7440-62-2	E446	0.0972 mg/L	0.1 mg/L	97.2	70.0	130	----
		Zinc, leachable	7440-66-6	E446	0.383 mg/L	0.4 mg/L	95.8	70.0	130	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WR2201414**	Page	: 1 of 9
Client	: **Alexco Keno Hill Mining Corp**	Laboratory	: Whitehorse - Environmental
Contact	: Environment	Account Manager	: Heather McKenzie
Address	: #2 Calcite Business Centre - 151 Industrial Road Whitehorse YT Canada Y1A 2V3	Address	: #12 151 Industrial Road Whitehorse, Yukon Canada Y1A 2V3
Telephone	: ----	Telephone	: +1 867 668 6689
Project	: Type A WL Tx	Date Samples Received	: 02-Nov-2022 10:20
PO	: 05562	Issue Date	: 07-Feb-2023 12:18
C-O-C number	: ----		
Sampler	: TF		
Site	: AKHM		
Quote number	: WR22-AKHM100-04 (Keno/Hecla)		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Matrix Spike outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers occur - please see following pages for full details.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Matrix Spike (MS) Recoveries								
Leachable Metals	Anonymous	Anonymous	Lithium, leachable	7439-93-2	E446	65.5 % MES	70.0-130%	Recovery less than lower data quality objective

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Acid Base Accounting : Acid Base Accounting (Modified Sobek)										
HDPE F&M	OA-VOL08m	01-Nov-2022	----	----	----		05-Feb-2023	----	----	
Acid Base Accounting : Inorganic Carbon by Coulometer										
HDPE F&M	C-GAS05	01-Nov-2022	----	----	----		05-Feb-2023	----	----	
Acid Base Accounting : Received Sample Weight										
HDPE F&M	WEI-21	01-Nov-2022	----	----	----		05-Feb-2023	180 days	96 days	✓
Acid Base Accounting : Saturated Paste pH										
HDPE F&M	OA-ELE07	01-Nov-2022	----	----	----		05-Feb-2023	----	----	
Acid Base Accounting : Sulfates by HCl Leaching and Gravimetry										
HDPE F&M	S-GRA06A	01-Nov-2022	----	----	----		05-Feb-2023	----	----	
Acid Base Accounting : Sulfide S (as S) Calc. (Total-S - SO4-S)										
HDPE F&M	S-CAL06a	01-Nov-2022	----	----	----		05-Feb-2023	----	----	
Acid Base Accounting : Total Sulfur by Combustion and IR										
HDPE F&M	S-IR08	01-Nov-2022	----	----	----		05-Feb-2023	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Sulfate by IC (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap F&M	E243.SO4	01-Nov-2022	08-Nov-2022	----	----		09-Nov-2022	28 days	8 days	✓
Leachable Metals : Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap F&M	E515	01-Nov-2022	08-Nov-2022	----	----		09-Nov-2022	28 days	8 days	✓
Leachable Metals : Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap F&M	E446	01-Nov-2022	08-Nov-2022	----	----		09-Nov-2022	180 days	8 days	✓
Metals : 51 Elements by Aqua Regia digestion and ICP-AES/MS										
HDPE F&M	ME-MS41	01-Nov-2022	----	----	----		05-Feb-2023	----	----	
Physical Tests : Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap F&M	E103	01-Nov-2022	08-Nov-2022	----	----		09-Nov-2022	28 days	8 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap F&M	E144	01-Nov-2022	----	----	----		08-Nov-2022	----	----	
Physical Tests : pH by Electrode (Shakeflask, 3:1 Ratio with Water)										
Glass soil jar/Teflon lined cap F&M	E116	01-Nov-2022	08-Nov-2022	----	----		09-Nov-2022	30 days	8 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	735590	1	4	25.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	735592	1	4	25.0	5.0	✓
Moisture Content by Gravimetry	E144	734959	1	3	33.3	5.0	✓
pH by Electrode (Shakeflask, 3:1 Ratio with Water)	E116	735591	1	4	25.0	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	735594	1	1	100.0	5.0	✓
Laboratory Control Samples (LCS)							
Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)	E103	735593	1	1	100.0	5.0	✓
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	735590	1	4	25.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	735592	1	4	25.0	5.0	✓
Moisture Content by Gravimetry	E144	734959	1	3	33.3	5.0	✓
pH by Electrode (Shakeflask, 3:1 Ratio with Water)	E116	735591	1	4	25.0	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	735594	1	1	100.0	5.0	✓
Method Blanks (MB)							
Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)	E103	735593	1	1	100.0	5.0	✓
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	735590	1	4	25.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	735592	1	4	25.0	5.0	✓
Moisture Content by Gravimetry	E144	734959	1	3	33.3	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	735594	1	1	100.0	5.0	✓
Matrix Spikes (MS)							
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515	735590	1	4	25.0	5.0	✓
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446	735592	1	4	25.0	5.0	✓
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4	735594	0	1	0.0	5.0	×

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Inorganic Carbon by Coulometer	C-GAS05 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals C-GAS05	Determine Total Inorganic Carbon (TIC) by using diluted perchloric acid to react with metal carbonate and yield carbon dioxide. Concentration of CO_2 is determined by coulometer.
Conductivity by Electrode (Shakeflask, 3:1 Ratio with Water)	E103 Vancouver - Environmental	Soil/Solid	MEND (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into an extract from a soil sample that has been added in a 3:1 ratio of deionized water to soil, then leached and the extract filtered prior to analysis. Conductivity measurements are temperature-compensated to 25°C.
pH by Electrode (Shakeflask, 3:1 Ratio with Water)	E116 Vancouver - Environmental	Soil/Solid	MEND (mod)/APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on an extract from a soil sample that has been added in a 3:1 ratio of deionized water to soil, then leached and the extract filtered prior to analysis. The pH is then measured by a standard pH probe. .
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Sulfate by IC (Shakeflask, 3:1 Ratio with Water)	E243.SO4 Vancouver - Environmental	Soil/Solid	MEND (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining an extract from a soil sample that has been added in a 3:1 ratio of deionized water to soil, then leached and the extract filtered prior to analysis, which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Metals by CRC ICPMS (Shakeflask, 3:1 Ratio with Water)	E446 Vancouver - Environmental	Soil/Solid	BC MINISTRY OF ENERGY AND MINES/EPA 6020B (mod)	A sample is extracted with water at a 3:1 liquid to solid ratio for 24 hours, then filtered through a 0.45 micron membrane filter. Analysis is by Collision/Reaction Cell ICPMS. This extraction is an empirical procedure with pre-defined characteristics. Recovery of some elements (Ag, Bi, and Sn) by this method can be variable due to the neutral pH of the extraction fluid, and therefore the LCS DQOs has been established at 50-130% for these elements.
Mercury by CVAAS (Shakeflask, 3:1 Ratio with Water)	E515 Vancouver - Environmental	Soil/Solid	BC MINISTRY OF ENERGY AND MINES/EPA 1631E (mod)	A sample is extracted with water at a 3:1 liquid to solid ratio for 24 hours, then filtered through a 0.45 micron membrane filter. Analysis is by CVAAS. This extraction is an empirical procedure with pre-defined characteristics. Recovery of mercury can be variable due to the neutral pH of the extraction fluid, and therefore the LCS DQO has been established at 50-130%.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Particle Size Analysis (Pipette) - MMER Classification	EC184E Saskatoon - Environmental	Soil/Solid	Metal Mining Technical Guidance for Environmental Effects Monitoring (2012)	The particle size determination is performed by various methods to generate a Grain Size curve. The data from the curve is then used to produce particle size ranges based on the Metal Mining Effluent Regulations (MMER) classification system for Environmental Effects Monitoring.
51 Elements by Aqua Regia digestion and ICP-AES/MS	ME-MS41 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals ME-MS41	A prepared sample is digested with aqua regia in a graphite heating block. After cooling, the resulting solution is diluted to with deionized water, mixed and analyzed by ICP-AES. Samples are then analyzed by ICP-MS for the remaining suite of elements.
Saturated Paste pH	OA-ELE07 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals OA-ELE07	Sample mix with water in 1:1 ratio to make a paste, pH is then determined.
Acid Base Accounting (Modified Sobek)	OA-VOL08m ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals OA-VOL08m	Determine the acid generation power of a sample as tonne $CaCO_3$ per kilo-tonne using modified Sobek method
Sulfide S (as S) Calc. (Total-S - SO4-S)	S-CAL06a ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals:S-CAL06a	Sulfide Sulfur (as S) is calculated by subtracting the HCL Leachable Sulfate Sulfur (as S) from the Total Sulfur (as S) obtained from combustion.
Sulfates by HCl Leaching and Gravimetry	S-GRA06A ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals S-GRA06A	A prepared sample is heated with dilute HCl and then filtered. The sulfate in the filtrate is precipitated with $BaCl_2$ in a dilute HCl. The $BaSO_4$ precipitate is filtered, ignited, weighed and the Sulfate Sulfur is determined (as S).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total Sulfur by Combustion and IR	S-IR08 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals S-IR08	A prepared sample is heated to approximately 1350°C in an induction furnace with oxygen stream. Sulfur dioxide released from the sample are measured by IR (Leco analyzer) and the Total Sulfur result is provided.
Received Sample Weight	WEI-21 ALS Minerals (Vancouver) - 2103 Dollarton Hwy North Vancouver British Columbia Canada V7H 0A7	Soil/Solid	ALS Minerals WEI-21	Weigh out sample received.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Shakeflask Leachate Preparation (3:1 Ratio with Water)	EP446 Vancouver - Environmental	Soil/Solid	BC MINISTRY OF ENERGY AND MINES	A sample is extracted with water at a 3:1 liquid to solids ratio for 24 hours, then filtered through a 0.45 micron membrane filter.
Dry and Grind in Soil/Solid <60°C	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Environmental Division
Whitehorse
Work Order Reference
WR2201414

Telephone : +1 867 668 6689

Report To		Report Format / Distribution	Service Requested (Rush for routine analysi
Company:	Alexco Keno Hill Mining	☑ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business D
Contact:	Environment Department	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Co
Address:	Suite 1225 - 555 Burrard Street Vancouver BC V7X 1M9	Email 1: YK-Environment@hecla.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - C
		Email 2: nspeiss@ensero.com	○ Same Day or Weekend Emergency - Contact ALS t
Phone:	867-995-3113 X5960 Fax:	Email 3: kwoloshyn@ensero.com	Analysis Rec
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**	
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: **Type A WL Tx**	
Company:	Alexco Keno Hill Mining	PO / AFE: PO#05562	
Contact:	Derek Meneghin; YK-AccountsPayable@hecla.com	LSD: **AKHM**	
Address:	Suite 1225 - 555 Burrard Street Vancouver BC V7X 1M9		
Phone:	604.633.4888 Fax: 604.633.4887	Quote #:	
Lab Work Order # (lab use only)		**ALS Contact:** Heather McKenzie	**Sampler:** TF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	time	Sample Type	ABA w modified Sobek	Aqua regia digestion w ICP	Shakeflask metals ICPMS	Shakeflask sulphate, pH, EC	Grain size >2mm, pipette	Number of Containers
	F&M	01-Nov-22	9:30	Other	x	x	x	x	x	1

Yukon EQWin and ACC200 digital formats. **General A:** pH, EC, TSS (low) **General B:** pH, EC, TSS (low), anions-all
General C: pH, EC, TSS (low), anions-all, ion balance, alkalinity **General D:** pH, EC, TSS (low), SO4, ion balance, alkalinity **Other:** Samples are sludge.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
TF	1-Nov-22	12:00		NOV 2	1020	6 °C				

APPENDIX B:

SLUDGE LOGBOOK TEMPLATE

Sludge Tracking Log **Week:**

Sludge Removal

Removed From	Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Comments
	gal	loads	gal	loads	gal	loads	gal	loads	gal	loads	gal	loads	gal	loads	
BM															
F&M															
BK 625															
Other:															
Other:															

Sludge Deposit

Deposited At	Sunday		Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Comments
	gal	loads	gal	loads	gal	loads	gal	loads	gal	loads	gal	loads	gal	loads	
VTF															
Mill/DSTF															
SW Pit															
Other:															
Other:															
Operator:															