KENO HILL SILVER DISTRICT MINING OPERATIONS

MONITORING, SURVEILLANCE AND REPORTING PLAN

September 2023

Prepared by:

HECLA YUKON

Prepared for:

ALEXCO KENO HILL MINING CORP.

DOCUMENT REVISIONS

SECTION	SUMMARY OF CHANGES
Entire document	Updated to reflect new ownership of company and revised reporting structure Figures updated Added reference to New Bermingham mine in multiple sections
Document Revisions	Table added to indicate areas where changes have been made to the previous revision of the Plan
Introduction	Overview of the KHSD mining operations added Change of ownership explained
Water Surveillance Network	Removed reference to ERDC water quality monitoring Added monitoring and sampling requirements for raw mine water discharge from Bellekeno Added water quality objectives (sourced from the December 2022 AMP) Removed heading 2.1 Updated text about set point triggers to be consistent with the December 2022 AMP Updated monitoring station tables to be consistent with the December 2022
Environmental Effects Monitoring	Updated the information provided about study design's and interpretive reports
Air Quality Monitoring	Directed the reader to the January 2023 Dust Abatement and Monitoring Plan for details about the monitoring program and deleted the outdated discussion on the monitoring program
Noise Monitoring	Directed the reader to the October 2021 Noise Monitoring and Management Plan for an update on the current monitoring program
Waste Rock Monitoring	Adding information about the studies completed after 2013 to be consistent with the October 2021 Waste Rock Management Plan
Adaptive Management Plan	Replaced all the text in this section
References	Section updated Removed current AKHM Management Plans submitted under the Water Licence and Quartz Mining Licence
Appendices	Decision Document and License Compliance trackers added (Appendix C and D)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

This plan is comprised of the monitoring, surveillance and reporting that will be carried out to ensure that the Keno Hill Silver District (KHSD) Mining Operations are managed in a manner that provides human and environmental protection. The framework of this plan includes monitoring and reporting of:

- the local and receiving environment through scheduled inspections and monitoring programs,
- effluent discharge points and treatment system performance,
- site facilities and incorporated design measures to ensure structural stability and prevention of accidents and malfunctions,
- remediation success, and
- adaptive management responses.

If monitoring indicates that physical structures, treatment systems or mitigative measures are not performing, then maintenance or contingency plans can be implemented following an adaptive management approach as discussed in Section 11. Compliance trackers relating to the Quartz Mining Licence and Decision Documents are presented in Appendix C and D.

The site is 354 km north of Whitehorse, in the vicinity of Keno City in the central Yukon. AKHM owns and operates of a series of small underground silver/lead/zinc mines with a centralized mill, as described in Table 1-1 and shown on Figure 1-1. On September 7, 2022, Alexco Resource Corp. (doing business as Hecla Yukon), the parent company of AKHM, was acquired by Hecla Mining Company.

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 location at Flame & Moth Mine area (Constructed 2010) Tailings placed in Dry Stack Tailings Facility (Established 2010) or underground as backfill
WORK FORCE	~ 250 employees and contractors during active mine and reclamation operations (as per Yukon Environmental and Socio-economic Assessment Act [YESAA] 2018-0169 Decision Document)
AIRSTRIP	Village of Mayo, YT
CAMP FACILITIES	Flat Creek camp facilities include a trailer camp, kitchen facility, welcoming center and dry 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 District Mill
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. ERDC activities are outside the scope of this Plan.

Prior to mine development in the KHSD, a number of monitoring programs and a surveillance network were already in place as per care and maintenance activities (Water Licence QZ06-074), advanced exploration and development activities at the Bellekeno, Flame & Moth and New Bermingham mines (Water Licence QZ18-044) as well as district-wide closure and new mine permitting studies. These programs include but are not limited to physical inspections, a water quality surveillance network, old mine workings monitoring, aquatic resources monitoring for benthic invertebrate and fisheries populations, sediment monitoring, waste rock and mine wall sampling and the Adaptive Management Plan. Monitoring, surveillance and reporting applicable to Bellekeno, Flame & Moth and New Bermingham mines are presented in this plan.

475,000 477,500 480,000 482,500 485,000 487,500

7,092,500 7,090,000 7,087,500 7,085,000

N W E S

South

HANSON MCQUESTEN ROAD

Christal Creek

South McQuesten River

Sandy Creek

SILVER TRAIL HIGHWAY

Christal Creek

KENO SUMMIT

Star Creek

No Cash Creek

WERNECKE ROAD

Erickson Gulch

Charity

SIGN POST ROAD

CALUMET DRIVE

BERMINGHAM ACCESS ROAD

CHRISTAL LAKE

CHRISTAL LAKE ROAD

FLAME AND MOTH PORTAL

DISTRICT MILL SITE

BELLEKENO HAUL ROAD

FLAT CREEK CAMP

FORMER ELSA TOWNSITE

Porcupine Gulch

GALENA HILL

KENO CITY

Brefalt Creek

NEW BERMINGHAM PORTAL

HISTORIC BERMINGHAM 200 ADIT

DUNCAN CREEK ROAD

Lightning Creek

BELLEKENO 625

BELLEKENO EAST PORTAL

Flat Creek

Thunder Gulch

SOURDOUGH HILL

1:40,000 (when printed on 11 x17 inch paper)

0 0.5 1 2 Kilometres

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

- Adit
- AKHM / ERDC Quartz Claims
- Silver Trail Highway
- Other Road
- Limited-Use Road
- Tailings Area
- Waterbody
- Watercourse
- Contours (100 ft intervals)

Hecla YUKON

ENSERO solutions

FIGURE 1-1

KENO HILL SILVER DISTRICT MINING OPERATIONS OVERVIEW

DECEMBER 2022

D:\Project\AllProjects\Keno_Area_Mines\ALL-SITES\02-Map\01_Overview\01-Property Overview\01-District_WideOverview_20221115.mxd
(Last edited by: fspalling; 31/22/2022/10:33 AM)

2 WATER SURVEILLANCE NETWORK

KHSD Mining Operations Water Licence QZ18-044 provides Effluent Quality Standards (EQS) which dictate maximum concentrations of specific parameters allowed to be discharged at locations where water treatment is being undertaken.

The Bellekeno Mine stopped dewatering activities in October 2021, and discharge from the Bellekeno 625 Treatment Pond Decant (KV-43) ceased. The raw mine water discharging from the Bellekeno 625 Adit (KV-42) will be tested monthly for glycol, benzene, ethylbenzene, toluene, xylene (BETX), styrene volatile petroleum hydrocarbons (VPHw), light extractable petroleum Hydrocarbons (LEPHw) and polycyclic aromatic hydrocarbons (PAH). Upon reaching a steady and compliant state in these parameters a request to reduce the testing program in accordance with the *Yukon Contaminated Sites Regulation* (YCSR) will be submitted to the Yukon Department of Environment, Environment Protection and Assessment Branch.

In addition to the monitoring of treated effluent discharge and associated adits, background surface water stations upstream of project facilities are also monitored along with the receiving environment.

Surface water quality objectives (WQOs) that are broadly protective of aquatic resources for the receiving environment have been established for Christal Creek (KV-50, KV-6, and KV-7), Lightning Creek (KV-81), and No Cash Creek (KV-21, KV-111), Star Creek (KV-56), and the South McQuesten River (KV-2). The results are used to calculate loading and potential effects to the receiving environment (Figure 2-1).

WQOs are thresholds of acceptable water quality conditions in specific receiving waters that may be affected by a project, including both narrative descriptions of expectations for acceptable water quality conditions and numerical benchmarks that define specific chemical or physical characteristics of acceptable water quality (Government of Yukon, 2021). The WQOs were established using generic Canadian Council of Ministers of the Environment (CCME) or British Columbia Ministry of Environment (BCMoE) guidelines or using the background concentration procedure. The background concentration procedure (BCP) was used to develop WQOs for constituents that frequently exceed CCME and BCMoE guidelines (i.e., >10% of samples exceed guideline). Short-term maximum and long-term average threshold concentrations were developed from the 95th percentile (P95) and upper confidence limit (95%) mean (UCLM) of the data set (past ten years, where available), respectively. The WQOs for Christal, Lightning, No Cash, and Star Creeks and the South McQuesten River are presented in Table 2-1.

Monitoring wells are used to measure and sample groundwater in the receiving environment and have been established as per Water Licence QZ18-044. Refer to Type A Water Licence QZ18-044, which specifies Effluent Quality Standards (Part G), monitoring and surveillance (Part H and Schedule B) and Reporting (Part I) required for the KHSD Mining Operations, which is available for download at www.yukonwaterboard.ca/waterline.

A Groundwater Monitoring Plan for the KHSD Mining Operations was developed in February 2011 and was last updated in October 2021 to include the New Bermingham Mine per Water Licence QZ18-044 (see Appendix A). This plan outlines monitoring locations and frequency for the District Mill and Dry Stack Tailings Facility (DSTF), the non-acid metal leaching (N-AML) waste rock disposal areas (New Bermingham and Bellekeno). Groundwater wells are scheduled for monthly monitoring for both water level and quality for 12 months to establish well conditions, followed by quarterly sampling thereafter for the duration of the project, as per Clause 87(a). Groundwater data will be compared to the Yukon *Contaminated Sites Regulations* Schedule 3:

Generic Numerical Water Standards (Aquatic Life) and to the Yukon *Contaminated Sites Regulations* Drinking Water Standards when near potable or potentially potable aquifers, as per Clauses 82 and 83.

Table 2-2 outlines the sampling stations and schedule for internal and external lab analysis in the area of the New Bermingham, Bellekeno, and Flame & Moth mines and in the vicinity of the District Mill site. Table 2-2 has been updated to includes requirements for monthly petroleum hydrocarbon and glycol testing at Bellekeno 625 Adit (KV-42). Figure 2-1 shows the surface water monitoring locations and includes three insets for the respective surface water quality location by mine component for the DSTF/District Mill/Flame & Moth, New Bermingham and Bellekeno. Figure 2-2 shows the existing and proposed groundwater locations for the District Mill and Flame & Moth Mine Mining Operations, while Figure 2-3 provides the New Bermingham Mine groundwater monitoring locations.

Hydrology monitoring is undertaken on a continuous basis during the open water season at stations on Christal Creek (KV-6), No Cash Creek (KV-21) and Lightning Creek (KV-41), as per Part H, Clause 73. In June 2015, a water level recorder with staff gauge were installed in Christal Lake and KV-51 (Christal Creek downstream of Hinton Creek). Should flow be present at site KV-11 and KV-118 manual measurements will be completed, and data submitted as part of monthly report, as per Part H, Clause 75. Instantaneous measurements of flow are also collected during monthly/quarterly sample events at all stations possible. Flow monitoring stations will be established for all locations where water is withdrawn from surface or ground for use with mining activities and discharged into the receiving environment.

Quality assurance and quality control (QA/QC) protocols have been implemented during collection, storage and shipping of samples. Standard QA/QC procedures conducted by field and laboratory staff including duplicate, relative percent difference analysis, analytic matrix spikes, spike blanks, and field, trip and method blanks.

Laboratory quality control analysis includes method blanks, laboratory duplicates, matrix spikes and blank spikes which are required to be reported by the laboratory showing acceptability criteria prior to issuing AKHM the data.

One field blank is collected per monthly event and is completed by taking de-ionized water (analyte free media) to the sample station, opening it and exposing it to ambient air and 'collecting' it in the sample bottles. These samples are treated the same as the actual water samples, preserved and filtered as necessary, and their analysis can provide an indication of contamination that may affect the actual samples. Additionally, one travel blank will accompany the samples for each monthly event and will be analysed for the same parameters as the routine samples.

Field duplicates are collected at a rate of 10% or 1 for every 10 samples. Relative Percent Difference (RPD) is used to determine field variability and is the difference between the sample result and replicate result, divided by the average of the sample result and replicate result and expressed as a percentage. Where analyte results have RPD greater than 25% a subsequent check is done against the laboratory detection limit (DL) to establish if the practical quantitation limit (PQL) was met. The PQL is five times the DL and is defined as the minimum concentration that can be measured within specified limits of precision and accuracy. Both results need to be above the PQL for the analyte to be considered as 'meeting the PQL'. If one result from the sample or duplicate is greater than 5X DL and the other result is less than 5X DL then the 'PQL is not met'. An analyte with results not meeting the PQL indicates that the constituent being analyzed is not present in a sufficient amount to be reliably quantified. Typically, as parameters approach their detection limit, high variability is more likely to

occur. The RPD of 25% can be used as a benchmark whereby an RPD greater than 25% warrants further comment or consideration.

All water quality data is stored in an EQWin database and additional QA/QC steps to determine potential outliers are identified. A variance report is generated on at least a quarterly basis for sitewide information that outlines the comparison off field vs laboratory pH and conductivity, and comparison to recent samples collected (i.e., RPD compared to samples from last 12 months).

As part of evaluation of the data a number of environmental models are updated with the water quality and quantity information outlined in Section 2, which include groundwater models, water quality models, water balances and water quality objectives (WQO) for Christal Creek, Lightning Creek and No Cash Creek. These tools are updated with additional water information available on an annual or as needed basis to inform decision making process or to further evaluate adaptive management responses. As an example, a number of stations (i.e., KV-6, KV-21 and KV-41) record continuous stream flow measurements. This information, in combination with the meteorology data, is used to refine the parameters and assumptions used in the water balances.

The surface water quality monitoring locations by mine are presented in Table 2-3. The water quality information collected under this plan is integrated into the existing water quality models to verify or adjust calibration factors used in the model. This advances the understanding of the dynamic nature of the district and numerous load sources including evaluation and determination of natural attenuation capacity in the receiving environment.

Additionally, the water quality data are compared with set point triggers placed in the EQWin database. In this way, parameters can be tracked, and fluctuations out of the normal levels where management is required to respond can be monitored. The set point triggers are based on the established WQOs (Table 2-2) and Adaptive Management Plan thresholds as part of the routine review.

The groundwater monitoring locations per mine is presented in Table 2-4. The groundwater levels collected as part of this program will be used to prepare groundwater contours maps twice per year and refinements to the groundwater models as required.

The water quality discharge monitoring is conducted by water treatment plant (WTP) operators and reporting is conducted by Ensero Solutions and reviewed by site environmental staff. The groundwater monitoring and reporting is completed by Ensero Solutions.

Table 2-1: Water Quality Objectives for Christal Creek, Lightning Creek, No Cash Creek, Star Creek, and South McQuesten River

	KV-50	KV-6	KV-7	KV-81[A]	KV-21[A]	KV-56	KV-111[A]	KV-2
	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
Ammonia-N	CCME	CCME	CCME	CCME	CCME	CCME	CCME	CCME
Nitrate-N	CCME	CCME	CCME	CCME	CCME	CCME	CCME	CCME
Nitrite-N	CCME	CCME	CCME	CCME	CCME	CCME	CCME	CCME
Arsenic	0.0432[b], 0.0277[c]	0.0167[b], 0.0098[c]	0.0102[b], 0.0043[c]	0.005	0.025[f]	0.005	0.005	0.005
Cadmium	BCMoE	0.00218[b], 0.00142[c]	0.00251[b], 0.000945[c]	BCMoE	0.0445[d], 0.0209[e]	0.000297[d], 0.000132[e]	0.000541[b], 0.000258[c]	0.000941[b], 0.000647[c]
Copper	0.00602[b], 0.00280[c]	0.0321[b], 0.00115[c]	0.00726[b], 0.00216[c]	0.00148[b], 0.00070[c]	0.00359[d], 0.00193[e]	BCMoE	BCMoE	0.00651[b], 0.00376[c]
Lead	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE
Nickel	CCME	CCME	CCME	CCME	CCME	CCME	CCME	CCME
Silver	CCME	CCME	CCME	CCME	CCME	CCME	CCME	CCME
Uranium	CCME	CCME	CCME	CCME	CCME	CCME	CCME	CCME
Zinc	0.271[b], 0.205[c]	0.367[b], 0.207[c]	0.220[b], 0.120[c]	CCME	4.94[d], 2.28[e]	CCME	0.179[b], 0.0602[c]	0.152[b], 0.103[c]
Sulphate	544[b], 409[c]	BCMoE	BCMoE	BCMoE	539[d], 349[e]	BCMoE	BCMoE	BCMoE
Selenium	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE	BCMoE
Radium	-	0.037 Bq/L	-	0.037 Bq/L	-	-	0.037 Bq/L	-

Notes:

a) Objectives for KV-81, KV-21, and KV-111 metals are dissolved

b) 95th percentile from July 2011 to August 2021 data set, except for KV-111 which ranges from September 2017 to August 2021

c) Upper confidence level mean from July 2011 to August 2021 data set, except for KV-111 which ranges from September 2017 to August 2021

d) 95th percentile from July 2017 and June 2018 to August 2021 data set for KV-21 and KV-56, respectively

e) Upper confidence level mean from July 2017 and June 2018 to August 2021 data set for KV-21 and KV-56, respectively

f) Site specific based on Golder (2013) presented in Bermingham Water Quality Model (AEG, 2019a)

Table 2-2 Keno Hill Silver District Mining Operations Water Monitoring Program Summary

SITE	SITE DESCRIPTION	WATER LICENCE	INSITU MEASUREMENTS / INTERNAL ANALYSIS									EXTERNAL LAB ANALYSIS															
		QZ18-044 Monitoring Status	Level	Synoptic Levels	Flow	pH	Temperature	Conductivity	Total Zn	Ammonia	Turbidity	Total Metals	Dissolved Metals	Hardness	pH	Conductivity	TSS	Alkalinity	Sulphate	Nitrate	Nitrite	Ammonia-N	DOC	Total Phosphorous	Total and Free Chlorine	Petroleum Hydrocarbons* * and Glycol	Radium 226	Acute Lethality LC50 Rainbow Trout 96 Hour
Mine Treatment / Effluent Discharge Sites																											
KV-42	Bellekeno 625 Adit	Existing	-		C	D	D	D	D	D	D	W	W	W	W	W	W	W	W	W	W	W	M	W		M	-	-
KV-43	Bellekeno 625 Settling Pond Decant	Existing	-		C	D	D	D	D	D	D	W	W	W	W	W	W	W	W	W	W	W	W	W			W/Q	M
KV-82	Flame and Moth Mill Site Collection and Sediment Pond	Existing	D		-	D	D	D	D	D	D	M	M	M	M	M	M	M	M	M	M	M	M	M			-	-
KV-83	Flame and Moth Mill Treatment Plant Discharge	Existing	-		C-WD	D-WD	D-WD	D-WD	D-WD	D-WD	D-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	Q-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD			W/Q	M
KV-105	Flame and Moth Adit Discharge	Existing	-		C	D-WD	D-WD	D-WD	D-WD	D-WD	D-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD			-	-
KV-104L	Flame and Moth Settling Pond Decant discharge to Lightning Creek	Existing	D		C-WD	D	D	D	D	D	D	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD			W/Q	M
KV-104C	Flame and Moth Settling Pond Decant discharge to Christal Creek	Existing	D		C-WD	D	D	D	D	D	D	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD			W/Q	M
KV-110	New Bermingham Portal	Existing	-		C-WD	D-WD	D-WD	D-WD	D-WD	D-WD	D-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	D-WD*		-	-
KV-114	New Bermingham Pond Decant	Existing	D		C-WD	D	D	D	D	D	D	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	W-WD	D-WD*		W/Q	M
Mine Surface Water Surveillance Sites																											
KV-1	South McQuesten River u/s Christal Creek	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-2	South McQuesten River @ Pumphouse	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-6	Christal Creek @ Keno Highway	Existing	-		C	M-WD	M-WD	M-WD	-	-	-	W-WD/M	W-WD/M	W-WD/M	W-WD	W-WD	W-WD	W-WD	W-WD/M	W-WD/M	W-WD/M	W-WD/M	W-WD/M	W-WD/M			-	-
KV-7	Christal Creek @ Hanson Road	Existing	-		M	M	M	M	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M			-	-
KV-8	Christal Creek @ mouth	Existing	-		Q	M	M	M	-	-	-	M	M	M	M	M	M	M	M	-	-	-	M	M			-	-
KV-21	No Cash Creek at Silver Trail Highway	Existing	-		C	M	M	M	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M			-	-
KV-37	Lightning Creek u/s Hope Gulch	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-38	Lightning Creek u/s Thunder Gulch	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-39	Hope Gulch u/s Lightning Creek	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-40	Charity Gulch u/s Lightning Creek	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-41	Lightning Creek u/s Bridge @ Keno City	Existing	-		C	M	M	M	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M			-	-
KV-44	Bellekeno 625 Seep	Existing	-		Ms	Ms	Ms	Ms	Ms	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	Q
KV-45	Onek 400 Adit	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-49	Hinton Creek u/s Christal Creek	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-50	Christal Creek u/s Hinton Creek	Existing	-		M-WD	M-WD	M-WD	M-WD	-	-	-	W-WD/M	W-WD/M	W-WD/M	W-WD	W-WD	W-WD	W-WD	W-WD/M	W-WD/M	W-WD/M	W-WD/M	W-WD/M	W-WD/M			-	-
KV-51	Christal Creek d/s Hinton Creek	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-52	Natural spring to Christal Lake @ Old Mackeno Pumphouse	Existing	-		M	M	M	M	-	-	-	M	M	M	M	M	M	M	M	-	-	-	M	M			-	-
KV-56	Star Creek at Silver Trail Highway	Existing	-		M	M	M	M	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M			-	-
KV-65	Thunder Gulch u/s of Bellekeno 625	Existing	-		Q	Q	Q	Q	-	-	-	M	M	M	M	M	M	M	M	-	-	-	M	M			-	-
KV-72	South McQuesten River at McQuesten Lake	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q				Q	Q				
KV-76	Thunder Gulch d/s Bellekeno 625	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-77	Thunder Gulch u/s Bellekeno East	Existing	-		Q	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-78B	Bellekeno East Temporary Waste Rock Storage Facility	Existing	Ms		-	Ms	Ms	Ms	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-79	Christal Creek d/s MacKeno Tailings	Existing	-		-	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-80	Christal Creek u/s Mackeno Tailings	Existing	-		-	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-81	Lightning Creek Southwest of Mill Site	Existing	-		M-WD	M-WD	M-WD	M-WD	-	-	-	W-WD/M	W-WD/M	W-WD/M	W-WD	W-WD	W-WD	W-WD	W-WD/M	W-WD/M	W-WD/M	W-WD/M	W-WD/M	W-WD/M			-	-
KV-106	Flame and Moth Temporary P-AML Waste Rock Storage Facility	Existing	Q		-	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-111	No Cash Creek above No Cash 500 Adit	Existing	-		M	M	M	M	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M			-	-
KV-115	Bermingham P-AML Facility #1	Existing	Ms		-	Ms	Ms	Ms	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-119	Bermingham P-AML Facility #2	Pending	Ms		-	Ms	Ms	Ms	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q			-	-
KV-118	No Cash Creek at Calumet Drive	Existing	-		M	M	M	M	-	-	-	M	M	M	M	M	M	M	M	M	M	M	M	M			-	-
Mine Groundwater Monitoring Wells																											
KV-84Nd	Keno City Well #1	Existing	Q	-	-	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-85D	Keno Hill Silver Distirict Mill Site Groundwater Well #1 (PH2) Deep	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-85S	Keno Hill Silver Distirict Mill Site Groundwater Well #2 (Shallow)	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-86	Keno Hill Silver Distirict Mill Site Groundwater Well #3 (PH5)	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-87	Keno Hill Silver Distirict Mill Site Groundwater Well #4 (PH6)	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-88D	Keno Hill Silver Distirict Mill Site Groundwater Well #5 (Deep)	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-88S	Keno Hill Silver Distirict Mill Site Groundwater Well #6 (Shallow)	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-89D	Keno Hill Silver Distirict Mill Site Groundwater Well #7 (Deep)	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-89S	Keno Hill Silver Distirict Mill Site Groundwater Well #8 (Shallow)	Existing	Q		-	Q	Q	Q	-	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
KV-122	Bermingham - downgradient of BH SW pit well #1	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-123	Bermingham - downgradient of BH SW pit well #2	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-124	Bermingham - upgradient of BH SW pit	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q				
KV-125	Bermingham - downgradient of BH P-AML well #1	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q				
KV-126	Bermingham - downgradient of BH P-AML well #2	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-127	Bermingham - upgradient of BH P-AML	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KC-MW-4	Keno City Well #3 (Well south of Onek 400 adit)	Existing	Q	-	-	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
ON-MW-2	Keno City Well #2 (Onek Monitoring Well d/g Project Facilities)	Existing	Q	-	-	Q	Q	Q	-	-	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q			-	-
ON-MW-3	Keno City Well (Well south of Onek 400 adit)	Pending	M/Q	-	-	M/Q	M/Q	M/Q	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
FM-MW-01	Flame and Moth Well #1 (KAR-01)	Existing	M	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
FM-MW-02	Flame and Moth Well #2 (KAR-02)	Existing	M	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
FM-MW-03	Flame and Moth Well #3 (KAR-03)	Existing	M	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
BH39	DSTF phase 1 area	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-107	DSTF phase II expansion area	Pending	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-108	Upgradient of DSTF Phase 2 Expansion Area	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q				
RB-MW-1	Ruby 400 adit Monitoring Well	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
BH-MW-1	Historical Bermingham 200 adit monitoring well	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-116	Bermingham Waste Rock Disposal Area Well	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
NC-MW-1	No Cash 500	Existing	M/Q		-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-109	Lightning Creek near KV-81	Existing	M/Q	-	-	M/Q	M/Q	M/Q	-	-	-	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q			-	-
KV-103	District Mill Supply Well	Existing	Q	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
KV-84	Overburden Monitoring Well	Existing	Q	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
KC-MW-1B	Bedrock Groundwater Monitoring Well	Existing	Q	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
KC-MW-2	Overburden Groundwater Monitoring Well	Existing	Q	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
KC-MW-3	Bedrock Groundwater Monitoring Well	Existing	Q	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
ON-MW-1	Onek Monitoring Well #1 d/g Project Facilities	Existing	Q	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-
ON-MW-4	Bedrock monitoring well	Existing	Q	SA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-

Pending Stations to be established

C = Continuous
C-WD = Continuous While Discharging
D = Daily
D-WD = Daily While Discharging
D-WD* = Daily While Discharging from breakpoint chlorination system
W = Weekly
W-WD = Weekly While Discharging
Petroleum Hydrocarbons** include BETX + Styrene, VPHw, LEPHw, and PAH

W/Q = Weekly migrating to quarterly to accord with monitoring frequency pursuant to MDMER
M = Monthly
Ms = Monthly (May - Oct)
M/Q = Monitoring to occur monthly for first 12 months, reverting to quarterly thereafter.
Q = Quarterly
A = Annually

470000 480000 490000

7100000 7090000

DISTRICT MILL AND KENO CITY INSET

N W E S

Christal Creek

KV-6 KV-79 KV-80 KV-52 KV-51 KV-49 KV-50 KV-121 KV-117 KV-104C KV-82 KV-83 KV-105 KV-106 KV-104L KV-81 KV-45 KV-41

GALKENO 900

Christal Lake

CHRISTAL LAKE ROAD

SILVER TRAIL HIGHWAY

WERNECKE ROAD

SIGN POST ROAD

KENO CITY BYPASS ROAD

ONEK 400 ADIT

FLAME AND MOTH PORTAL

BELLEKENO HAUL ROAD

Lightning Creek

DISTRICT MILL WEATHER STATION

1:20,000

BELLEKENO INSET

SIGN POST ROAD

BELLEKENO HAUL ROAD

Lightning Creek

KV-38 KV-76 KV-44 KV-43 KV-42 KV-65

BELLEKENO 625 ADIT

BELLEKENO EAST PORTAL

KV-78B KV-77

TEMPORARY P-AML WRSF

Thunder Gulch

1:30,000

BERMINGHAM INSET

BERMINGHAM ACCESS ROAD

KV-114 KV-110 KV-18

HISTORIC BERMINGHAM 200

NEW BERMINGHAM PORTAL

P-AML KV-115

P-AML KV-119

1:7,500

McQuesten Lake KV-72

Cache Creek

Hanson Lakes

Ladue Lake

South McQuesten River

HANSON/MCQUESTEN ROAD

Ladue Creek

Gambler Lake

Germaine Lake

Faro Gulch

Silver Basin Gulch

Keno Ladue River

McKay Gulch

Sadie Ladue Creek

Gambler Gulch

Allen Creek

Faith Creek

KV-1 KV-8 KV-7 KV-2

Christal Creek

No Cash Creek

Sandy Creek

Star Creek

KV-56 KV-21 KV-20 KV-111 NO CASH 500

KV-118

BERMINGHAM INSET

VALLEY TAILINGS WEATHER STATION

CALUMET WEATHER STATION

Breriatt Creek

SILVER TRAIL HIGHWAY

CALUMET DRIVE

GALKENO 300

KV-48

Christal Lake

DISTRICT MILL AND KENO CITY INSET

BELLEKENO INSET

KENO 700

Hope Gulch

Charity Gulch

KV-40 KV-39 KV-37

McMillan Gulch

McNeill Gulch

Lightning Creek

Thunder Gulch

National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced underlicense from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

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

1:90,000 (when printed on 11 x17 inch paper)

0 1 2 3 4 5 Kilometers

- Active Surface Water Quality Station
- Pending/Proposed Water Quality Station
- Weather Station
- Adit
- As Built Mine Feature
- Valley Tailings
- Silver Trail Highway
- Other Road
- Watercourse
- Waterbody

Hecla YUKON

KENO HILL SILVER DISTRICT MINING OPERATIONS

FIGURE 2-1
SURFACE WATER QUALITY MONITORING LOCATIONS

DECEMBER 2022

D:\Projects\AllProjects\ALEX-05-01\gis\mxd\Overview_Maps\WQ\02-SURFACEWATER\Specific_Topic\Licensed\SWMonitoring_KenoHill_Qz09-092_Hecla_20221129.mxd
(Last edited by: amalla/shevska; 2022-12-08 15:01 PM)

Monitoring Well

Proposed Monitoring Well

Adit

Proposed Road

DSTF 322k Tonnes Design

Current DSTF

To Be Constructed Features

KENO HILL SILVER DISTRICT MINING OPERATIONS

FIGURE 2-2

DISTRICT MILL AND FLAME & MOTH GROUNDWATER MONITORING LOCATIONS

DECEMBER 2022

Satelite imagery obtained from Yukon Geomatics map service http://mapservices.gov.yk.ca/ArcGIS/services on December 2022

Datum: NAD 83; Projection: UTM Zone 8N

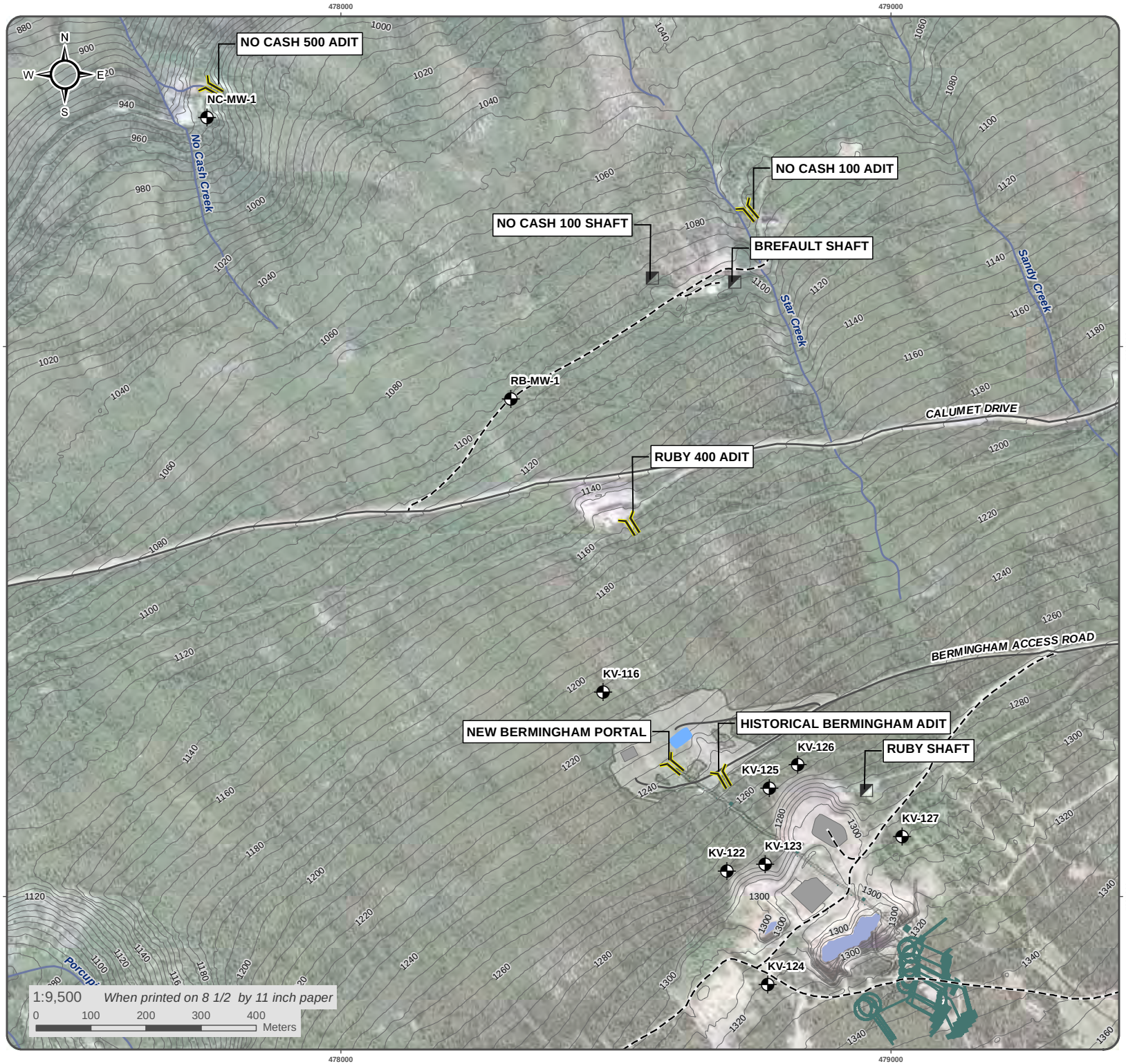
D:\Project\AllProjects\Keno_Area_Mines\ALL-SITES\02-Map\01_Overview\04-WQ\GW\GW_monitoring_locations_Distict_Mill_Onek_20221115.mxd
(Last edited by: amatlashevska; 2022-12-08/15:13 PM)

KENO HILL SILVER DISTRICT
MINING OPERATIONS

FIGURE 2-3

NEW BERMINGHAM GROUNDWATER MONITORING LOCATIONS

DECEMBER 2022



- Adit/Portal
- Shaft
- Groundwater Quality Monitoring, Existing
- Pond
- Proposed Underground Workings
- Road
- Limited-Use Road
- Contour (5m interval)

Satellite imagery obtained from Yukon Geomatics map service http://mapservices.gov.yk.ca/ArcGIS/services on November 22 2022

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

Hecla YUKON

D:\Project\AllProjects\Keno_Area_Mines\BERM\Maps\02-WQ\02-Groundwater\GW_Berm_Zoom_Out_Hecla_20221116.mxd
(Last edited by: fsparling;11/22/2022/11:06 AM)

Table 2-3: Surface water quality monitoring stations per mine

MINE	MAIN WATER COURSES MONITORED	MINE ASSOCIATED STATIONS	RECEIVING ENVIRONMENT STATIONS USED FOR WATER BALANCE AND WATER QUALITY MODEL	LOCATIONS FOR WATER QUALITY PREDICTIONS AND WATER QUALITY OBJECTIVES
Bellekeno	Lightning Creek and Thunder Gulch	KV-42, KV-43, KV-44, KV-78b	KV-37, KV-38, KV-39, KV-40, KV-41, KV-76, KV-77	KV-41
Flame & Moth	Christal Creek and Lightning Creek	KV-104, KV-105, KV-106	KV-49, KV-50, KV-51, KV-6, KV-7, KV-41, KV-81	KV-81, KV-6, KV-7
District Mill/DSTF	Christal Creek	KV-82, KV-83	KV-50, KV-6, KV-7	KV-6, KV-7
New Bermingham	No Cash Creek	KV-114, KV-115	KV-56, KV-111, KV-118	KV-21

Table 2-4: Groundwater monitoring stations per mine

MINE	MINE INFRASTRUCTURE MONITORED	UPGRADIENT WELLS	DOWNGRADIENT WELLS
Keno City	P-AML WRDA	-	ON-MW-2, **ON-MW-3**, KV-84Nd, KC-MW-4
Flame & Moth	Mine and P-AML WRSF	KV-108	FM-MW-2 and FM-MW-3, KV-103, KV-109
District Mill/DSTF	Mill and DSTF	KV-87N, KV-108	KV-85D/S, KV-86, KV-88D/S, KV-89S, KV-89D, BH-39, KV-107
New Bermingham	Mine, N-AML WRDA, P-AML WRSF and Bermingham SW Pit	-	KV-116, BH-MW-1, RB-MW-1, NC-MW-1, KV-122, KV-123, KV-124, KV-125, KV-126, KV-127
Flat Creek Camp	Camp	ST-MW-1	-

Bold wells are pending

3 ENVIRONMENTAL EFFECTS MONITORING (UNDER MDMER)

The KHSD mines are subject to the Metal and Diamond Mining Effluent Regulations (MDMER), administered under the federal Fisheries Act, which apply to mining and milling operations that discharge effluent(s) at a rate greater than 50 m^3/day. The MDMER outline requirements for routine effluent monitoring, acute lethality testing, Environmental Effects Monitoring (EEM) and provides maximum authorized limits of deleterious substances. Effluent monitoring under MDMER tends to overlap with that required under Water Licence QZ18-044; although, unlike the Water Licence a reduction or increase in monitoring frequency may be triggered based on analysis results. Ensero Solutions implements and conducts the reporting for this program with review by site environmental staff. Maximum authorized concentrations of deleterious substances for MDMER Schedule 4 is presented below in Table 3-1 below. The MDMER also requires Daphnia magna monitoring tests at the same time as acute lethality testing.

Table 3-1: MDMER authorized limits of deleterious substances

Item	Column 1 Deleterious Substance	Column 2 Maximum Authorized Monthly Mean Concentration	Column 3 Maximum Authorized Concentration in a Composite Sample	Column 4 Maximum Authorized Concentration in a Grab Sample
1.	Arsenic	0.50 mg/L	0.75 mg/L	1.00 mg/L
2.	Copper	0.30 mg/L	0.45 mg/L	0.60 mg/L
3.	Cyanide	1.00 mg/L	1.50 mg/L	2.00 mg/L
4.	Lead	0.20 mg/L	0.30 mg/L	0.40 mg/L
5.	Nickel	0.50 mg/L	0.75 mg/L	1.00 mg/L
6.	Zinc	0.50 mg/L	0.75 mg/L	1.00 mg/L
7.	Total Suspended Solids	15.00 mg/L	22.50 mg/L	30.00 mg/L
8.	Radium 226	0.37 Bq/L	0.74 Bq/L	1.11 Bq/L

NOTE: All concentrations are total values.

The objective of EEM is to determine whether mining activity is causing an effect on fish or fish habitat, benthic invertebrate communities and/or the use of fisheries resources. A Bellekeno Mine Cycle 5 EEM Study Design is being developed with Environment and Climate Change Canada. Effluent monitoring, acute lethality testing and EEM Study Designs have been implemented as required by MDMER for Flame & Moth. The Flame & Moth Cycle 1 interpretive report is to be issued to Environment and Climate Change Canada. The interpretive reports are provided in the Quartz Mining Licence (QML-0009) annual reports.

Sampling requirements under the EEM program are as follows:

Part 1. Effluent and Water Quality Monitoring Studies

a) Effluent Characterization: Quarterly sampling from final discharge point includes extra parameters,

b) Water Quality Monitoring: Quarterly sampling of sites within reference and exposure areas,

c) Reference Area: Water frequented by fish that is not exposed to effluent and that has fish habitat that, as far as is practicable is most similar to the exposure area,

d) Exposure Area: All fish habitat and waters frequented by fish that are exposed to effluent, and

e) Sublethal Toxicity Testing: Semi-annual sampling required at each final discharge point and analysis of effects on reproduction or growth of a fish species, a plant species, an invertebrate species and an algal species as acceptable to MDMER.

Part 2: Biological Monitoring Studies

A number of study cycles that each include:

- a study design,
- Environment Canada and stakeholder review,
- a Field Sampling Program, and
- submission of an Interpretive Report that indicates whether or not an effect is observed.

Within each cycle, studies are conducted to determine if the effluent is having an effect on the following biological components including:

a) Fish Population: Studies conducted in exposure and reference areas;

b) Fish Tissue Studies: Only required if concentrations in effluent is equal to or greater than 0.1 µg/l or ppb – as determined by the effluent characterization program);

c) Benthic Invertebrate Community: Studies conducted in exposure and reference areas following the Canadian Aquatic Biomonitoring Network's (CABIN) protocols; and

d) Sediment sampling for analysis of particle size distribution and total organic carbon content. Sediment samples will be collected in replicates of three from active channels, placed in plastic containers and sent to an accredited laboratory where they are dried and sieved. Frequency of benthic and sediment sampling required by QZ18-044 is presented in Table 3-2.

Table 3-2: Sediment and benthic invertebrate sampling frequency under QZ18-044

STATION	SEDIMENT SAMPLING	BENTHIC SAMPLING
KV-38	Annual	Annual
KV-41	Annual	Annual
KV-6	Biannual	Biannual
KV-21	Annual	Annual
KV-42	Annual	-
KV-82	Annual	-
KV-104L	Annual	-
KV-104C	Annual	-
KV-111	Annual	Annual

The first study cycle (Cycle 1) is 30 months in duration, while subsequent cycles are 24 to 72 months in duration, depending on previous results (i.e., if an effect is indicated). A final cycle is required if notification of mine closure is issued. To avoid redundancy in sampling sites and monitoring programs, final discharge points for MDMER will be considered final discharge points under Water Licence QZ18-044.

Reporting and field component schedules are shown in Table 3-3.

Table 3-3: Reporting or Field Requirements for Bellekeno Environmental Effects Monitoring

REQUIREMENT	TIMELINE
EEM Interpretive Report for Bellekeno Mine's latest cycle (Cycle 4)	Submitted March 2022
EEM Study Design for Bellekeno Mine Cycle 5	Submitted January 2023, amended May 2023
Biological Studies for next study (Bellekeno Mine Cycle 5 and Flame & Moth Mine Cycle 1: fish population and benthic invertebrates)	Scheduled August to September 2023
EEM Interpretive Report for Flame & Moth Mine Cycle 1	Due November 30, 2023
EEM Interpretive Report for Bellekeno Mine Cycle 5	Due March 7, 2025

EEM – environmental effects monitoring

4 PERMAFROST MONITORING

While the broad region in which the KHSD Mining Operations are located is generally characterized by discontinuous permafrost, Hecla Yukon has not encountered significant permafrost anywhere in the Keno Hill mining camp. Notwithstanding, geotechnical programs have identified areas of permafrost within operational areas; specifically, some permafrost was encountered beneath the Bellekeno mine N-AML Waste Rock Storage Area (WRSA) and in the vicinity of the Dry Stack Tailings Facility (DSTF). Ground temperature and permafrost monitoring is currently in place at these locations. Details on monitoring for the DSTF are included in the DSTF Operation, Maintenance, and Surveillance Manual, which forms a part of the DSTF Development and Operations Plan. Details on permafrost monitoring for the N-AML WRDA and potential acid or metal leaching (P-AML) WRSF are included in the KHSD Mining Operations Mine Development and Operations Plan. The site Engineering Department conducts the monitoring and reporting of permafrost. Tetra-Tech reviews and evaluates the monitoring data. Appendix A provides analysis for potential effects from blasting occurring during the development of the Flame & Moth decline to the monitoring wells in the vicinity of the District Mill and DSTF. The analysis shows that with appropriate management of the blasting the integrity of the monitoring wells including the ground temperature and slope indicator monitoring will not be compromised. Monitoring outlined in the analysis will be undertaken as part of the plan to ensure the integrity of the instrumentation is not compromised.

Similarly, permafrost monitoring will be implemented should it be encountered during construction of facilities for new mine development in the KHSD. Monitoring activities will consider the use of ground temperature and slope indicator monitoring devices to track potential changes in the ground conditions. Since much of the surface development is likely to occur on previously disturbed areas, the likelihood of encountering permafrost at surface is relatively low. However, if significant permafrost is encountered in areas of development an engineer will be consulted on the best practice to mitigate further degradation and plan around the permafrost laden material.

Specifically, for the final design, construction and operations of the phase 2 of the DSTF permafrost characterization and monitoring will be undertaken per Water Licence Clause 18 (below) and subsurface investigation program listed in Schedule C 1.5 (d) in the Quartz Mining Licence.

18. Prior to construction of the DSTF expansion, the Licensee must conduct a subsurface investigation program and submit the results of that investigation to the Board. The program must provide for representative sampling from the entire footprint of the DSTF expansion and include, but not be limited to:

    a) a minimum of 12 holes advanced to bedrock using a drill capable of recovering undisturbed frozen overburden samples;
    b) installation of sub-surface monitoring instrumentation including slope indicators and ground temperature cables; and
    c) laboratory testing of samples for shear strength, particle size and moisture content, as described in the Application in exhibit 1.13 .4 of Register QZ09-092-2.

5 PHYSICAL INSPECTIONS AND REPORTING PLAN

The purpose of physical inspection is to observe and record sufficient information for mine related structures to determine a course of action, repair or rehabilitation if it is required. Physical inspections are conducted under the Physical Inspections and Reporting Plan updated in October 2020 (Appendix B). Photo documentation at photo hubs is undertaken on a monthly basis in order to aid in identifying temporal changes and as a record keeping tool. The Physical Inspection and Reporting Plan describes scheduled physical inspections of infrastructure associated with the New Bermingham, Bellekeno Mine, Flame &Moth and District Mill operations. Information is collected through use of weekly and monthly checklists and reporting forms and any damage or movement is noted. If any seepage is noted from any water retaining structures it will be noted on the next monthly inspection report and a plan will be in place sample, test and manage the discharge within 60 days of the discovery. All annual monitoring and inspections for water conveyance and retaining structures and associated mine waste and earthworks structures will be conducted by a professional engineer. Annual physical inspections and associated reporting are conducted by Tetra-Tech.

In the vicinity of the Bellekeno mine, physical inspections include the Bellekeno 625 settling ponds, the Bellekeno East Temporary P-AML Waste Rock Storage Facility, and the haul road and Lightning Creek Bridge along the Keno City Bypass road. In the vicinity of the mill, physical inspections include the water supply and discharge pipelines and infrastructure, the mill site water collection and diversion structures, the mill site collection and sedimentation pond, the Flame and Moth P-AML facility and the dry stack tailings facility.

The Physical Inspection and Reporting Plan was updated in accordance with Water Licence QZ18-044 to include provisions for the New Bermingham structures. Such facilities for Bermingham include settling pond, N-AML waste rock disposal area, and P-AML waste rock storage facilities.

6 METEOROLOGICAL MONITORING

Meteorological data have been collected in the KHSD since 2007 at the Calumet weather station (Figure 6-1) as part of the development of the ESM Reclamation supporting studies), since 2011 at the District Mill meteorological station (installed as part of Bellekeno mining operations) and since 2012 at the Valley Tails meteorological station. Stations output data on an hourly and daily basis, with data downloaded on a monthly basis, weather and access permitting. Ensero Solutions conducts the monitoring and reporting, a review is completed by site environmental staff. All three stations collect air temperature, relative humidity, rainfall, solar radiation, wind speed and wind direction, as per Clause 80. In addition, the District Mill station has a snowfall conversion adaptor and calculates evapotranspiration, while the Valley Tailings station collects barometric pressure and soil water content. The Calumet station collects soil temperature. Instrumentation used at each of the weather stations is listed in Table 6-1, Table 6-2, and Table 6-3.

Table 6-1: Galena Hill HOBO Meteorological Station Components

COMPONENT	MODEL	SERIAL NUMBER
Datalogger	HOBO Weather Logger	1153440
Temp & RH Sensor	S-THB-XXXX	10064003
Soil Temp Sensor	S-TMB-XXXX	985390
Pyranometer	S-LIB-XXXX	1048627
Rain Gauge	S-RGB-M002	1017667
Wind Speed & Direction Sensor	S-WCA-XXXX	1254995
BP Sensor	S-BPA-XXXX	1037089

Table 6-2: District Mill Campbell Scientific Meteorological Station Components

COMPONENT	MODEL	SERIAL NUMBER
Air Temperature and Relative Humidity Sensor	HMP45C212	n/a
Tipping Bucket Rain Gauge	TE525M	45303-910
Wind Speed and Direction Sensor	05103AP-10-L	WM105907
Solar Panel	SX320J	T21008289B30EC8
Datalogger	CR800	16119
Battery	PS-12120 F2	06299-HC
Pyranometer	SP Lite2	125766

Table 6-3: Valley Tailings HOBO Meteorological Station Components

COMPONENT	MODEL	SERIAL NUMBER
Datalogger	U30 NRC	10231016
Input Expander kit		
Solar Panel	6W	
AC Power Adaptor	120V - 60Hz	
HOBOware	Pro	2580 2976 6309 4793
Temp & RH Sensor	THB-M002	10220040
Solar Radiation Shield	RS3	
Pyranometer	LIB-M003	10191222
Rain Gauge	RGB-M002	10222664
Light Sensor Bracket	LBB	
Light Sensor Level	LLA	
Wind Speed & Direction Sensor	WSET-A	10233230
Full Cross Arm	CAA	
BP Sensor	BPB-CM50	10212093
Soil Moisture Sensor	SMC-M005	10225679
Tripod	TPA-KIT 3m	

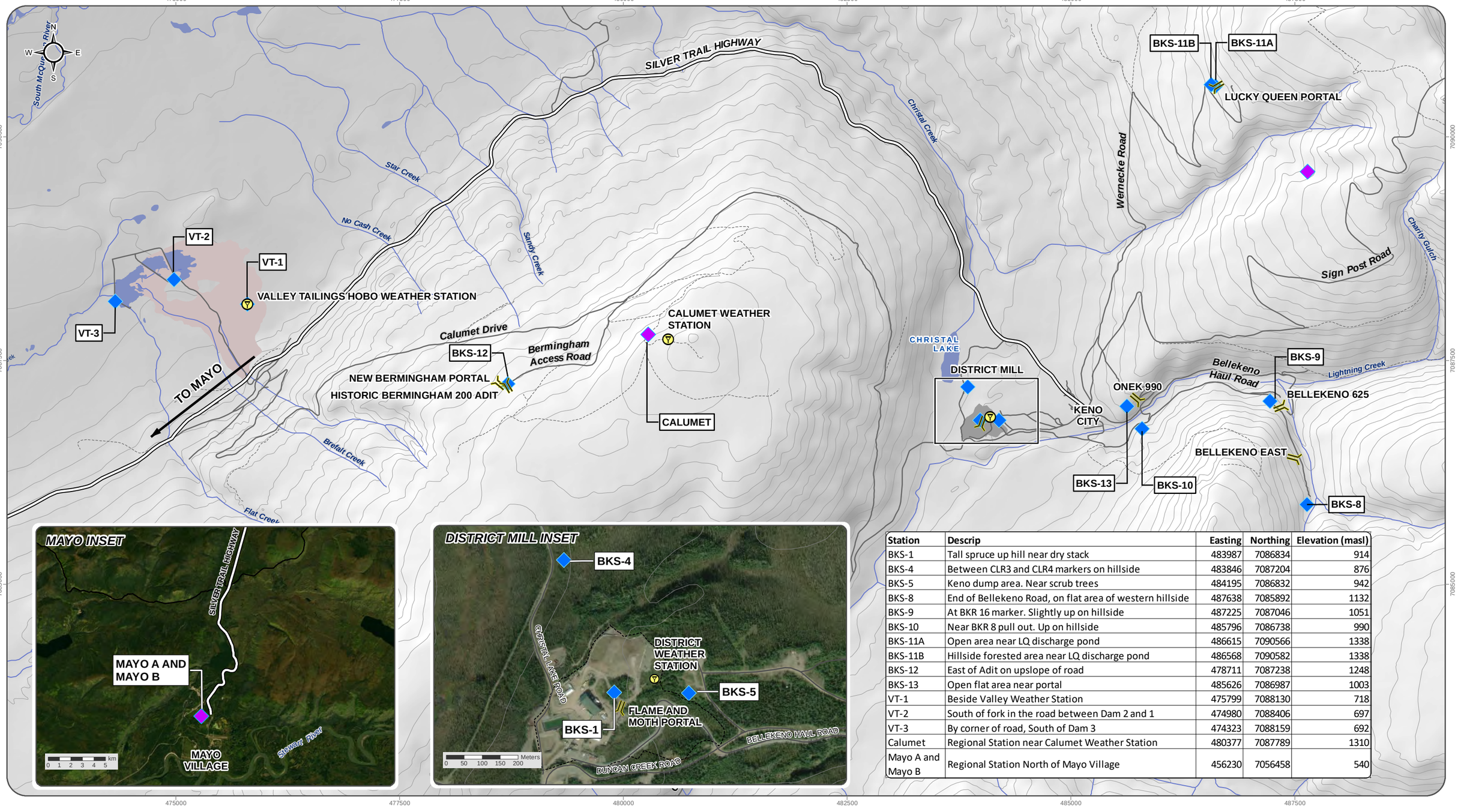
AKHM conducted manual snow surveys at thirteen monitoring stations in order to adequately represent the varying snow conditions as a function of aspect, elevation, etc. Snow surveys are conducted at locations outlined in Table 6-4 each year in February, March, and April, weather permitting.

Table 6-4: Snow Survey Station Names and Descriptions

STATION NAME	STATION DESCRIPTION
BKS-1	Tall spruce up hill near dry stack
BKS-4	Between CLR3 and CLR4 markers on hillside
BKS-5	Keno Dump area, near scrub brush
BKS-8	End of Bellekeno Road on flat area
BKS-9	At BKR 16 marker on hillside
BKS-10	Near BKR-8 pull out
BKS-11a	LQ discharge pond on flat area
BKS-11b	Above the LQ discharge pond on hillside
VT-1	Beside Valley weather station
VT-2	South of fork in the road between dam 1 and 2
VT-3	By corner of road south of dam 3
Calumet	Regional station near Calumet Weather Station
Mayo A and Mayo B	Regional Stations North of Mayo Village

A Yukon Government monitored snow course station located at 1,310 masl elevation also exists in the area and has been monitored for over 30 years. Thirteen snow survey locations have been established at the District Mill Site, Bellekeno and New Bermingham sites, as per Clause 81. Information collected is submitted as part of the annual report.

Data collected from these stations will be used to update meteorological/hydrological information and water balances.



Station	Descrip	Easting	Northing	Elevation (masl)
BKS-1	Tall spruce up hill near dry stack	483987	7086834	914
BKS-4	Between CLR3 and CLR4 markers on hillside	483846	7087204	876
BKS-5	Keno dump area. Near scrub trees	484195	7086832	942
BKS-8	End of Bellekeno Road, on flat area of western hillside	487638	7085892	1132
BKS-9	At BKR 16 marker. Slightly up on hillside	487225	7087046	1051
BKS-10	Near BKR 8 pull out. Up on hillside	485796	7086738	990
BKS-11A	Open area near LQ discharge pond	486615	7090566	1338
BKS-11B	Hillside forested area near LQ discharge pond	486568	7090582	1338
BKS-12	East of Adit on upslope of road	478711	7087238	1248
BKS-13	Open flat area near portal	485626	7086987	1003
VT-1	Beside Valley Weather Station	475799	7088130	718
VT-2	South of fork in the road between Dam 2 and 1	474980	7088406	697
VT-3	By corner of road, South of Dam 3	474323	7088159	692
Calumet	Regional Station near Calumet Weather Station	480377	7087789	1310
Mayo A and Mayo B	Regional Station North of Mayo Village	456230	7056458	540

1:40,000 (when printed on 11 x17 inch paper)

0 500 1,000 1,500 2,000 Meters

- ERDC Snow Monitoring Station
- Regional Snow Monitoring Stations
- Audit
- AKHM District Mill
- Tailings Area
- Waterbody
- Watercourse
- Silver Trail Highway
- Other Road
- Limited-Use Road
- Contours (100 ft)

ALEXCO KENO HILL MINING CORP.

FIGURE 6-1

METEOROLOGICAL STATIONS AND SNOW SURVEY STATIONS LOCATION

OCTOBER 2021

D:\Projects\All\Projects\ALEX-05-01\gis\mxd\Overview_Maps\SpecificTopics\Monitoring\Snow Monitoring\SnowMonitoring_Weather_Stations_20210203.mxd
(Last edited by: amadashevska; 2021-10-19/3:0:28 AM)

7 AIR QUALITY MONITORING

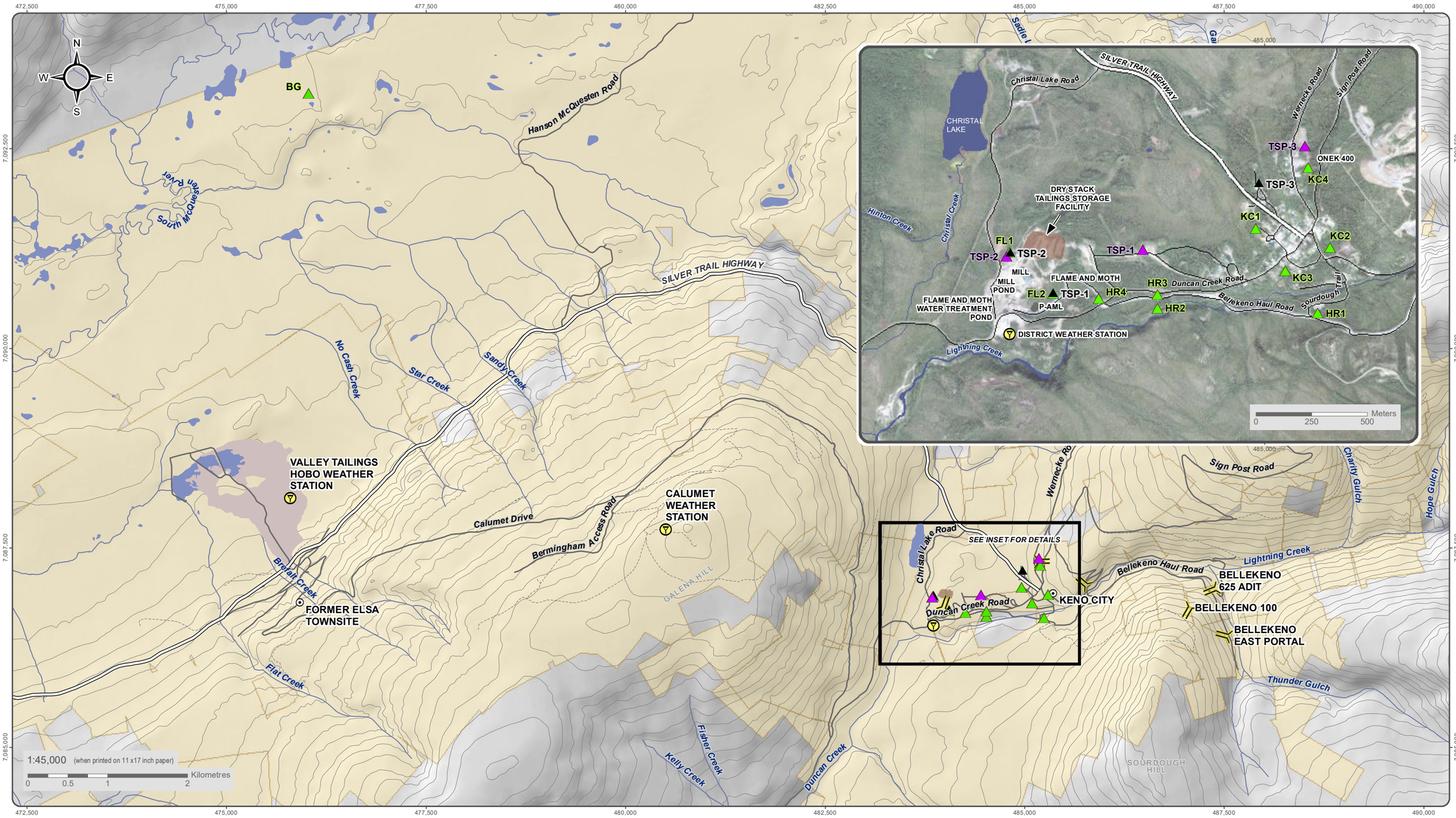
In accordance with Clause 69 of the Decision Document for the assessment of the Bellekeno Mine Project (YESAB File Number 2009-0030), dustfall monitoring was installed at two initial locations near the Keno District Mill site in March 2011 and two additional sampling locations were established in August 2011. Bergerhoff dust monitoring gauges were initially selected as the appropriate instrumentation to carry out this program. In accordance with Clauses 36 and 37 of the Decision Document for the assessment of the Onek and Lucky Queen Deposit production (YESAB File Number 2011-0315), total suspended particulates (TSP) monitoring was subsequently initiated in August 2012 and dustfall monitoring was discontinued in January 2013. Additional sampling for coarse and fine fractions of particulate matter (PM_{10} and $PM_{2.5}$ respectively) was instigated in August 2015, in accordance with the revised Dust Abatement and Monitoring Plan required in the Decision Document (Clause 19) for the assessment of the Flame & Moth Development and Production Program (YESAB file Number 2013-0161).

Details of the air quality monitoring and pre-emptive and reactive dust control procedures are provided in the 2023 Dust Abatement and Monitoring Plan. The plan has been updated for New Bermingham and includes the District Mill, and Flame & Moth. This plan was developed to ensure that fugitive dusting does not become an issue. A summary of past and current air quality monitoring stations used to monitor dust for the KHSD are summarized in Table 7-1 and shown in Figure 7-1. Air quality monitoring is conducted by site environmental staff and reports are prepared by Ensero Solutions.

Table 7-1: Summary of Dust Monitoring Locations for the Keno Hill Silver District

STATION	LOCATION	COORDINATES		COMMISSIONING DATE	OPERATIONAL STATUS
		INITIAL	CURRENT		
DM-1	East of the DSTF.	484099.4 7086871	N/A	2011	Decommissioned
DM-2	South of the Mill Pond.	483754 7086687	N/A	2011	Decommissioned
DM-3	East of the mill and crusher.	484047.8 7086714	N/A	2011	Decommissioned
DM-4	Toe of the DSTF.	483855.1 7086898	N/A	2011	Decommissioned
TSP-1	Initially located east of the mill and crusher. In January 2021, the station rendered unsalvageable and replaced to the north side of Keno City, adjacent the Onek 400 water treatment plant.	484051 7086715	484454.3 7086913	August 2012	In use
TSP-2	Initially located at the toe of the DSTF. Relocated in 2018 to the DSTF phase 2 expansion area (approximately 22 m from initial location) to characterize ambient concentrations closer to Keno City.	483857 7086898	483841.7 7086882	August 2012	In use
TSP-3	Initially located at the north side of Keno City. Relocated to the west side of Keno City in 2022.	484972.4 7087208	485179.5 7087377	December 2014	In use

N/A – not applicable (station has been decommissioned).



- Alexco TSP Monitoring Stations
- Former Alexco TSP Monitoring Stations
- YG PM10 Monitoring Sites 2013
- Weather Station
- Adit
- Mine Feature Footprint
- Current DSTF
- Tailings Area
- Waterbody
- Alexco/ERDC Quartz Claims
- Watercourse
- Silver Trail Highway
- Other Road
- Limited-Use Road

HECLA KENO HILL

FIGURE 7-1
METEOROLOGICAL AND AIR QUALITY MONITORING STATIONS LOCATION

MARCH 2023

D:\Project\All\Projects\Keno_Area_Mines\ALL-SITES\02-Map\04-Studies\Air_Noise_Dust\Air_Quality_Stns_YTG_20230203.mxd
(Last edited by: amalishevska,2023-03-22;08:58 AM)

8 NOISE MONITORING

AKHM has monitored noise at the five locations selected in the noise impact assessment as being potential noise receptors within a 2 km radius study area around Keno City. Since November 2013, noise has also been monitored at a sixth location, the Keno City Campground. These monitoring locations are listed in Table 8-1 and shown in Figure 8-1. Site enviornmental staff complete the monitoring, reports are prepared by Ensero Solutions.

Table 8-1: Representative locations assessed in Keno City

MONITORING LOCATION	GPS LOCATION	DESCRIPTION
R01	N63.90827 W135.29599	East end residence, north side of Lightning Creek Road
R02	N63.91019 W135.29968	Residence, east side of Sign Post Road
R03	N63.91023 W135.30205	Town center, north from the Snack Bar
R04	N63.91239 W135.30376	Residence, west side of Wernecke Road
R05	N63.90851 W135.30993	Residence, about 850 m east from the Mill
Campground	N63.90772 W135.29998	Keno City campground

The background noise levels experienced by these locations vary considerably, depending on location and local activities. Climate parameters, such as relative humidity, temperature, and temperature inversions impact the sound level and propagation experienced by each of these receptors.

Noise impacts and sound monitoring programs are discussed in the 2021 Noise Monitoring and Management Plan. The plan has been updated for New Bermingham and includes the District Mill, and Flame & Moth.

484000 484500 485000 485500

7087500 7087000 7086500

N W E S

CHRISTAL LAKE

CHRISTAL LAKE ROAD

Christal Creek

DRY STACK TAILINGS STORAGE FACILITY

TSP-2 AQ1

MILL

FLAME AND MOTH

MILL POND

CRUSHER

TSP-1

FLAME & MOTH WATER TREATMENT POND

P-AML

DUNCAN CREEK ROAD

Lightning Creek

AQ2

R05

TSP-4

SILVER TRAIL HIGHWAY

R04

SIGN POST ROAD

ONEK 400

WERNECKE ROAD

R03

R02 AQ3

KENO CITY BYPASS ROAD

ONEK 990 PORTAL

R01

KENO CAMPGROUND

BELLEKENO HAUL ROAD

SOURDOUGH TRAIL

Satelite imagery obtained from Yukon Geomatics map service http://mapservices.gov.yk.ca/ArcGIS/services on October 2021

Datum: NAD 83; Projection: UTM Zone 8N

1:6,000 *(when printed on 11 x17 inch paper)*

0 50 100 150 200 250 Meters

- Noise Monitoring Stations
- Former Air Quality Monitoring Station
- Proposed Air Quality Monitoring Station
- Adit

- Infrastructure Footprint
- Pond
- DSTF 322k Tonnes Design
- Current DSTF
- Permitted To Be Constructed Features

- Watercourse
- Silver Trail Highway
- Secondary Road

Hecla YUKON

ALEXCO KENO HILL MINING CORP.

FIGURE 8-1

NOISE MONITORING STATIONS

OCTOBER 2021

D:\Project\AllProjects\Keno_Area_Mines\ALL-SITES\02-Map\04-Studies\Air_Noise_Dust\Air_Quality_Noise_Mill_20211019.mxd
(Last edited by: amallashevska;2021-10-19/14:14 PM)

9 WASTE ROCK MONITORING

Between May and October of each year, all waste rock management facilities are subject to monitoring for physical and geochemical stability (acid rock drainage and/or metal leaching) including seep surveys, as per Clause 96 of Water Licence QZ18-044. The waste rock management plan presents rock characterization processes, field screening protocols, rock management, confirmatory testing and rock monitoring. A complete Waste Rock Management Plan was first prepared in 2009 and includes detailed descriptions of waste rock monitoring and mine wall testing. The waste rock monitoring plan was implemented in 2012 at the Bellekeno Mine with a detailed report testing and describing the effectiveness of waste rock screen procedures as presented in the plan (ACG, 2013). Monitoring is conducted by the site Geology Department and reporting is completed by environmental staff and Ensero Solutions.

Since the Bellekeno Waste Rock Management Plan was developed, permitting and licencing of the Flame & Moth and New Bermingham deposits has been completed. Clause 9.10 of QML-0009 and Clause 21 of Water Licence QZ18-044 outline the maximum quantities waste rock that are to be removed from the Bellekeno, Flame & Moth, and New Bermingham workings during the undertaking. To use the Waste Rock Management Plan for Flame & Moth and New Bermingham, geochemical characterization studies of the Flame & Moth deposit (AEG, 2016) and New Bermingham deposit (AEG, 2019b) were completed. The Waste Rock Management Plan was updated in October 2021 to include the New Bermingham deposit.

As part of annual reports for the Quartz Mining License and Water Licence a waste rock management summary report will be submitted presenting the results for all of the static and kinetic data generated from the Waste Rock Management Plan in a given year. The report will compare the field screening and on-site classification of waste rock to the laboratory analysis outlining the effectiveness of the implementation of the plan including tonnage of waste rock brought to the surface and a percentage breakdown of the N-AML and P-AML for each mine site, as per Clause 97.

10 SPILL CONTINGENCY PLAN

The Spill Contingency Plan has been updated per Clauses 110 to 115 of Water Licence QZ18-044 that specifies:

110. Where a spill or an unauthorized discharge occurs that is of a reportable quantity under the Yukon Spills Regulations, the Licensee must immediately contact the 24-hour Yukon Spill Report telephone number, (867) 667-7244 and implement the Spill Contingency Plan. A detailed written report on any such event including, but not limited to, dates, quantities, parameters, causes and other relevant details and explanations, must be submitted to the Board not later than 10 days after the occurrence.

111. The Licensee must apply the relevant procedures in the Spill Contingency Plan. The Licensee must review the Spill Contingency Plan annually and must provide a summary of that review, including any revisions to the plan, as a component of the annual report.

112. The Licensee must maintain a log book of all spills or unauthorized discharge occurrences, including spills that are less than the reportable quantities under the Yukon Spills Regulations. The log book must be made available at the request of an Inspector. The log book must include, but not necessarily be limited to the:

a) date and time of the spill,

b) substance spilt or discharged,

c) approximate amount spilt or discharged,

d) location of the spill,

e) distance between the spill or discharge and the nearest Watercourse, and

f) remedial measures taken to contain and clean-up the spill area or to cease the unauthorized discharge.

113. The Licensee must include a summary of all spills or unauthorized discharges that occur, as part of the monthly reports, within 30 days of the spill occurrence.

114. The Licensee must ensure all relevant personnel are trained in procedures to be followed and equipment to be used in the containment of a spill.

115. The Licensee must post the Spill Contingency Plan on site for the duration of the project.

For more details, see the KHSD Mining Operations Spill Contingency Plan and the Emergency Response Plan updated in November 2020. All incident reports including the occurrence of a spill, should it occur, will be forwarded to the FNNND. Reporting is conducted by site environmental staff.

11 ADAPTIVE MANAGEMENT PLAN

An Adaptive Management Plan (AMP) is a management tool designed to guide responses to unforeseen or contingency events respecting. The adaptive management approach provides for assessment of mitigation measures and their effectiveness and guides the orderly implementation of responses. The AMP provides procedures that can be implemented to ensure appropriate action is taken before adverse effects are realized. The AMP and Management Response Plan developed as a result, provide possible management responses that range in level of intervention or mitigation. Analysis and reporting are conducted by Ensero Solutions and reviewed by environmental staff.

The AMP was updated in December 2022. Adaptive management initiatives (AMIs) have been developed for KHSD Mining Operations to address the following risks:

1. Increase in contaminant load from mine water discharge or the water treatment plant effluent causes adverse effects to aquatic resources in the receiving environment;
2. Acidic or metal leachate occurs because of seepage or runoff though N-AML waste rock or the DSTF;
3. Seepage from or lack of storage capacity in the sludge storage areas results in a risk to aquatic resources;
4. Physical instability of waste rock disposal areas or underground workings endangers the health and safety of site employees or visitors, or leads to an increase in contaminant loading to the receiving environment.
5. Public access to the site creates an unacceptable safety risk to mine employees, contractors, and the public;
6. Modelling has underestimated the foundation pore pressures leading to slope failure and exposure of tailings in the long term;
7. Large precipitation event erodes through the surface cover, exposes the tailings resulting in transport of tailings into the natural environment;
8. Erosion develops because of water being discharged from a WTP or the District Mill ponds;
9. Transport of sediment from the District Mill or WTP discharge areas causes an adverse effect to the receiving environment;
10. Large differential settlement in the long-term leads to tailings exposure on the surface from compromised cover;
11. Large differential settlement of a water conveyance or water retaining structure leads to an uncontrolled release of contact water to the environment or effluent to the environment.
12. Surface water quality objectives exceeded in the receiving environment occurring irrespective of compliance with effluent discharge standards;
13. Flux of geochemical load from the mines, waste rock disposal areas, or DSTF via groundwater pathways causes surface water quality objectives to be in exceeded downgradient;
14. Fugitive dust generated exhibits potential effects on the community of Keno City; and
15. Natural attenuation of several metals in Christal Creek or No Cash Creek is reduced or stopped, which results in a risk to aquatic resources resident in the creeks.

12 RECLAMATION EFFECTIVENESS MONITORING PROGRAM

With the cessation of mining, the monitoring and surveillance programs will be tailored to assess closure measures and continue as necessary. At closure, Water Licence QZ18-044 will undergo amendment to regulate activities around reclamation and reclamation monitoring. Post closure reclamation benchmarks should be well defined, measurable and documented. A thorough effectiveness monitoring program will allow for recognition of restoration successes and needed improvements. This program will be conducted by site environmental staff.

Section 7.10 of the Reclamation and Closure Plan for KHSD Mining Operations (Revision 6 – November 2021) states:

> *"Monitoring activity will be required to determine the on-going and continued success of closure measures in meeting the closure objectives for a period of 10 years. The adaptive management approach will be used to determine thresholds identifying when remedial action have been triggered, and then the success of the remedial measures will need to be incorporated into the monitoring and surveillance regime."*

Proposed closure monitoring activities include:

- water quality monitoring at some of the stations identified in the Water Licence,
- monitoring of road bank and drainage along access road,
- physical inspection of the passive water treatment systems,
- physical stability of all waste rock disposal areas,
- success of revegetation measures (principally portal area, DSTF and mill pad area),
- monitoring of cover system integrity (P-AML WRSFs and DSTF), and
- physical inspection of impacted earthen surfaces for evidence of erosion, gullying or sediment transport to watercourses.

Permafrost beneath the waste rock disposal areas will be monitored at least 10 years post closure, after which time the necessity of the requirement will be reviewed. An annual geotechnical inspection should be conducted on the waste rock disposal areas for at least 5 years post closure, after which time the necessity of this requirement will also be re-evaluated. Success of implementation of final reclamation will be measured by the ability to achieve stated closure objectives in the Reclamation and Closure Plan. The Reclamation and Closure Plan has been updated to include Flame & Moth and New Bermingham.

As part of progressive reclamation monitoring will be completed to assess the effectiveness of the progressive reclamation activities completed on an annual basis. For example, the progressive reclamation completed for the DSTF cover, monitoring has been conducted and will continue to be conducted to assess the cover effectiveness including infiltration, stability/erosion, vegetation establishment and metal uptake in cover vegetation. The vegetation monitoring program will be established to measure the success of interim revegetation and gain information about cover effectiveness, vegetation health and metal uptake to inform final closure revegetation prescriptions. Vegetation monitoring will occur on a reoccurring timeline to build a temporal dataset of vegetation success and performance.

13 REPORTING

Reporting on water quality monitoring and management issues will be directed to the Yukon Water Board (YWB) and YG Energy, Mines and Resources in accordance with the requirements of the Water Licence (Part I, Clause 119 and 120) and Quartz Mining License (Clause 13). Monthly and annual reporting will be carried out during mine development activities and through the implementation of site decommissioning until it can be demonstrated through the monitoring results that the final closure objectives have been achieved.

AKHM also continues to liaise with the regulatory agencies, FNNND, the Mayo Renewable Resource Council and the local communities on environmental issues relating to KHSD Mining Operations; all monthly and annual reports are provided to FNNND.

14 REFERENCES

Access Consulting Group (ACG), 2013. *Waste Rock Management Plan, Keno Hill Silver District Mining Operations*.

Alexco Environmental Group (AEG), 2016. *Geochemical Rock Characterization, Flame & Moth Project, Keno Hill District, Yukon*. Report prepared for Alexco Keno Hill Mining Corp. March 2016.

Alexco Environmental Group (AEG), 2019a. Mass Load Model for Bermingham Productions and Development Program, December 2, 2019.

Alexco Environmental Group (AEG), 2019b. *Bermingham Waste Rock Static Geochemical Characterization*. Report prepared for Alexco Keno Hill Mining Corp. April 2019.

Government of Yukon, 2021. *Yukon Guide for Developing Water Quality Objectives and Effluent Quality Standards for Quartz Mining Projects*. October 2021.

APPENDIX A

GROUNDWATER MONITORING PLAN (OCTOBER 2021)

KENO HILL SILVER DISTRICT MINING OPERATIONS

GROUNDWATER MONITORING PLAN

October 2021

Prepared for:

ALEXCO KENO HILL MINING CORP.

Prepared by:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

1.1 PURPOSE OF THE PLAN

This plan was originally submitted to fulfill the conditions set out in Part H, Clauses 85, 86, and 87 of Water Licence QZ09-092 issued to Alexco Keno Hill Mining Corp. (AKHM or the Company) on August 19th, 2010. This plan was subsequently updated to fulfill the conditions set out in Part G, Clauses 94, 95, 96 and 97 of Water Licence QZ12-053 issued to Alexco Keno Hill Mining Corp. (AKHM) on May 16th, 2013. The Plan was revised to fulfill the conditions set out in Part G, Clauses 105, 106, 107, 108 and 109 of Water Licence QZ09-092-2 issued to AKHM on December 22, 2017.

This version of the Plan has been updated to fulfill the conditions set out in Part F, Clauses 45, 46 and 47 of Water Licence QZ18-044 (hereafter referred to as the Licence) issued to AKHM on July 22, 2020 as summarized below:

45. Within 90 days of the effective date of this Licence, the Licensee must submit to the Board an update to the Keno Hill Silver District Mining Operations: Groundwater Monitoring Plan (GMP), dated January 2018. The updated plan must include all groundwater monitoring associated with the Bellekeno Mine, Keno Hill Silver District Mill Site, and Flame and Moth Mine, Historic Bermingham SW Open Pit and New Bermingham Mine.
46. With respect to groundwater monitoring:
    a. the Licensee must install the following:
        i. one groundwater well within the DSTF Phase 2 Expansion area (KV-107) to be installed as part of the DSTF expansion;
        ii. one groundwater well upgradient of the DSTF Phase 2 Expansion area (KV-108) six months prior to the expansion;
        iii. at least three groundwater monitoring wells within 100 meters of the Historic Bermingham SW Open Pit prior to placement of any sludge;
        iv. at least three groundwater monitoring wells within 100 meters of the historical waste rock dump underlying the proposed New Bermingham P-AML facility prior to commencement of operations at the New Bermingham Mine; and
        v. at least three groundwater monitoring wells within 100 meters of the VTBSSA prior to disposal of any sludge;
    b. groundwater monitoring wells must be:
        i. designed, installed, and developed under the supervision of a qualified professional;
        ii. individually completed at all depths required to monitor upgradient and downgradient groundwater level and quality for these features;
        iii. equipped with datalogging pressure transducers (and an associated barometric logger) to log groundwater level, at minimum frequency of daily; and
        iv. sampled and manually monitored monthly for groundwater level and a full suite of field and laboratory parameters for the first 12 months from installation after which time sampling frequency can occur quarterly.
47. Upon installation of a groundwater monitoring well(s), the Licensee must submit as part of the next monthly report, the geographical coordinates for any newly finalized monitoring stations.

In addition, Part H Clauses 82, 83, 84, 85, 86 87,119 and 120of the Licence provided additional guidance on the groundwater monitoring program:

82. The Licensee must compare groundwater monitoring data to the Yukon Contaminated Sites Regulation (YCSR) Schedule 3: Generic Numerical Water Standards (Aquatic Life) and submit the data and analysis as part of the annual report.
83. The Licensee must compare data from wells screened in the potable, or potentially potable aquifer near Keno City to the YCSR Schedule 3: Generic Numerical Water Standards (Drinking Water Standards) and submit the data and analysis as part of the annual report.
84. The Licensee must submit all documentation and data produced by the Groundwater Monitoring Plan (GMP) as part of the monthly report and ensure all monitoring and reporting is certified by a professional hydrogeologist registered with a provincial regulatory organization.
85. The Licensee must provide the Board with a summary of hydrogeological monitoring which interprets the sources of inflows and contaminant loads into the underground mine workings as part of the annual report.
86. For those wells subject to freezing, pressure transducers must be installed as soon as wells are ice-free.
87. The Licensee must adhere to the groundwater monitoring schedule in Schedule B3 with the exception that:
    a. Sampling of all wells must be completed monthly after installation for the first twelve months where they contain water. Sampling can revert to quarterly as shown in Schedule B3, following the first twelve samples; and
    b. The Licensee must monitor the water level in all groundwater monitoring wells where water is present at least monthly for the first year. Water level monitoring can be reduced to quarterly after the first twelve monthly readings are completed.

119. The Licensee must submit an annual report to the Board for the period of January 1 to December 31 of each year. Annual reports are to be submitted on or before March 31 of the year following the year reported. The annual report must include the information required by the Regulation as well as:

    f. documentation and data produced by the HMP as required by Clause 49;
    g. updated site groundwater contour maps as required by Clause 50;
    h. if required by Clause 50, an update to the conceptual site groundwater model as required by Clause 51;
    x. all data generated as a result of the monitoring requirements of this licence, including analysis and interpretation by a qualified individual or firm and a discussion of any variances from baseline conditions or from previous years' data; analysis of predictions vs real data model trajectory;
    z. a discussion of any proposed changes to the monitoring programs or WQOs; and

120. Unless otherwise specified in this Licence, the Licensee must submit to the Board a copy of all monitoring data no more than 30 days after the conclusion of the month in which that data was collected. Monthly reports must include:

a. a summary of recent groundwater monitoring well(s) installation as required by Clause 47, when applicable;
f. all data collected in accordance with Schedule B3.

2. MINE LOCATION AND DESCRIPTION

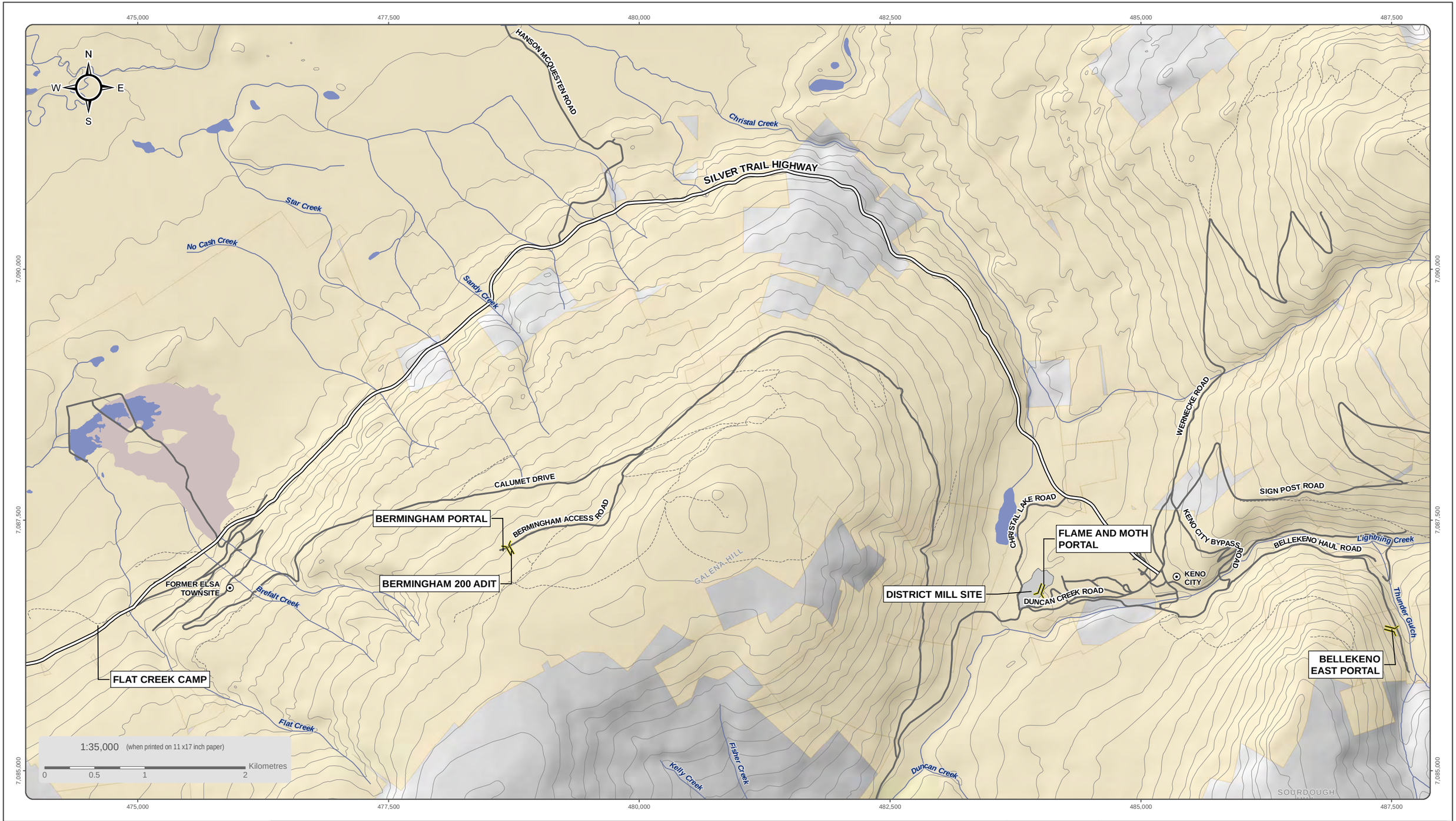
The KHSD is located in central Yukon (63° 54' 32" N, 135° 19' 18" W; NTS 105M/14 & 105M/13), 354 km due north of Whitehorse. Access to the property is via the Alaska, Klondike and Silver Trail Highways from Whitehorse to Mayo (407 km) and an all-weather gravel road northeast from Mayo to Elsa (45 km); a total distance of 452 km. The KHSD is located on and around Galena Hill, Keno Hill and Sourdough Hill and are collectively known as the KHSD. The property lies along the broad McQuesten River valley with three prominent hills to the south of the valley. The property, as well as the mines covered under the water license are located on Figure 2-1.

The District Mill Site and Dry Stack Tailings Facility (DSTF) are located approximately 1 km west of Keno City. The mill site contains offices, crusher, water management ponds, water supply well, and other infrastructure.

The Flame and Moth mine is located adjacent to the District Mill. Currently the portal and the first 20 m of ramp down towards the ore body have been constructed. Up to 8,000 m^3 of mine workings are planned for future development.

The Bellekeno portal is located on a slope in Thunder Gulch, which is narrow tributary of Lightning Creek. The mine site is ~ 3km to the mill site, which crosses over Lightning Creek. The Flame and Moth mine is located adjacent to the District Mill.

The Bermingham deposit is located on northwest slope of Galena Hill ~6.8 km east of Keno City in the No Cash Bog catchment. Bermingham Mine is located up gradient from the Ruby Mine and is drained by the Bermingham 200 adit, which is located at an elevation of ~1,250 masl. The Bermingham 200 adit is near the plateau area of Galena Hill, which limits the available gradient towards the mine opening and there is some recharge from the overlying pit.



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

AKHM

ALEXCO KENO HILL MINING CORP.

FIGURE 2-1
KENO HILL SILVER DISTRICT MINING OPERATIONS OVERVIEW

OCTOBER 2020

D:\Projects\Projects\ALEX-05-01\gis\mxd\Overview_Maps\Property_Overviews\New_Mines_20200903.mxd
(Last edited by: amalashevska;2020-09-03\15:24 PM)

3. PREVIOUS GROUNDWATER STUDIES

Surface and underground mining conducted throughout the KHSD have altered natural groundwater flow such that mine workings dictate recharge/discharge. Groundwater is most likely to travel from high elevation to low elevation, resulting in a water table (phreatic surface) that is a muted image of the surface topography. Much of the groundwater flow is concentrated at relatively shallow depths, as shallower material typically has higher hydraulic conductivities.

Extensive groundwater studies have been conducted throughout the KHSD, which include reasonably extensive mapping of the geology and mine development in the District, hydrogeological investigations and ongoing monitoring, as well as a Conceptual Model and Preliminary 3D Groundwater Model that also includes preliminary particle tracking to map of the potential groundwater flow paths.

The following subsections summarise the main findings for groundwater flow paths from the AKHM proposed and license mines.

3.1 FLAME AND MOTH, ONEK, AND KENO CITY

In 2009, SRK Consulting Canada Inc. (SRK) was retained by AKHM to investigate groundwater conditions at the Mill Site in relation to Keno City and Lightning Creek. Three groundwater monitoring wells were installed for this program (PH2, PH5, and PH6). These wells will be referred to in this plan according to their KV station numbers as listed in Schedule A of the Licence (KV-85D, KV-86 and KV-87), respectively. Key findings of the SRK groundwater investigation (SRK, 2010) include the following:

- The water table is in bedrock beneath the site. South of the site, the water table in a relatively thick overburden unit at a depth of greater than 25 meters below ground surface;
- Water-level data from monitoring wells at site and Keno City indicate that groundwater flows from east to west/northwest); that is, from Keno City towards the Mill Site and Christal Lake;
- Water level data also indicate ground water flow from Lightning Creek towards the Keno City area; and
- The probability of groundwater wells in Keno City being affected by Mill activities is very low given the current understanding of local groundwater gradients and large distance between the Mill Site and Keno City.

Interralogic, Inc. conducted a groundwater evaluation for Keno City between October 2010 and March 2012. During this program, two trenches were excavated within the dry stream channel downstream of the Onek 400 adit, and these verified that the adit discharge was not flowing within the channel alluvium. As part of the groundwater evaluation, Interralogic installed five monitoring wells in the Keno City area (KC-MW-1a, 1b, 2, 3, and 4) to determine water levels, water chemistry, and approximate material transmissivities. Interralogic sampled these five wells, as well as a monitoring well, ON-MW-1, installed in 2011 to understand groundwater elevations near the historic Onek waste rock dumps and open pit.

To evaluate groundwater flow paths, water levels in available wells were measured and water-level contour maps were prepared (ITL, 2012a). Based on this evaluation, Interralogic set forth the following conclusions:

- There is a convergence of southwest and northward flowing groundwater below the central portion of Keno City.

- The groundwater below Keno City is conveyed northwest along a postulated feature that appears to have higher permeability than adjacent geologic units. Evidence for this is:
    - The interpretation that groundwater converges toward this feature;
    - The change in hydraulic head is relatively small between upgradient wells in Keno City and downgradient wells MW-1A, MW-1B, and MW-2; and
    - The relatively high initial yield of the Firehall well (57 to 96 litres per minute), which is located within the postulated high permeability feature.
- Water-level contours suggest that groundwater discharges to Lightning Creek east of Keno City. However, South of Keno City, there appears to be seepage loss from the stream that recharges the groundwater system below the townsite. The zone of seepage loss from the stream could be associated with the southeast extension of the postulated higher permeability feature.
- At and downgradient (west) of the Onek 400 portal, the groundwater flow direction is generally southwest towards the postulated higher permeability feature, but not towards any of the Keno City water wells.

In September 2012, Interralogic completed a preliminary conceptual groundwater model for the proposed Onek 990 mine workings and two potential pathways were identified (ITL, 2012b). The first was a direct pathway from the mine to Keno City, with bedrock monitoring well ON-MW-02 providing an adequate monitoring location to identify if Onek 990 mine water were to migrate in that direction. The second pathway was perpendicular to the water-level contours, but following a trajectory where groundwater would veer east of the mine before migrating through Keno City. The overburden monitoring well KC-MW-4 is along this pathway; however, a bedrock well (ON-MW-3), was recommended as an additional monitoring point along the pathway. The overburden/bedrock well combination was considered adequate to monitor if Onek 990 mine water were to migrate along this pathway (ITL, 2012b).

During August and September 2013, three deep monitoring wells (FM-MW-1, FM-MW-2 and FM-MW-3) were installed in and around the Flame and Moth deposit. Interralogic Inc. summarised the results from the drilling and associated air-lift testing of these wells (ITL, 2013). A long-term (72 hour) air-lift pump test was conducted on well FM-MW-1 to provide data for estimating the potential mine inflows for the Flame and Moth Mine. At maximum mine depth of about 270 mbgs the computed inflow rate is 35 L/s (ITL, 2013). The Interralogic report concludes that Flame and Moth Mine dewatering would not have a significant impact on surface water flows in Lightning Creek and it is highly unlikely that mine dewatering would have an effect on groundwater levels and the availability of water supply in the Keno City area.

Morrison Hershfield (MH) was retained by Yukon Government (YG) Community Services (CS) in 2015 to upgrade the Keno City Firehall well to meet current well-head construction standards. During the rehabilitation, an open portion of the hole collapsed and had to be re-bored with steel casing driven down the hole to prevent further collapse. Following the rehabilitation work, the Fire hall well was sampled and it was found that the water quality had deteriorated such that concentrations of arsenic and uranium no longer met the Guidelines for Canadian Drinking Water Quality.

In 2016 MH was retained by YG CS to conduct a review of the groundwater resources around Keno City and provide support for future water supply options. MH created a conceptual hydrogeological model which describes two distinct aquifer systems below Keno City; the overburden aquifer and the bedrock aquifer (MH, 2017).

- The saturated thickness of the overburden aquifer within Keno City is thin, generally less than 10 m, and is not suitable for water production, even for low-flow, small scale, municipal groundwater supply. The groundwater chemistry of the overburden aquifer is variable from well to well, but is typically quite mineralized and contains parameters that do not meet the aesthetic and health-related parameters of the GCDWQ.
- The bedrock aquifer is fractured and has a greater potential for groundwater production; however, the wells are typically low-yield (produce only a few gallons per minute). The bedrock groundwater is typically of lower quality than the overburden aquifer, with water chemistry that is very mineralized and contains parameters that do not meet the aesthetic and health-related parameters of the GCDWQ.

The overarching conclusion of the MH report was that any groundwater in the Keno City area used for municipal water supply would likely require advanced treatment to meet the GCDWQ (MH, 2017).

3.2 BERMINGHAM

In 2016, Piteau Associates Engineering Ltd. (Piteau) developed a preliminary groundwater model for the KHSD for Elsa Reclamation and Development Corporation for mine reclamation. The preliminary model included particle tracking to determine probable groundwater flow paths from historic mine workings. The particle tracking indicates that regional groundwater derived from the Ruby, Bermingham, and No Cash Mine workings discharges downgradient between the lower reaches of Star Creek and Christal Creek (Piteau, 2017).

In October 2016 drilling and testing of two boreholes at Bermingham were performed. The best-estimate hydraulic conductivities were calculated for the two boreholes and were found to be similar, providing evidence that the rock mass is relatively homogeneous with regard to hydraulic properties. The average of the calculated hydraulic conductivities is 4.3×10^{-6} cm/s, which is taken as the best-estimate of the large-scale (bulk) hydraulic conductivity for rock within the mine area. Based on the average hydraulic conductivities a portal discharge rate during closure was estimated to be 2.L/s (AEG, 2017).

4. REGIONAL GEOLOGY AND HYDROGEOLOGICAL IMPLICATIONS

The long history of mining and exploration in the KHSD means that regional geology has been well studied. Although no comprehensive studies specific to groundwater have been completed in the district, a number of observations can be made relating to bedrock and surficial geology and their hydrogeological characteristics. Some background information pertinent to district geology and groundwater, are summarized below from the Environmental Conditions Report (Ensero, 2020a).

The KHSD is underlain primarily by Yukon Group metasedimentary rocks, locally divided into three formations; Upper Schist, Central Quartzite and Lower Schist. The Upper Schist (Hyland Group, pre-Cambrian to Cambrian age) overlies the quartzite in what is inferred to be a thrust contact (Robert Service Thrust) and consists of quartz-mica schist, quartzite, graphitic schist and minor limestone.

The Central Quartzite (Keno Hill Quartzite, Mississippian age) contains thick-and thin-bedded quartzite, massive quartzite, graphitic phyllite, graphitic schist, calcareous schist and minor Triassic greenstone. This unit is approximately 700 m thick and host most of the past producing ore bodies. Structurally juxtaposed below the quartzite is the Lower Schist which includes graphitic schist, argillite, thin-bedded quartzite, calcareous schist, phyllite, slate, sericite schist, minor thick-bedded quartzite and locally significant intervals of Triassic greenstone. The greenstone forms sills and / or boudins and consists of metadiorite and metagabbro. A number of quartz-feldspar porphyritic sills have intruded the stratigraphy parallel to schistosity. The sills are most common in the Lower and Upper Schists and can reach thicknesses of up to fifty metres.

Structurally, the property is characterized by four sets of faults; many of which have been filled by hydrothermal minerals veins. The oldest fault set consists of south dipping structures that are generally parallel to foliation. Locally, brittle deformation has been observed along these structures. A second fault set, known as “longitudinal veins”, strikes north east to east northeast and dips steeply southeast. Depending on the competency of the host rock, longitudinal veins can be up to thirty metres wide in an anastomosing system of sub-veins. Essentially, all mineralized rock was mined from these longitudinal veins. A third set of faults, known as “transverse faults”, is north-west striking and dips steeply to the north. Transverse faults typically do not contain silver and lead mineralization but are commonly filled by quartz with trace to minor arsenopyrite, pyrite and jamesonite.

A younger set of faults, known as cross faults, strike north to north east with a dip of sixty degrees west to south west and offset vein or longitudinal faults by up to 2,000 metres.

At Keno Hill, the largest accumulation of ore minerals occurred in structurally prepared competent rocks, such as the Central Quartzite, resulting in areas of increased fluid flow. Incompetent rocks like phyllites tend to produce fewer and smaller, if any, open spaces, limiting fluid flow and resulting mineral precipitation.

Mineralization in the District is of the polymetallic silver-lead-zinc vein type. In general, common gangue minerals include manganiferous siderite and to a lesser extent quartz and quartz breccia as well as calcite. Silver occurs in argentiferous galena and argentiferous tetrahedrite (freibergite). In supergene assemblages, silver is further found as native silver, in polybasite, stephanite, and pyrargyrite. Lead occurs in galena and

zinc in iron-rich sphalerite. Other sulphides include pyrite, arsenopyrite (locally gold-bearing) and chalcopyrite.

The veins of the District display characteristics associated with both mesothermal and epithermal deposits and it is not clear if a continuum exists or if separate and distinct mineralizing events are involved. The most prominent examples of epithermal style mineralization are found in the western part of the District, although the Lucky Queen mine on Keno Hill produced native silver and ruby silver in quantity. Proximity to a magmatic heat source has often been called upon to explain the District zonation, though this is by no means a complete explanation.

Mineral zonation is common within base metal-rich veins (zinc-rich margin and silver/lead-rich center). Changes in mineralogy within individual ore shoots are less clearly documented, although there has long been a conviction that silver and lead rich zones occur higher in the veins while zinc becomes dominant at depth. Anecdotal evidence suggests that vertically stacked ore shoots may repeatedly show zoning of lead rich upper portions to zinc dominant roots, but data confirming this has not been found. In general, lead-zinc mineralization appears to be nearly contemporaneous in age.

Irrespective of stratigraphic formations or regional map units only a few major rock types are commonly encountered in the area of the old mine workings. These are:

- schists and phyllites with variable carbonate content;
- chloritic phyllites or schists;
- quartzites and phyllitic quartzites;
- sericite-quartz phyllites; and
- greenstones.

SRK (2009) further described the bedrock geology of the site as it relates to hydrogeological characteristics:

"The bedrock geology of the area around Keno consists predominantly of layered metasedimentary rocks consisting mainly of quartzite, schist and phyllite. Unlike high yielding aquifer rocks such as sandstone, where groundwater can flow through connected 'pores' in the rock mass, the metasediments typically found in the Keno Hill district have a very low permeability, with little or no space between rock grains due to the metamorphosed character. The main medium through which water travels in these metasedimentary rocks therefore is via fractures and joints within the rock. The permeability of the rock (or the ease at which groundwater can flow through the rock formation) in this case is dependent on how many fractures are within the rock, and how well they are connected to each other, and how well connected to a water source (such as rainfall, a lake or a river) these fractures are."

SRK (2009) also describes surficial sediments and their hydrology:

"Shallow surficial sediments are found locally and typically are present in topographic lows which control surface drainage patterns. These overburden deposits have limited thickness and lateral extent, and likely form only small local aquifers. It is generally recognised that metasedimentary rocks do not commonly form high yielding aquifers. Fractures are not typically well connected and the resulting permeability is low. Evidence for this around Keno City can be seen in the characteristic marshy conditions seen in the area. The surface water found within these marshy areas is unable to drain easily

down through the underlying rocks. The regional groundwater flowpaths can be generally described as mimicking surface water pathways."

It is further recognized in that the presence of complex glacial and glaciofluvial sediments present in the valley bottoms and along the margins of the hills produces complex overburden stratigraphy. Overburden thickness and composition are known to vary widely, which can result in complex hydrology (e.g., perched aquifers) and generally poor drainage and low permeability. Also, the ubiquitous presence of permafrost and, in some areas, massive ground ice further complicate near surface groundwater regimes. In general, surficial sediment drainage can be described as generally poor, and complex, while bedrock hydrogeology can be described as generally low permeability with groundwater flow controlled by fractures and joints.

5. DISTRICT MILL AND FLAME & MOTH GROUNDWATER MONITORING

As per Clause 109a of Licence QZ09-092, three multi-level groundwater monitoring wells were installed down gradient of the DSTF. Clause 97 of Water Licence QZ09-092 specified that three multi-level groundwater monitoring wells (e.g., Westbay type) are to be installed down gradient of the DSTF. However, because of the known challenges in the ground conditions near the DSTF (the presence of permafrost and massive ice, in some cases), AKHM believes that separate boreholes to monitor each potential groundwater zone (shallow overburden, and deep bedrock) are more likely to provide reliable results than complicated multi-level monitoring well systems, which are more likely to fail. The decision to use individual monitoring wells was also based on discussions with professional hydrogeologists experienced in monitoring well installations.

AKHM believes that the intention of Clause 109a of QZ09-092 was to ensure that three relatively shallow overburden monitoring wells and three deeper, bedrock groundwater monitoring points were installed down gradient of the DSTF to allow for monitoring of both shallow and deep groundwater. AKHM complied with Clause 109a of QZ09-092 through the use of the groundwater monitoring network described below in Table 5-1 and shown on Figure 5-1. The selection of these wells were based on a review of available geotechnical and hydrogeological information for the site and in discussion with EBA Engineering Consultants on the location of ground ice in this area.

Table 5-1: District Mill Site Groundwater Monitoring Well Summary

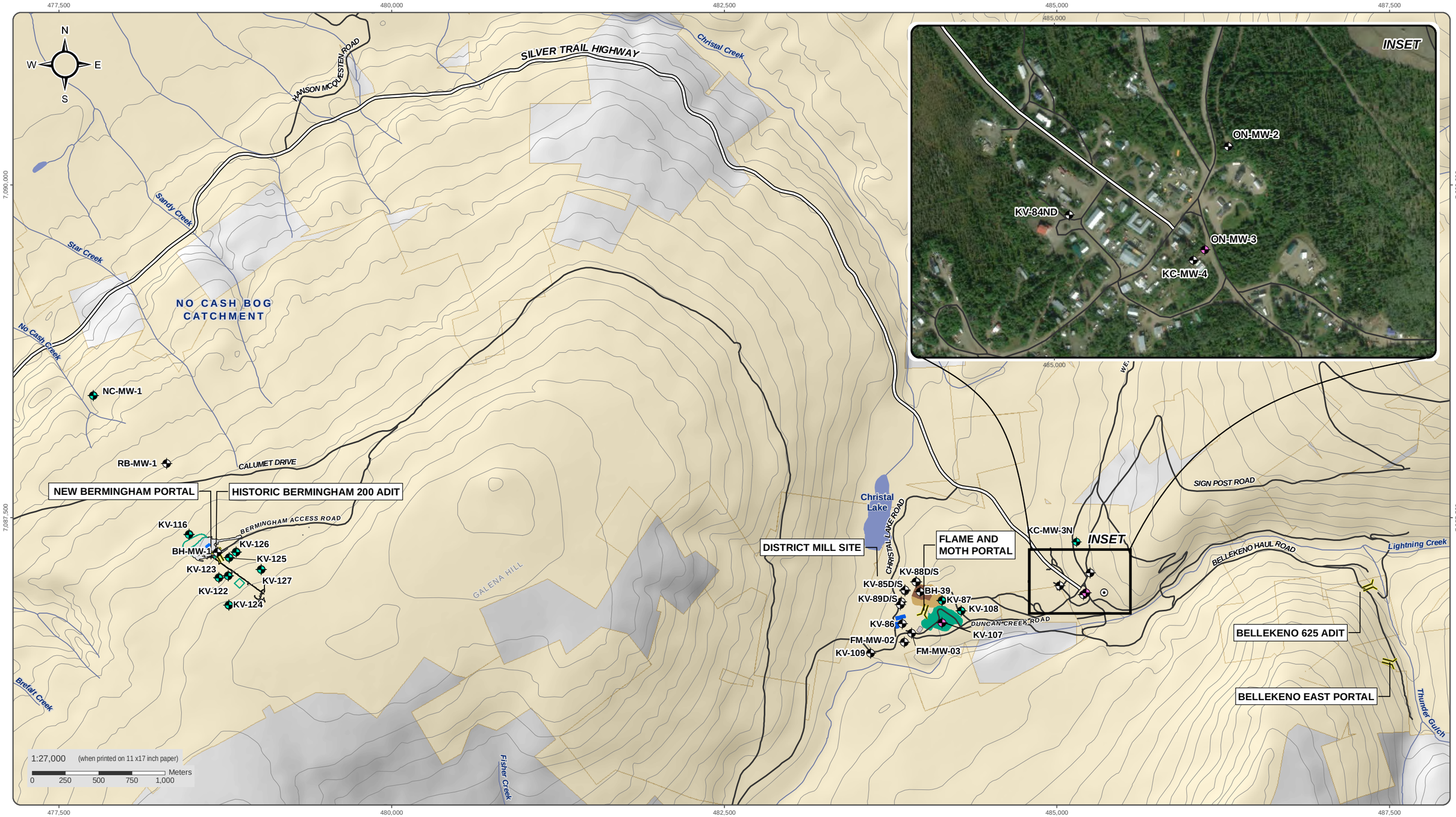
Station #	Hole #	Purpose	Total Depth (m)	Depth in Overburden (m)	Depth in Bedrock (m)	Northing[1]	Easting[1]
KV-85D	PH2	Deep bedrock groundwater monitoring	42.7	11.5	31.2	7,086,952	483,864
KV-85S	TBD2	Shallow or perched groundwater monitoring	4.2	4.2	-	7,086,952	483,858
KV-86	PH5	Overburden Groundwater Monitoring Well with Pressure Transducer Wire	36	36	-	7,086,707	483,836
KV-87	PH6	Bedrock Groundwater Monitoring Well upgradient of DSTF	94.79	-	94.79	7,086,865	484,138
KV-88D	-	Deep bedrock groundwater monitoring	50.1	4.3	45.8	7,087,016	483,946
KV-88S	-	Shallow or perched groundwater monitoring	3.72	3.72	-	7,087,016	483,942
KV-89D	-	Deep bedrock groundwater monitoring	39.12	14.5	20.5	7,086,864	483,831
KV-89S	BH17	Shallow or perched groundwater monitoring	4.8	4.8	-	7,086,844	483,825
KV-103	-	District Mill Supply Well	85.3	2.4	82.9	7,086,752	483,778
FM-MW-1	KAR1301	Christal Zone	182.3	12	160	7,086,770	484,026
FM-MW-2	KAR1302	Lightning Zone	244.4	0	244.4	7,086,562	483,854
FM-MW-3	KAR13016	Mill Fault	195.7	15	180.7	7,086,628	483,910
BH39	BH39	DSTF phase I GW monitoring	7.5	-	-	7,086,938	483,973
KV-107		Proposed well in phase II of DSTF	TBD	-	-	TBD	TBD
KV-108		well upgradient of phase II of DSTF	90.68	-	90.68-	7,086,795	484,284
KV-109	-	Well near KV-81 on Lightning Creek	26.7	4.0	22.7	7,086,479	483,601

1Coordinates are UTM Zone 8 NAD 1983
*Estimated based on nearby wells or boreholes

Well BH39 is a monitoring well within phase I of the DSTF which is screened within tailings to identify if porewater is present. Well KV-109 has been installed prior to the construction of the expanded mill area and development of the underground mine. Well KV-107 will be installed in phase II of the DSTF following the completion of the initial bench. Well KV-108 will be installed in the fall of 2020, which will be at least six months prior to the DSTF phase 2 expansion.

KV-85D and KV-89s are monitoring wells that were installed down gradient of the DSTF. These serve as one of the deep and shallow groundwater monitoring locations (PH2 and BH17, respectively). KV-85D is located in an ice wedge and is currently frozen.

Appendix A, EBA blasting analysis, provides analysis for potential effects from blasting occurring during the development of the Flame and Moth decline to the monitoring wells in the vicinity of the District Mill and DSTF. The blasting analysis shows that with appropriate management of the blasting the integrity of the monitoring wells, including the ground temperature and slope indicator monitoring, will not be compromised. Monitoring outlined in the analysis will be undertaken as part of the plan to ensure the integrity of the instrumentation is not compromised.



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

- Proposed Monitoring Well
- Monitoring Well
- Newly Installed Groundwater Monitoring Well
- Adit
- Infrastructure Footprint
- Pond
- DSTF 322k Tonnes Design
- Current DSTF
- To Be Constructed Mine Features
- Alexco/ERDC Quartz Claims
- Silver Trail Highway
- Other Road

AKHM

ALEXCO KENO HILL MINING CORP.

FIGURE 5-1
KHSD GROUNDWATER MONITORING LOCATIONS

OCTOBER 2021

D:\Projects\AI\Projects\Keno_Area_Mines\ALL-SITES\02-Map\01_Overview\04-WQ\GW\District\GW_monitoring_locations_District_AMP_20211018.mxd
(Last edited by: amattacheriska,2021-10-19/15:48 PM)

6. BERMINGHAM GROUNDWATER MONITORING

Groundwater around the Bermingham project has been studied and understood over the last several years as part of permitting process for the Bermingham mine and licensing of the Elsa Reclamation and Development Company (ERDC) Care and Maintenance activities (QZ17-076). Groundwater flow direction is to the northwest following the contours of Galena Hill and groundwater in the vicinity is monitored by ten wells: BH-MW-1, RB-MW-01, NC-MW-1, KV-116, KV-122, KV-123, KV-124, KV-125, KV-126 and KV-127.

Table 6-1: Bermingham Groundwater Monitoring Wells

Station #	Purpose	Total Depth (mbgs)	Depth in Overburden (m)	Depth in Bedrock (m)	Northing[1]	Easting[1]
BH-MW-1	Well d/g of Bermingham 200 Adit	21.3	3.8	17.5	7,087,273	478,690
RB-MW-1	Well d/g of Ruby 400 Adit	13.4	12.4	1.0	7,087,905	478,309
NC-MW-1	Well downgradient of No Cash 500	34.44	-	34.44	7,088,416	477,766
KV-116	Well downgradient of Bermingham Portal	12.04	-	12.04	7,087,372	485,156
KV-122	Bermingham - downgradient of BH SW pit well #1	25.78	-	25.78	7,087,037	484,284
KV-123	Bermingham - downgradient of BH SW pit well #2	43.43	-	43.43	7,087,059	478,472
KV-124	Bermingham - upgradient of BH SW pit	14.84	1.75	13.09	7,086,840	478,702
KV-125	Bermingham - downgradient of BH P-AML well #1	58.19	-	58.19	7,087,199	478,768
KV-126	Bermingham - downgradient of BH P-AML well #2	70.61	-	70.61	7,087,235	478,779
KV-127	Bermingham - upgradient of BH P-AML	26.64	1.25	25.39	7,087,109	478,781

7. REVIEW OF RESULTS

Results of all groundwater monitoring activities will be subject to periodic review and interpretation by AKHM as part of the monthly and the annual reports, which will compare the data to the Yukon Contaminated Sites Regulation (YCSR) Schedule 3: Generic Numerical Water Standards (Aquatic Life). Data from wells screened in the potable, or potentially potable aquifer near Keno City shall also be compared to the YCSR Schedule 3: Generic Numerical Water Standards (Drinking Water Standards). This review and interpretation is important in identifying any potential changes in baseline conditions, and if necessary, trigger mitigation and/or adaptive management measures.

8. GROUNDWATER MONITORING SCHEDULE

Groundwater monitoring will follow the schedule as described in Table 8-1. Groundwater sampling and monitoring will be carried out by competent and trained field operators. The operators will also document the condition of the well at each location and record any non-standard observations (e.g., icing, blockage, physical damage to wellhead) for maintenance planning.

A groundwater quantity monitoring plan that assesses potential effects from the District Mill well to the Keno City and Mill areas, in terms of water levels, water contour maps, and flow paths is described under the Keno Hill Silver District Mining Operations Hydrogeological Monitoring Plan (Ensero, 2020b). These sites are summarized in Table 8-2.

8.1 MONITORING WELL SAMPLING

Representative groundwater samples will be collected from each identified site as per Groundwater Standard Operating Procedure (GW SOP). Below is a summary of sampling activities to take place:

- Depth to water level will be recorded prior to sampling.
- The well volume will be calculated.
- Purging will consist of either removal of three (3) well volumes (volume of standing water in the well) by an appropriate method (manually, submersible pump, hydrolift, etc.) or by utilizing a low-flow sampling method, such that the discharge rate does not exceed 500 ml/min, drawdown within the well is not greater than 0.1m and stabilization of water quality parameters inclusive of oxidation reduction potential (ORP), dissolved oxygen (DO), pH, conductivity, and temperature have been achieved.
- Following purging of three volumes with stabilization of parameters, or low flow stabilization of parameters, groundwater sample collection can then take place.
- For quality assurance/quality control, field duplicates and blank will be collected with a frequency of 1 in 10 groundwater samples collected.

8.2 GROUNDWATER SAMPLE COLLECTION AND ANALYSES

Groundwater samples will be collected in appropriately labelled laboratory grade bottleware with preservation for the analytes requested as per GW SOP.

8.3 GROUNDWATER SAMPLE CHAIN-OF-CUSTODY RECORD, PACKING AND SHIPPING

Based on the remote location of the sites, groundwater samples will be collected and shipped to coincide with immediate offsite transportation. The samples will be shipped via air courier from Whitehorse to a lab in the Vancouver area for analyses.

Table 8-1: Groundwater Monitoring Program Summary

Site	Description	Water Licence	In situ Measurements/ Internal Analysis				External Lab Analysis												
		Proposed & Existing Monitoring	Level	pH	Temp.	Conductivity	Total Metals	Diss. Metals	Hardness	pH	Conductivity	TSS	Alkalinity	Sulphate	Nitrate	Nitrite	Ammonia(-N)	DOC	Phosphorous
KV-84Nd	Bedrock well on Keno Firehall lot to replace KV-84	Existing	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	-	-	-	Q	Q
KV-85D	DSTF and Mill Site Groundwater Well #1 (PH2) Deep	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KV-85S	DSTF and Mill Site Groundwater Well #1 (Shallow)	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KV-86	DSTF and Mill Site Groundwater Well #2 (PH5)	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KV-87	DSTF and Mill Site Groundwater Well #3 (PH6)	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KV-88D	DSTF and Site Groundwater Well #4 (Deep)	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KV-88S	DSTF and Mill Site Groundwater Well #4 (Shallow)	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KV-89D	Flame and Moth Site Groundwater Well #5 (Deep)	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KV-89S	DSTD and Mill Site Groundwater Well #5 (Shallow)	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	-	-	Q	Q	Q
KC-MW-4	Well south of Onek 400 adit	Existing	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
ON-MW-2	Onek Monitoring Well #1 d/g Project Facilities	Existing	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
ON-MW-3	Well south of Onek 400 adit	To be developed	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
FM-MW-1	Flame and Moth Well #1 (KAR-01)	Existing	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-MW-2	Flame and Moth Well #2 (KAR-02)	Existing	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FM-MW-3	Flame and Moth Well #3 (KAR-16)	Existing	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH39	Phase I of DSTF	Existing	M	M	M	M	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q
KV-107	Proposed DSTF expansion area	To be developed	M/Q	M/Q	M/Q	M/Q	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q
KV-108	Upgradient of proposed DSTF expansion area	Existing	M/Q	M/Q	M/Q	M/Q	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q
KV-109	Flame and Moth Lightning Creek Discharge area near KV-81	Existing	M/Q	M/Q	M/Q	M/Q	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q
BH-MW-1	Well d/g of the Bermingham 200 Adit	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
RB-MW-1	Well d/g of the Ruby 400 Adit and WRSA	Existing	Q	Q	Q	Q	-	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
NC-MW-1	Well near NC 500 Adit	Existing	M/Q	M/Q	M/Q	M/Q	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
KV-116	Bermingham Waste Rock Disposal Area	Existing	M/Q	M/Q	M/Q	M/Q	-	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
KV-122	Bermingham - downgradient of BH SW pit well #1	Existing	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
KV-123	Bermingham - downgradient of BH SW pit well #2	Existing	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
KV-124	Bermingham - upgradient of BH SW pit	Existing	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
KV-125	Bermingham - downgradient of BH P-AML well #2	Existing	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
KV-126	Bermingham - downgradient of BH P-AML well #2	Existing	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q
KV-127	Bermingham - upgradient of BH P-AML	Existing	M/Q	M/Q	M/Q	M/Q		M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q	M/Q

Legend:
Q = Quarterly, M = Monthly, M/Q = Monitoring to occur monthly for first 12 months, reverting to quarterly thereafter

Table 8-2: Hydrogeological Monitoring Schedule

Site	Alternate Well IDs	Description	Proposed & Existing Monitoring	Hydrogeology		
				Discrete WLs	Synoptic WL	Download Logger
KV-84Nd	-	Bedrock well on Keno Firehall lot to replace KV-84	Existing	Q	SA	Q
KV-85D	PH2	DSTF and Mill Site Groundwater Well #1 (PH2) Deep	Existing	Q	SA	
KV-86	PH5	DSTF and Mill Site Groundwater Well #2 (PH5)	Existing	Q	SA	
KV-87	PH6	DSTF and Mill Site Groundwater Well #3 (PH6)	Existing	Q	SA	
KV-88D	-	DSTF and Site Groundwater Well #4 (Deep)	Existing	Q	SA	Q
KV-89D	-	Flame and Moth Site Groundwater Well #5 (Deep)	Existing	Q	SA	Q
KV-103	Mill Well	District Mill Supply Well	Existing	Q	SA	
KV-109	-	Well near KV-81 on Lightning Creek	Existing	Q	SA	
KV-108	-	Upgradient of proposed DSTF expansion area	Existing	Q	SA	
KV-84	MW-5	Overburden Monitoring Well	Existing	Q	SA	
KC-MW-1B	MW-1	Bedrock Groundwater Monitoring Well	Existing	Q	SA	
KC-MW-2	MW-2	Overburden Groundwater Monitoring Well	Existing	Q	SA	
KC-MW-3	MW-3	Bedrock Groundwater Monitoring Well	Existing	Q	SA	
KC-MW-4		Well south of Onek 400 adit	Existing	Q	BA	
FM-MW-01	KAR13-02	Mill / Flame and Moth - Christal Zone	Existing	Q	SA	Q
FM-MW-02	KAR13-01	Mill / Flame and Moth - Lightning Zone	Existing	Q	SA	Q
FM-MW-03	KAR13-16	Mill / Flame and Moth - Mill Zone	Existing	Q	SA	Q
KV-116		Bermingham Waste Rock Disposal Area Well	Existing	M/Q	SA	Q
KV-122		Bermingham - downgradient of BH SW pit well #1	Existing	M/Q	SA	Q
KV-123		Bermingham - downgradient of BH SW pit well #2	Existing	M/Q	SA	Q
KV-124		Bermingham - upgradient of BH SW pit	Existing	M/Q	SA	Q
KV-125		Bermingham - downgradient of BH P-AML well #2	Existing	M/Q	SA	Q
KV-126		Bermingham - downgradient of BH P-AML well #2	Existing	M/Q	SA	Q
KV-127		Bermingham - upgradient of BH P-AML	Existing	M/Q	SA	Q

**Quarterly once the monitoring well is installed, SA = semi-annual, in May and November*

9. REPORTING

As per Clauses 121 and 122 of Water Licence QZ18-044:

> 121. The Licensee shall provide to the Board, one unbound, single-sided, paper copy of all deliverables required by this Licence. All deliverables, with the exception of design drawings, must be reproducible by standard photocopier.
>
> 122. The Licensee must upload electronic copies of all deliverables required by this Licence to the Yukon Water Board's online licensing registry. Electronic copies must be submitted in one of the following formats: MS Word, MS Excel, or Adobe .pdf format. Water quality results must be in the format outlined in the Laboratory Data Submission Standards for Water Quality, as amended from time to time and available on the Board website.

10. REFERENCES

Alexco Environmental Group Inc. 2017. Bermingham Mine Groundwater Evaluation.

Ensero Solutions Canada Inc. 2020a. *Keno Hill Silver District Environmental Conditions Report Version 3.* Report prepared for Elsa Reclamation and Development Company Ltd.

Ensero Solutions Canada Inc. 2020b. *Keno Hill Silver District Mining Operations Hydrogeological Monitoring Plan.* Report prepared for Alexco Keno Hill Mining Corp.

Interralogic, Inc. 2012a, *Technical Memorandum. Update: Keno City Groundwater Evaluation.* March 27, 2012.

Interralogic, Inc. 2012b, *Technical Memorandum. Evaluation of the Potential Effects on Keno City Groundwater Chemistry from Construction of a New Underground Mine Southeast of the historic Onek 400 adit.* September 6, 2012.

Interralogic Inc. 2013. *Flame and Moth Groundwater Evaluation.* November 27, 2013

Piteau Associates. 2017. Keno Hill Silver District Preliminary Groundwater Model. *Prepared for Elsa Reclamation and Development Company Corp.*

SRK Consulting (Canada) Inc. (2009) *Desktop review: Effects of Water Extraction at Christal Lake on Water Levels in the Keno City Community Well.* Memorandum to Alexco Keno Hill Mining Corp. SRK Project # 1CE012.003.

SRK Consulting (Canada) Inc. (2010) 2010 Bellekeno Groundwater Program. Report Prepared for Alexco Keno Hill Mining Corp. SRK Project # 1CA009.003.

APPENDIX A

KENO HILL DISTRICT MILL SITE – BLASTING PLAN ANALYSIS

TETRA TECH EBA

TECHNICAL MEMO

ISSUED FOR USE

To:	Brad Thrall, Kai Woloshyn	**Date:**	July 23, 2015
c:	Anders Frappell, P.Eng.; Aaron Nickoli; Justin Pigage	**Memo No.:**	1
From:	James Kidd	**File:**	W14103353-01
Subject:	Keno Hill District Mill Site – Blast Plan Analysis		

1.0 INTRODUCTION

Tetra Tech EBA Inc. (Tetra Tech EBA) has been commissioned by Alexco Resource Corp. (Alexco) to provide guidance with regards to blast vibrations and specifically to estimate and assess the potential effects blasting may have on instrumentation installed at the Flame and Moth site. The site is being developed as a new underground mine operation from a portal located in the vicinity of existing mine infrastructure such as the processing plant and dry stack tailings facility. In the development of the decline from the portal blasting will occur which will induce vibrations on existing infrastructure. Elements of the instrumentational infrastructure is considered sensitive to blast induce vibrations. It is understood that the instrumentation consists of 12 ground monitoring wells, 3 proposed ground monitoring wells, 5 ground temperature cells (GTC), and 2 slope inclinometers (SI) installed in the area of the proposed portal.

It is further understood that the blast analysis detailed within this memo will be used as the basis for development of a Peak Particle Velocity threshold limit, for which blasting can move ahead without producing permanent harmful effects on various geotechnical instruments.

1.1 Scope of Work

1. Review of proposed blast report data – Tetra Tech EBA reviewed the following data:

    (i) AutoCAD site plan; containing 22 locations of known geotechnical instrumentation and existing structure.

    (ii) Typical Blast Round Summary Sheet: Amex/Packaged Powder.

    (iii) Grout-Well® – Product Information Sheet: Which contained information pertaining to the ground wells.

2. Engineering Analysis and Evaluation - The information obtained from Alexco was analyzed and evaluated in order to establish recommendations for the proposed blast operations.

3. Report – This report provides comments on the proposed blast plan and makes recommendations for attenuation. Figures 2a and 2b shows the location of the well sites and instrumentation.

2.0 BLAST VIBRATIONS

This section of the memo details how blast vibrations can be predicted and controlled if the charge weight per delay is known.

Tetra Tech EBA Inc.
61 Wasson Place
Whitehorse, YT Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

2.1 Simultaneous charge

The primary means of controlling vibrations is by controlling the explosive charge weight per delay during firing. A simultaneous charge is defined as anything less than 8 milliseconds per delay. The control of the explosive charge per delay can be obtained by reducing the drilled length per hole or providing more than one delay in each hole, known as decking. Decking is a method of creating unloaded zones within the borehole to enhance explosive performance or limit the charge weight initiated at any given time.

2.2 Scaled distance

Scaled distance is an equation that reduces two controllable variables in the blast to a single variable. The scaled distance is defined as:

$$SD = \left(\frac{D}{\sqrt{W}}\right)$$

Where;

D = Distance from the blast
W = Mass of the explosive per simultaneous charge

2.3 Peak Particle Velocity Predictions

To determine the Peak Particle Velocity (PPV but often referred to as the mean Peak Vector Sum or PVS) the following equation is used;

$$\mathrm{PPV}=\mathrm{k}\left(\frac{\mathrm{D}}{\sqrt{\mathrm{W}}}\right)^{\beta}$$

k and β are site specific constants developed through a scaled distance plot.

We are not aware of any site specific constants determined from previous blasts, therefore Tetra Tech EBA suggests using the following 'Upper Bound – High Confinement' site constants based on the findings of Blasters handbook 18th Edition for measurements of the proposed blasts. We note that these constants are conservative and are mainly dependent on the lithology, number, and nature of fractures plus other site specific conditions.

k = 4320

β = - 1.6

By recording actual blast vibrations on site at known locations and distances from a planned blast, the site specific constants k and β can be determined for the Flame and Moth site and used to better predict future blast vibrations. To carry this out will require a blast monitoring program.

3.0 PROPOSED BLASTS

It is understood that Alexco proposes to develop the portal at the Flame and Moth site by conducting blasting with the utilization of two separately weighted blast plans. These are detailed in Figure 1.

3.1 Typical round loaded with Amex

297.4 kg of Amex explosive (63 % Anfo, 8 % Geldyne, 28 % Xactex) will be distributed over 60 holes. Assuming that the explosives are distributed evenly throughout the holes this gives 4.96 kg / hole.

3.2 Typical round loaded with packaged explosive

348.1 kg of packaged explosive (72 % Geldyne, 28 % Xactex) will distributed over 60 holes. Assuming that the explosives are distributed evenly throughout the holes this gives 5.8 kg / hole.

4.0 DISCUSSION

Due to the proximity of certain sensitive structures (including instrumentation) blast vibration levels should be controlled. Blasting at the specified site should follow either of the two proposed options detailed below. The first option is essentially a prescriptive basis for blast design and considered to have a low risk, the second option is a risk based approach using an observational methodology.

4.1 Option 1

We recommend a peak particle vibration threshold of 50 mm / second be adopted at each sensitive structure (geotechnical instrumentation). Sensitive instrumentation structures are listed in Appendix B.

The vibration threshold for this option is taken as a conservative approach to sensitive structures, and was determined using the following conservative constants.

k = 4320

β = - 1.6

The 50 mm / s PPV level has been estimated from case studies in which Tetra Tech monitored the effects of ground vibrations in close proximity to sensitive structures. Furthermore, case studies by Matheson (2000) on the blast vibration damage to water supply wells in the United States concluded similar PPV threshold limits at 50 mm / s. For this reason we recommend the blasts be designed to produce vibrations with a velocity less than 50 mm / s.

Figures 2a and 2b present locations of sensitive structures that might be affected by a blast that will produce vibrations greater than 50 mm / sec. Analysis was conducted on Option 1 PPV threshold, relative minimum distances were able to be determined based on the proposed charge weight per delay discussed in Section 3.0.

The minimum required distance for each blast / hole delay are detailed further in Table 1.

Table 1: Typical Blast Round Analysis

Holes per delay	Proposed minimum distance required from blast for estimate PPV ≤ 50 mm / sec (m)	
	Amex	Packaged Explosives
0.333 (2 decks per hole)	24	24
0.5 (1 deck hole)	28	28
1	36	40
2	52	56
3	64	68
4	72	80
5	83	

4.2 Blast Plan Option Two – Risk Based Approach

As an alternative to Option 1, Alexco may elect to take a risk based approach towards the blasting. In this case we recommend that a PPV of 75 mm / second for fully bentonite grouted Ground Monitoring Wells is used, and 100 mm / second for grouted inclinometers. It is understood the ground water monitoring wells are installed with Grout-Well bentonite grouting materials. The bentonite grouting material creates an effective measure for sealing the annular space between a well casing and the borehole wall.

The threshold for Option 2 should be adopted as a risk based approach to blasting and was determined using the following constants.

$k\,(1)$ = 1730 (Blast rounds 1 and 2; during initial open area blast conditions are present).

$k\,(2)$ = 4320 (Blast rounds 3 onwards; Should be adopted after confinement has increased into tunneling conditions unless a monitoring program has developed a site specific constant).

β = - 1.6.

Specific PPV data constants should be developed for the site in the first few blasts and refined accordingly as blasting progresses into full confinement conditions, where an appropriate k constant can be estimated from measured vibrations.

Aside from the initial blast of the portal, tunneling excavations for the proposed project will mostly have one free vertical face, which is also the drilling face, and for this reason relief of the blast is expected to be poor. This results in a high degree of confinement of the blast and therefore higher vibrations can be expected. This is reflected in the selection of 4320 for the k site constant in Options 1 and 2 in lieu of a site specific constant.

The $k\,(1)$ value was adopted as an upper bound blasting constant from the High Confinement site constants based on the findings of Blasters handbook 18th Edition for measurements of the proposed blasts.

4.3 Vibration Analysis:

Respective to Option Plan 1 (Section 4.1), provided five or less holes are not simultaneously detonated, damage to the monitoring wells and inclinometers outside of the minimum distance is unlikely to be caused from the proposed blasts. Blast vibrations inside the minimum distance (Figure 2a, 2b) may have an effect on the surrounding rock by opening and closing of discontinuities, which may affect the rate of discharge/recharge of monitoring wells.

Option 2 (Section 4.2) is designed with a greater risk approach to development of the heading with respect to the integrity of the instrumentation. Blasting using Option 2 should be undertaken accepting that unknown site constants in the blast analysis may result in alteration or damage to instrumentation which may require repair or replacement after blasting.

When an explosive charge is confined in the ground and detonated, the volume that is permanently deformed is ideally a conical solid with the open end of the cone along the ground surface, or free face. The radius of the open end of the cone is approximately equal to the depth of the borehole. According to Matheson (1997), outside of this conical volume, little permanent deformation takes place. Therefore, in theory instrumentation located outside the 'crater zone' should not sustain damage. Provided blast vibrations surrounding inclinometers do not affect the movement of the probe up and down the PVC piping, there should be no major issues blasting with PPV below the specified threshold limit.

5.0 RECOMMENDATIONS

5.1 Pre Blast evaluation of Instrumentation and Blast Review

- All blast monitoring should be undertaken as described by the International Society of Explosive Engineers Field Practice Guidelines for Blasting Seismographs (2009). This document can be found in Appendix A.
- Site specific constants (k and β) should be developed as blasting progresses.
- If Option 1 is adopted it is recommended that blasts not exceed the PPV threshold limit of 50 mm / second at each sensitive structure (Appendix B).
- An initial blast condition survey should be undertaken on all ground water monitoring wells, slope inclinometers; and ground temperature monitoring wells. This would entail taking a pre and post reading for each of the 22 instruments under analysis, subject instrumentation is presented in Appendix B. Instrumentation within zones of interest (Figure 2a, 2b) should be monitored before and after each scheduled blast until no further change is noted. Zones of interest include boreholes; BH23, BH36, BH39, BH40, KV87, KV103, FM-MW-01, FM-MW-03.
- Instrumentation showing movement in measured data should continue to be monitored until the change in movement is not noted.

6.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Alexco Resource Company and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Alexco Resource Company, or for any Project other than the blast monitoring program at the Keno Hill site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions (Appendix C) are attached to this memo.

7.0 CLOSURE

We trust that this meets your current requirements. Should you have any further questions, please don't hesitate to contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

Prepared by:
James Kidd, M.Eng.
Intermediate Geotechnical Engineer
Direct Line: 778.945.5834
Email: James.Kidd@tetratech.com

Reviewed by:
Anders Frappell, P.Eng. FGS
Senior Geotechnical Engineer – Group Leader
Direct Line: 778.945.5833
Email: Anders.Frappell@tetratech.com

Reviewed by:
Carlos Chaparro, M.Sc., P.Eng.
Senior Geotechnical Engineer
Direct Line: 778.945.5765
Email: Carlos.Chaparro@tetratech.com

REFERENCES

International Society of Explosive Engineers, Field Practice Guidelines for Blasting Seismographs, 2009 Edition.

International Society of Explosive Engineers, Blasters' Handbook, 18th Edition, 2011. Cleveland, Ohio.

Matheson, M. G., Miller, K. D., Blast Vibration damage to Water Supply Well Water Quality and Quantity, International Society of Explosive Engineers, (2000), Maryland.

Robertson, D. A., Gould, J. A., Straw, J, A., and Dayton, M, A., "Survey of Blasting Effects on Ground Water Supplies in Appalachia: Volumes I and II. BuMines Open File Report 8 (1)-82, 1980, 400 pp. Available from National Technical Information Service, Springfield, VA PB 82-152125.

FIGURES

Typical Round loaded with Amex

Holes	Round length Meters	Total Meters	Load Density per meter of hole	Kg/meter	Totals		
38	4	152	1.14	42.5	169.8	63%	Anfo
5	4	20	1.48	7.3	29.0	8%	Geldyne
17	4	68	1.48	24.7	98.6	28%	Xactex
60				74.4	297.4		

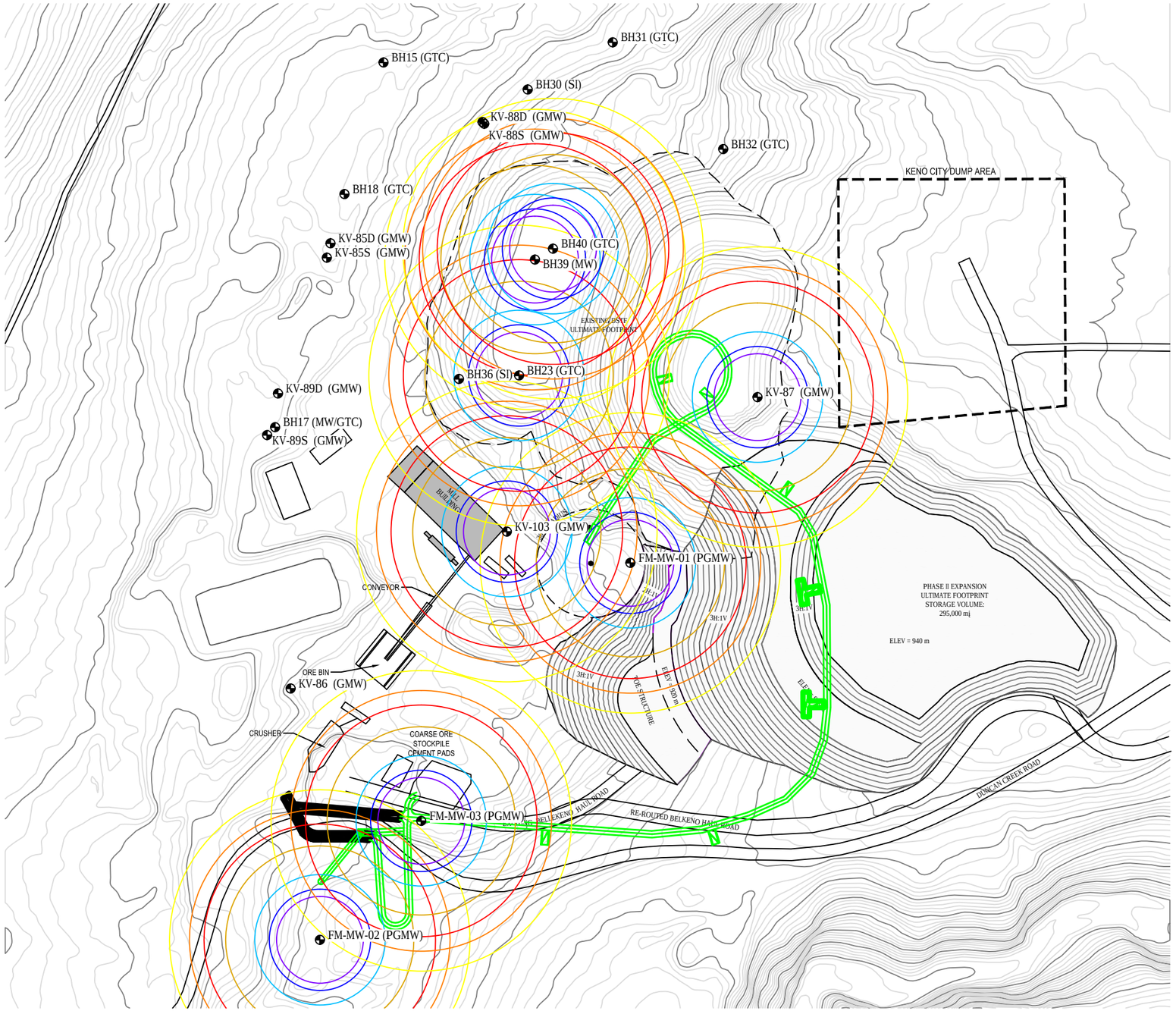
Typical Round loaded with Stick powder

43	4	172	1.48	62.4	249.5	72%	Geldyne
17	4	68	1.48	24.7	98.6	28%	Xactex
60				87.0	348.1		

Summary

A 4 x 4 x4 meter round with a combination of Anfo, Sitick powder will use 298 Kg of explosive per

A 4 x 4 x4 meter round with Sitick powder will use 298 Kg of explosive per round.



ISSUED FOR USE

LEGEND

- Instrumentation Location

AMEX

- 24 m minimum distance (2 decks per hole)
- 28 m minimum distance (1 deck hole)
- 36 m minimum distance
- 52 m minimum distance
- 64 m minimum distance
- 72 m minimum distance
- 83 m minimum distance

SCALE 1:2500

20 0 20 60 100m

NOTES

1. Based on Figure 3-29, Flame and Moth Monitoring Locations

CLIENT

ALEXCO

KENO HILL SILVER DISTRICT MINING OPERATIONS

"PPV THRESHOLD CONTOUR HOLES 1-5"
AMEX EXPLOSIVE

TETRA TECH EBA

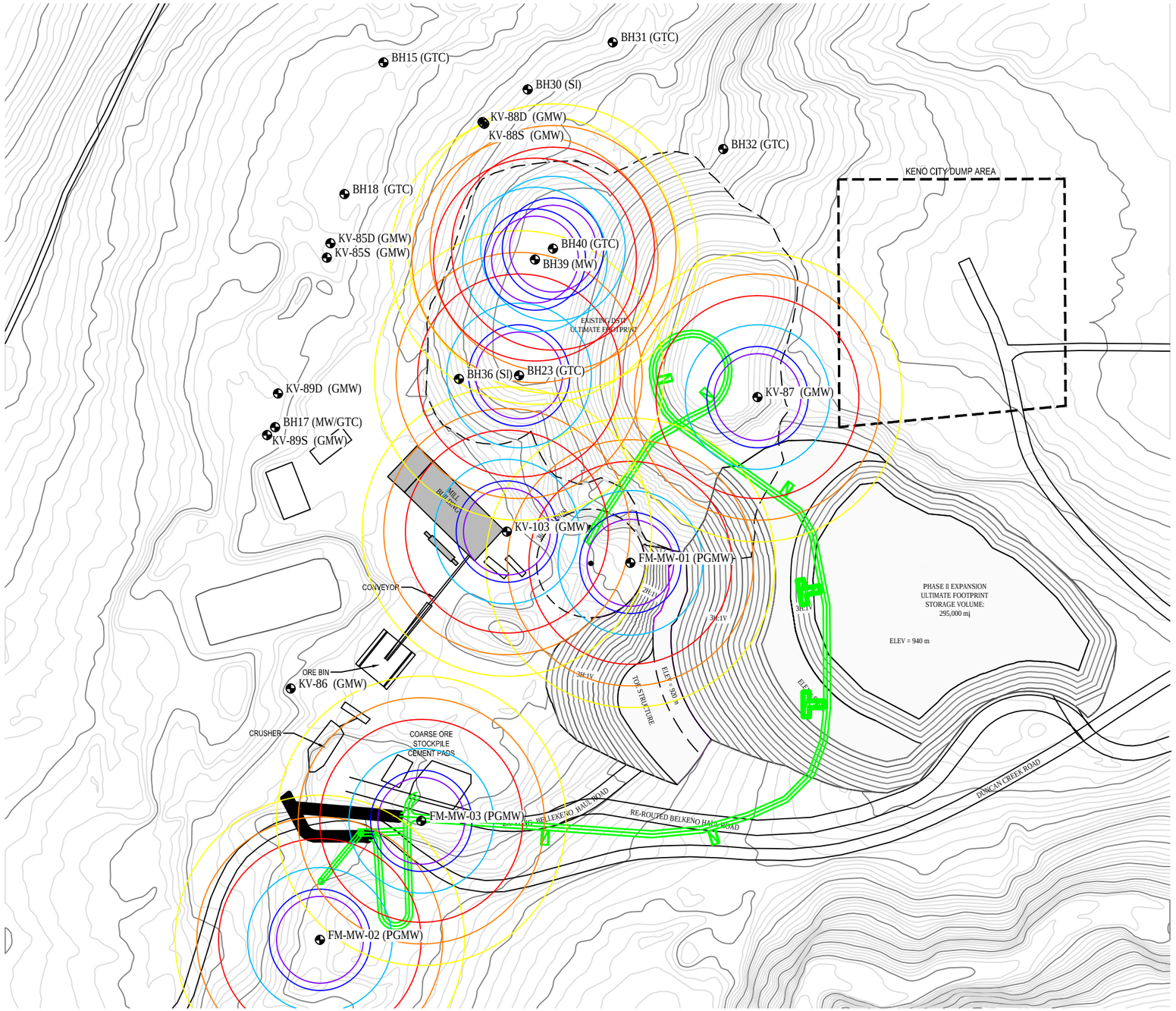
PROJECT NO.	DWN	CKD	REV
W14103303-01	RH	JK	0

OFFICE: EBA-VANC

DATE: June 16, 2015

Figure 2a

Q:\Vancouver\Drafting\Engineering\W1411W14103303-01\Site Plan - June 2015\W14103303-01 amex and sick powder R0a.dwg [FIGURE 2A] June 16, 2015 - 4:51:42 pm (BY: HALL, ROBERT J)



ISSUED FOR USE

LEGEND

Instrumentation Location

PACKAGED EXPLOSIVE

- 24 m minimum distance (2 decks per hole)
- 28 m minimum distance (1 deck hole)
- 40 m minimum distance
- 56 m minimum distance
- 68 m minimum distance
- 80 m minimum distance

SCALE 1:2500

20 0 20 60 100m

NOTES

1. Based on Figure 3-29, Flame and Moth Monitoring Locations

CLIENT

ALEXCO

KENO HILL SILVER DISTRICT MINING OPERATIONS

"PPV THRESHOLD CONTOUR HOLES 1-4"
PACKAGED EXPLOSIVE

TETRA TECH EBA

PROJECT NO.	DWN	CKD	REV
W14103303-01	RH	JK	0

OFFICE: EBA-VANC

DATE: June 16, 2015

Figure 2b

Q:\Vancouver\Drafting\Engineering\W14\W14103303-01\Site Plan - June 2015\W14103303-01 amex and stick powder R0a.dwg [FIGURE 2B] June 16, 2015 - 4:51:15 pm (BY: HALL, ROBERT J)

APPENDIX A

INTERNATIONAL SOCIETY OF EXPLOSIVES ENGINEERS BLAST VIBRATIONS AND SEISMOGRAPH SECTION

INTERNATIONAL SOCIETY OF EXPLOSIVES ENGINEERS
BLAST VIBRATIONS AND SEISMOGRAPH SECTION

ISEE Field Practice Guidelines for Blasting Seismographs

Disclaimer: These field practice recommendations are intended to serve as general guidelines, and cannot describe all types of field conditions. It is incumbent on the operator to evaluate these conditions and to obtain good coupling between monitoring instrument and the surface to be monitored. In all cases, the operator should describe the field conditions and setup procedures in the permanent record of each blast.

Preface: Seismographs are used to establish compliance with regulations and evaluate explosive performance. Laws and regulations have been established to prevent damage to property and injury to people. The disposition of the rules is strongly dependant on the reliability and accuracy of ground vibration and airblast data. In terms of explosive performance the same holds true. One goal of the ISEE Blast Vibrations and Seismograph Section is to ensure reliable and consistent recording of ground vibrations and air blasts between all blasting seismographs.

Part I. General Guidelines

Seismographs are deployed in the field to record the levels of blast-induced ground vibration and airblast. Accuracy of the recordings is essential. These guidelines define the user's responsibilities when deploying seismographs in the field.

1. Read the instruction manual. Every seismograph comes with an instruction manual. Users are responsible for reading the appropriate sections before monitoring a blast.

2. Seismograph calibration. Annual calibration of the seismograph is recommended.

3. Keep proper records. A seismograph user's log should note: the user's name, date, time, place and other pertinent data.

4. Record the blast. When seismographs are deployed in the field, the time spent deploying the unit justifies recording an event. As practical, set the trigger levels low enough to record each blast.

5. Record the full waveform. It is not recommended that the continuous recording option available on many seismographs be used for monitoring blast-generated vibrations.

6. Document the location of the seismograph. This includes the name of the structure and where the seismograph was placed on the property relative to the structure. Any person should be able to locate and identify the exact monitoring location at a future date.

7. Know and record the distance to the blast. The horizontal distance from the seismograph to the blast should be known to at least two significant digits. For example, a blast within 1000 feet would be measured to the nearest tens of feet and a blast within 10,000 feet would be measured to the nearest hundreds of feet. Where elevation changes exceed 2.5h:1v, slant distances or true distance should be used.

8. Know the data processing time of the seismograph. Some units take up to 5 minutes to process and print data. If another blast occurs within this time the second blast may be missed.

9. Know the memory or record capacity of the seismograph. Enough memory must be available to store the event. The full waveform should be saved for future reference in either digital or analog form.

10. Know the nature of the report that is required. For example, provide a hard copy in the field, keep digital data as a permanent record or both. If an event is to be printed in the field, a printer with paper is needed.

11. Allow ample time for proper setup of the seismograph. Many errors occur when seismographs are hurriedly set-up. Generally, more than 15 minutes for set-up should be allowed from the time the user arrives at the monitoring location until the blast.

12. Know the temperature. Seismographs have varying manufacturer specified operating temperatures.

13. Secure cable. Suspended or freely moving cables can produce false triggers from the wind or other extraneous sources.

Part II. Ground Vibration Monitoring

Placement and coupling of the vibration sensor are the two most important factors to ensure accurate ground vibration recordings.

A. Sensor Placement

The sensor should be placed on or in the ground on the side of the structure towards the blast. A structure can be a house, pipeline, telephone pole, etc. Measurements on driveways, walkways, and slabs are to be avoided where possible.

1. Location relative to the structure. Sensor placement should ensure that the data obtained adequately represents the vibration levels received at the structure being protected. The sensor should be placed within 10 feet of the structure or less than 10% of the distance from the blast, whichever is less.

2. Soil density evaluation. The soil density should be greater than or equal to the sensor density. Fill material, sand, unconsolidated soils, flower-bed mulch or other unusual mediums may have an influence on the recording accuracy if not properly dealt with during geophone installation.

3. The sensor must be nearly level.

4. The longitudinal channel should be pointing directly at the blast and the bearing should be recorded.

5. Where access to the structure and/or property is not available, the sensor should be placed closer to the blast in undisturbed soil.

B. Sensor coupling

If the acceleration exceeds 0.2 g, slippage of the sensor may be a problem. Depending on the anticipated acceleration levels spiking, burial, or sandbagging of the geophone to the ground may be appropriate.

1. If the acceleration is expected to be:
   a. less than 0.2 g, no burial or attachment is necessary
   b. between 0.2 and 1.0 g, burial or attachment is preferred. Spiking may be acceptable.
   c. greater than 1.0 g, burial or firm attachment is required (USBM RI 8506).

The following table exemplifies the particle velocities and frequencies where accelerations are 0.2 g and 1.0 g.

Frequency, Hz	4	10	15	20	25	30	40	50	100	200
Particle Velocity - in/s at 0.2 g	3.07	1.23	0.82	0.61	0.49	0.41	0.31	0.25	0.12	0.06
Particle Velocity - in/s at 1.0 g	15.4	6.15	4.10	3.05	2.45	2.05	1.55	1.25	0.60	0.30

2. Burial or attachment methods.

   a. The preferred burial method is excavating a hole that is no less than three times the height of the sensor (ANSI S2.47-1990, R1997), spiking the sensor to the bottom of the hole, and firmly compacting soil around and over the sensor.

   b. Attachment to bedrock is achieved by bolting, clamping or gluing the sensor to the rock surface.

   c. The sensor may be attached to the foundation of the structure if it is located within $\pm$1.0 foot of ground level (USBM RI 8969). This should only be used if burial, spiking or sandbagging is not practical.

3. Other sensor placement methods.

   a. Shallow burial is anything less than described at 2a above.

   b. Spiking entails removing the sod, with minimal disturbance of the soil and firmly pressing the sensor with the attached spike(s) into the ground.

   c. Sand bagging requires removing the sod with minimal disturbance to the soil and placing the sensor on the bare spot with a sand bag over top. Sand bags should be large and loosely filled with about 10 pounds

of sand. When placed over the sensor the sandbag profile should be as low and wide as possible with a maximum amount of firm contact with the ground.

d. A combination of both spiking and sandbagging gives even greater assurance that good coupling is obtained.

C. Programming considerations

Site conditions dictate certain actions when programming the seismograph.

1. Ground vibration trigger level. The trigger level should be programmed low enough to trigger the unit from blast vibrations and high enough to minimize the occurrence of false events. The level should be slightly above the expected background vibrations for the area. A good starting level is 0.05 in/s.

2. Dynamic range and resolution. If the seismograph is not equipped with an auto-range function, the user should estimate the expected vibration level and set the appropriate range. The resolution of the printed waveform should allow verification of whether or not the event was a blast.

3. Recording duration - Set the record time for 2 seconds longer than the blast duration plus 1 second for each 1100 feet from the blast.

Part III Airblast Monitoring

Placement of the microphone relative to the structure is the most important factor.

A. Microphone placement

The microphone should be placed along the side of the structure nearest the blast.

1. The microphone should be mounted near the geophone with the manufacturer's windscreen attached.

2. The preferred microphone height is 3 feet above the ground or within 1.2 inches of the ground. Other heights may be acceptable for practical reasons. (ANSI S12.18-1994, ANSI S12.9-1992/Part2) (USBM RI 8508)

3. If practical, the microphone should not be shielded from the blast by nearby buildings, vehicles or other large barriers. If such shielding cannot be avoided, the horizontal distance between the microphone and shielding object should be greater than the height of the shielding object above the microphone.

4. If placed too close to a structure, the airblast may reflect from the house surface and record higher amplitudes. Structure response noise may also be recorded. Reflections can be minimized by placing the microphone near a corner of the structure. (RI 8508)

B. Programming considerations

Site conditions dictate certain actions when programming the seismograph to record airblast.

1. Trigger level. When only an airblast measurement is desired, the trigger level should be low enough to trigger the unit from the airblast and high enough to minimize the occurrence of false events. The level should be slightly above the expected background noise for the area. A good starting level is 120 dB.

2. Recording duration. When only recording airblast, set the recording time for at least 2 seconds more than the blast duration. When ground vibrations and airblast measurements are desired on the same record, follow the guidelines for ground vibration programming (Part II C.3).

Approved December 1999

APPENDIX B
INSTRUMENTATION LOCATION

Borehole ID	Easting	Northing	Elev (masl)	Depth (m)
FM-MW-01 (PGMW)	484025.71	7086770.45	911.72	183.5
FM-MW-02 (PGMW)	483854.14	7086562.16	911.41	244.4
FM-MW-03 (PGMW)	483910.16	7086627.86	904.96	195.7
BH15 (GTC)	483889.3	7087046.9	896.9	21.3
BH17 (MW/GTC)	483829.4	7086845.4	899.9	15.25
BH18 (GTC)	483867.7	7086974.2	898.9	8.5
BH23 (GTC)	483964.2	7086874	908.2	10.2
BH30 (SI)	483969	7087032	907.25	26
BH31 (GTC)	484016	7087058	907.79	24.4
BH32 (GTC)	484077	7086999	923.75	9
BH36 (SI)	483931	7086872	906.5	14
BH39 (MW)	483973	7086938	920	12.6
BH40 (GTC)	483983	7086944	920	13.7
KV-85D (GMW)	483860	7086947	898.5	41
KV-85S (GMW)	483858	7086939	897.5	4.6
KV-86 (GMW)	483838	7086701	900	36
KV-87 (GMW)	484096	7086862	937	56.4
KV-88D (GMW)	483944	7087014	906	50.1
KV-88S (GMW)	483945	7087013	906	4.1
KV-89D (GMW)	483831	7086864	898	38.3
KV-89S (GMW)	483825	7086841	899.9	15.25
KV-103 (GMW)	483957.4415	7086787.666	904	85.3

APPENDIX C
TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA’s Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA’s Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. Tetra Tech EBA’s instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, Tetra Tech EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. Tetra Tech EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of testholes and/or soil/rock exposures. Stratigraphy is known only at the locations of the testhole or exposure. Actual geology and stratigraphy between testholes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. Tetra Tech EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

Tetra Tech EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

PHYSICAL INSPECTION AND REPORTING PLAN (OCTOBER 2020)

KENO HILL SILVER DISTRICT MINING OPERATIONS

PHYSICAL INSPECTION AND REPORTING PLAN

October 2020

Prepared for:

ALEXCO KENO HILL MINING CORP.

Prepared by:

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1. INTRODUCTION

1.1 PURPOSE OF PLAN

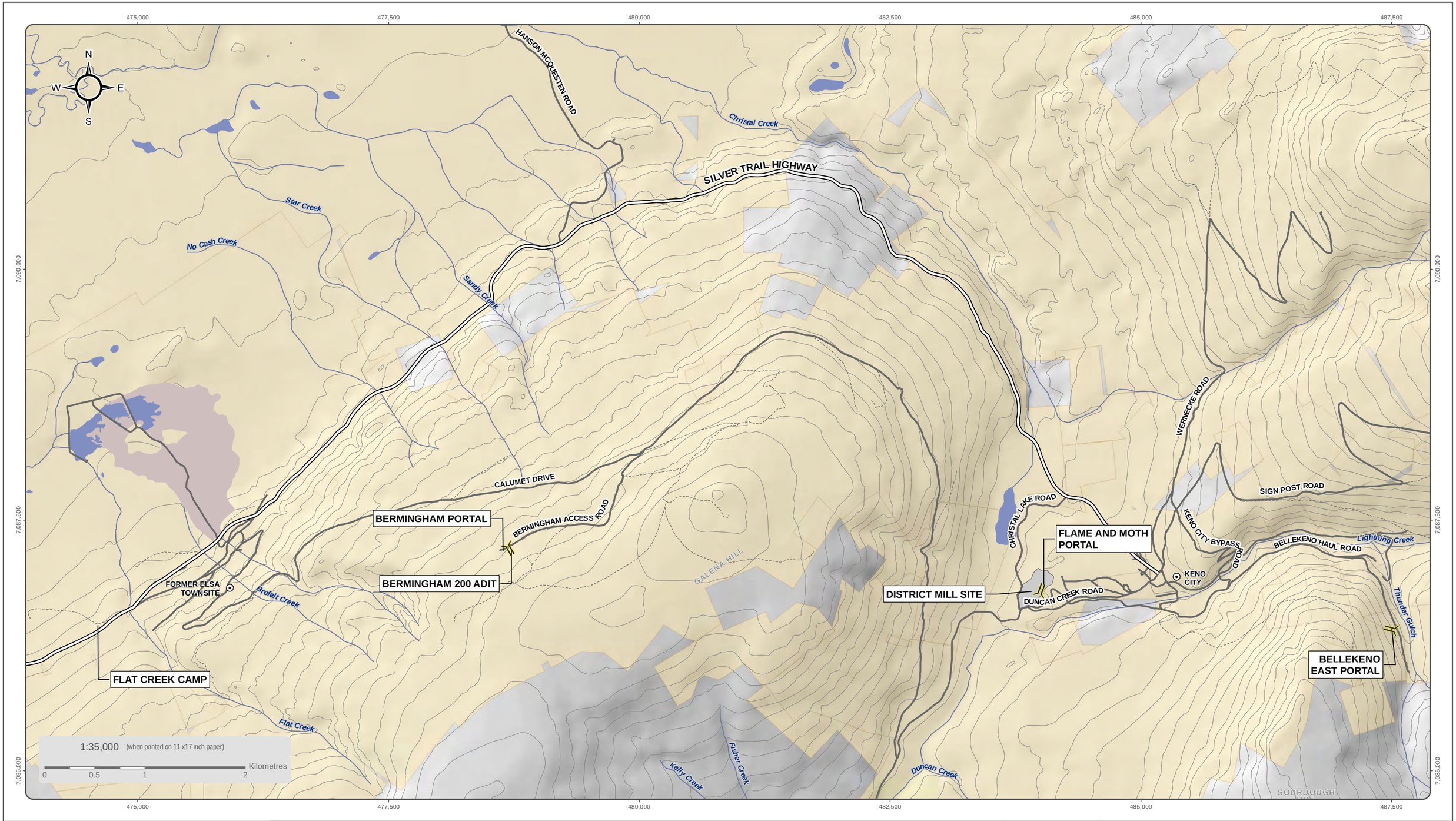
This plan is submitted to fulfill the conditions set out in Part H, Clauses 60 to 62 of Water Licence QZ18-044 issued to Alexco Keno Hill Mining Corp. on July 23rd, 2020:

> 60. Within 90 days of the effective date of this Licence, the Licensee must submit to the Board an update to *Alexco Keno Hill Mining Corp., Keno Hill Silver District Mining Operations: Physical Inspection and Reporting Plan* (PIRP), dated January 2018.
>
> 61. The Licensee must implement the PIRP for all Engineered Structures associated with the Bellekeno 625 settling ponds, the Flame and Moth water treatment pond, New Bermingham settling ponds, the Historic Bermingham SW Open Pit, the Valley Tailings Bellekeno Sludge Storage Area (VTBSSA), all N-AML Waste Rock disposal areas and all P-AML Waste Rock storage facilities, the access roads, the Flame and Moth Christal Creek and Lightning Creek discharge areas, DSTF, and Mill Pond.
>
> 62. The Licensee must inspect weekly, all structures identified in Clause 61 and submit inspection reports quarterly as part of the associated monthly report.

This plan outlines the Physical Inspection and Reporting methodology that will be used during mining and milling operations at Alexco's Keno Hill Silver District mining operations.

2. MINE LOCATION AND DESCRIPTION

The Keno Hill Silver District is located in central Yukon Territory, 354 km (by air) due north of Whitehorse. The Bellekeno mine area is located approximately 3 km east of Keno City within the Keno Hill Silver District. The Flame and Moth mine, District Mill site and Dry Stack Tailings Facility (hereinafter referred to as the "DSTF") are located approximately 1 km west of Keno City. The Bermingham deposit is located on northwest slope of Galena Hill ~6.8 km east of Keno City in the No Cash Bog catchment. Please refer to see Figure 2-1 for the site map.



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

AKHM

ALEXCO KENO HILL MINING CORP.

FIGURE 2-1
KENO HILL SILVER DISTRICT MINING OPERATIONS OVERVIEW

OCTOBER 2020

D:\Projects\Projects\ALEX-05-01\gis\mxd\Overview_Maps\Property_Overviews\New_Mines_20200903.mxd
(Last edited by: amalashevska;2020-09-03\15:24 PM)

3. PHYSICAL INSPECTION LOCATIONS

As per Part H, Clause 61 of Water Licence QZ18-044, the areas to be inspected include:

- Bellekeno 625 settling ponds;
- Flame and Moth Water Treatment Pond;
- New Bermingham settling ponds;
- Historic Bermingham SW Open Pit;
- VTBSSA;
- Bermingham N-AML Waste Rock Disposal Area (WRDAs);
- Bellekeno temporary P-AML Waste Rock Storage Facility (WRSFs);
- Flame and Moth P-AML Waste Rock Storage Facility(WRSFs);
- Bermingham P-AML Waste Rock Storage Facilities (WRSFs);
- Access roads;
- Flame and Moth Christal Creek and Lightning Creek discharge areas;
- Dry stack tailings facility (DSTF); and
- Mill pond.

4. PHYSICAL INSPECTION SCHEDULE

As per Clauses 91 of Water Licence QZ18-044

> 91. The Licensee must conduct weekly physical inspections of water retaining and conveyance structures, and associated mine waste and earthworks structures in accordance with the Keno Hill Silver District Physical Inspection and Reporting Plan and provide a summary as part of the annual report.

The physical inspection for all water retaining and conveyance structures will be conducted on a weekly basis (once constructed). The water ponds include the Bellekeno 625 settling ponds, the Bermingham settling pond, Flame and Moth Water Treatment Pond and Mill Pond. The P-AML Waste Rock Storage Facilities include: Bellekeno East, Flame and Moth and Bermingham. The Bermingham N-AML waste rock storage areas (once constructed) and access roads will be inspected weekly. Additionally, the discharge areas for Flame and Moth and the water conveyance structures for the sites will be inspected.

The physical inspection schedule is shown in Table 4-1 below.

Table 4-1: Physical Inspection Schedule

Physical Inspection Location	Inspection Schedule
	Weekly
Bellekeno 625 settling ponds	x
Mill pond	x
Flame and Moth Water Treatment Pond	x
VTBSSA	x
New Bermingham settling pond	x
Bellekeno temporary P-AML waste rock storage facility	x
Historic Bermingham SW Open Pit	x
Flame and Moth P-AML waste rock storage facility	x
Bellekeno N-AML waste rock disposal area	x
Access roads	x
DSTF	x
Bermingham Settling Pond	x*
Bermingham P-AML waste rock storage facilities	x
Bermingham N-AML waste rock disposal area	x

*See Appendix B for DSTF inspection schedule

5. PHYSICAL INSPECTION METHOD

The purpose of the physical inspection is to observe and record sufficient information to permit development of a course of action; repair or rehabilitation if it is required.

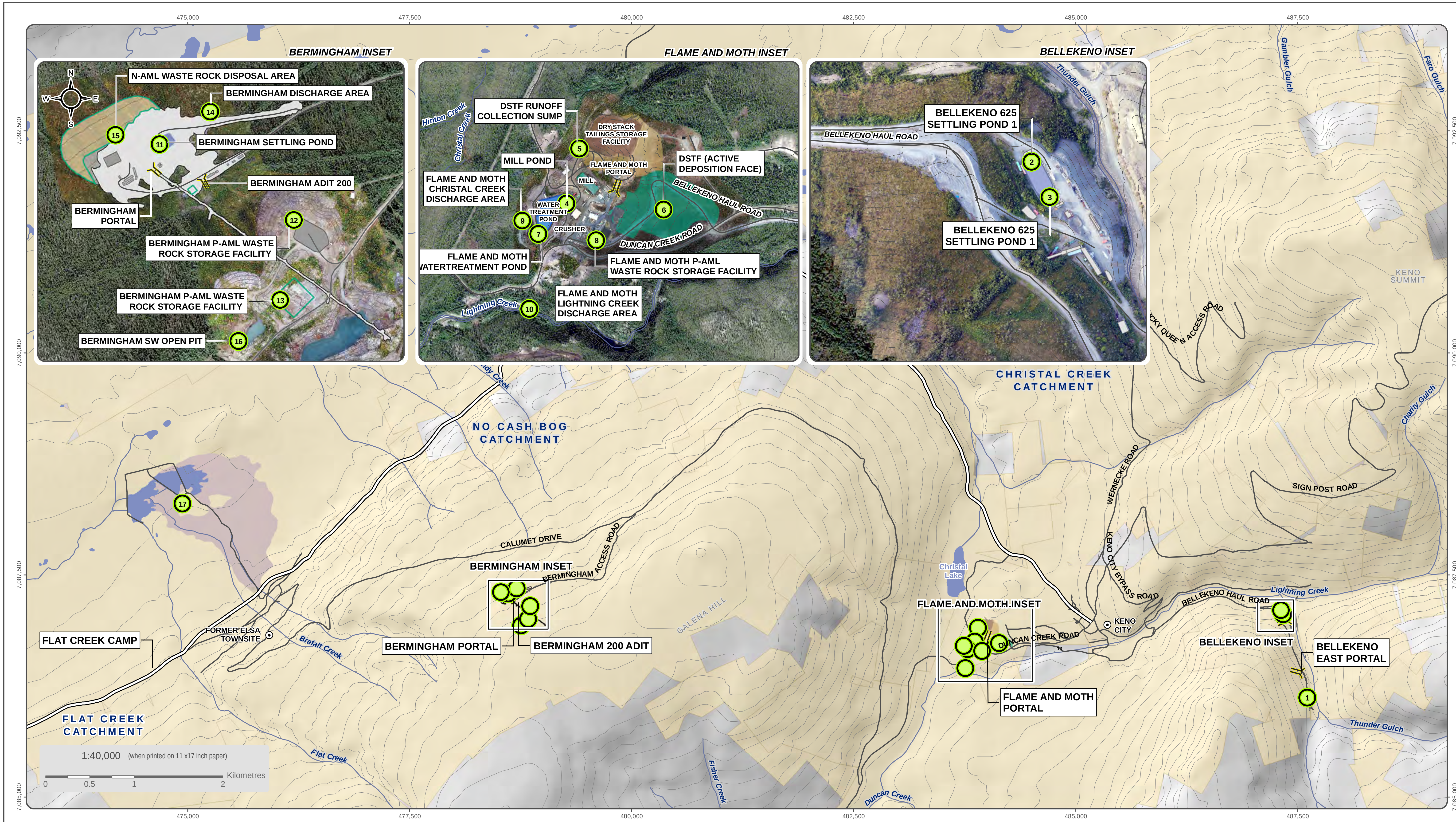
The physical inspection will comprise of completing visual inspection methods by competent and trained field operators. Maintaining clear and accurate records is as important as the physical inspection process itself, so documentation is carried out by the use of an inspection checklist. This will ensure that the inspections, even if carried out by different field personnel on different days, will record information of a similar nature.

5.1 PHOTO DOCUMENTATION

Photo hubs (physical locations where photos are to be repeatedly taken) will be selected to document the features as listed in Section 3 above. Approximate locations of photo hubs are shown in the overview map (Figure 5-1), and a detailed list and description of these photo hubs is included in Table 5-1below.

Table 5-1: Photo Hub Descriptions

Photo Hub #	Photo Hub Description
1	Bellekeno Temporary P-AML waste rock storage facility
2	Bellekeno 625 settling pond 1
3	Bellekeno 625 settling pond 2
4	Mill pond (from S corner, facing Mill)
5	DSTF runoff collection sump (on road, facing NW)
6	DSTF (active deposition face)
7	Flame and Moth Water Treatment Pond
8	Flame and Moth P-AML waste rock storage facility
9	Flame and Moth Christal Creek Discharge Area
10	Flame and Moth Lightning Creek Discharge Area
11	Bermingham Settling Pond
12	Bermingham P-AML Waste Rock Storage Facility North
13	Bermingham P-AML Waste Rock Storage Facility South
14	Bermingham Discharge Area
15	Bermingham N-AML Waste Rock Disposal Area
16	Bermingham SW open pit
17	Valley Tailings Bellekeno Sludge Storage Area



National Topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Cadastral data compiled by Natural Resources Canada. Reproduced underlicense from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Satelite imagery obtained from Yukon Geomatics map service http://mapservices.gov.yk.ca/ArcGIS/services on October 2020. Aerial imagery obtained in 2018

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

Photo Hub Locations
Adit

Infrastructure Footprint
Pond
DSTF 322k Tonnes Design
Current DSTF
To Be Constructed Features

Tailings Area
Waterbody
Watercourse
Contours (100 ft intervals)
Silver Trail Highway
Other Road

AKHM

ALEXCO KENO HILL MINING CORP.

FIGURE 5-1
PHYSICAL INSPECTIONS AND REPORTING PHOTO HUB LOCATIONS

OCTOBER 2020

GPS coordinates of the photo hubs will be uploaded onto the Site Inspection Map, to accompany inspection to ensure the inspections can be conducted by different personnel. The photo hub sites will be visited for photographic documentation on a monthly basis. The photos will be kept with the onsite Environmental Department for review as needed.

5.2 INSPECTION CHECKLISTS

Inspection checklists will be filled out on a weekly basis to ensure structural integrity of mine components and that runoff and discharge is being appropriately managed (see Appendix I). The following rating system will be used in the field reporting to evaluate the structural integrity of the areas to be physically inspected:

Excellent: "As New" Condition.

Good: System or element is sound and performing its function; although it shows signs of use and may require some minor repairs, mostly routine.

Fair: System or element is still performing adequately at this time but needs "priority" and/or "routine" repair to prevent future deterioration and to restore it to good condition. A fair rating will be reported to site manager after the inspection.

Poor: System or element cannot be relied upon to continue to perform its original function without "immediate" and/or "priority" repairs. A poor rating will be reported to site manager after the inspection.

If issues are identified during the weekly inspections the site manager will be informed immediately and the appropriate mitigative measures will be implemented. An inspection by a qualified geotechnical engineer would be undertaken for physical stability if necessary. Additional erosion and sediment controls may need to be implemented as required.

If geotechnical inspections are required, they will be carried out during the summer months when the surface and sides of the various rock-fill structures are not obscured by snow.

5.3 DSTF SURVEILLANCE, INSPECTION AND MONITORING

As a requirement of QML-0009, a dry stack tailings facility Operation Maintenance and Surveillance (OMS) manual was prepared by Tetra Tech Inc. (formerly EBA Engineering Consultants Ltd.) on behalf of Alexco. The OMS Manual forms part of the Dry Stack Tailings Facility Construction and Operation Plan under QML-0009. In addition to physical inspection and monitoring measures described in this plan, the OMS Manual describes more detailed operational physical inspection and monitoring.

Section 9 of the OMS Manual deals with surveillance and physical inspection of the DSTF, and is provided attached as Appendix B.

6. REPORTING

The weekly and monthly physical inspection checklists in addition to monthly photo documentation will be kept on file internally for proof of inspections and for reference as required.

The results of the weekly physical inspection check list will be summarized and incorporated into the annual reports.

In accordance with Clause 92 and 93 of Water Licence QZ18-044, identified seepage form any water retaining structures shall be reported as part of the monthly report. AKHM will submit and implement a plan for collection, testing and managing the seepage.

> 92. If the Licensee identifies seepage from any water retaining structures, the Licensee must:
>
> a) report on the seepage as part of the next monthly report in accordance with the Keno Hill Silver District Physical Inspection and Reporting Plan; and
>
> b) provide a summary of any new seepage or ponding locations identified through inspection and assign a unique identifier consistent with monitoring stations in this Licence as part of the annual report.

> 93. The Licensee must, within 60 days of the discovery of seepage from any water retaining structures, submit to the Board and implement a plan for collecting, testing, containing or managing the seepage. Reporting on the plan and any proposed mitigative actions are to be submitted as part of the annual report.

Additionally, an inspection report will be prepared certified by a Professional Engineer and submitted as part of the annual report. The report will include the information outlined Clause 94 below:

> 94. The Licensee must conduct an annual physical inspection of all Engineered Structures. The inspection must be conducted by a professional engineer licensed to practice in the Yukon. A report prepared by the professional engineer must be submitted as a part of each annual report and include:
>
> a) documentation of the inspection locations and methodologies;
>
> b) the results of the inspection;
>
> c) all problems identified;
>
> d) remedial measures recommended;
>
> e) the status of any remedial measures recommended in the previous year's report with an explanation regarding any recommendation not implemented; and
>
> f) actions taken or planned in response to any identified issues and/or to prevent recurrence.

APPENDIX A

PHYSICAL INSPECTIONS CHECKLIST

Physical Monitoring Program
Inspection Checklist

	BELLEKENO		FLAME AND MOTH			DISTRICT MILL			BERMINGHAM							ROADS					
	BK P-AML Waste Rock Storage Facility	BK 625 Treatment Ponds	F&M P-AML Waste Rock Storage Facility	F&M WTP Pond	F&M Dischage Areas	Mill Pond	DSTF	Water Diversion Structures	Treatment Pond	P-AML North	P-AML South	N-AML Waste Rock Disposal Area	Bermgingham SW Open Pit	Water Diversion Structures	BH Dischage Area	CLR 0-8	BKR 0-5	BKR 5-15	BKR 15-18	BH Road	Calumet Road
General																					
Checked visually?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Photo(s) taken?	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y						
Checked after storm event?							Y	Y						Y		Y	Y	Y	Y	Y	Y
Soil / Rock Structures																					
Materials being disposed of properly?	Y		Y					Y		Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y
Check for movement?	Y		Y					Y		Y	Y	Y		Y		Y	Y	Y	Y	Y	Y
Crest checked?	Y		Y					Y		Y	Y	Y		Y							
Toe checked?	Y		Y					Y		Y	Y	Y		Y							
No tension cracks?	Y		Y					Y		Y	Y	Y		Y							
No creep?	Y		Y					Y		Y	Y	Y		Y							
No failure?	Y		Y					Y		Y	Y	Y		Y		Y	Y	Y	Y	Y	Y
Safe for use next 24 hrs?	Y		Y					Y		Y	Y	Y		Y		Y	Y	Y	Y	Y	Y
Water Conveyance Structures																					
No loose material or exposed liner?	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y						
Spillway clear?		Y		Y	Y	Y		Y	Y					Y	Y						
Good runoff management?		Y		Y	Y	Y		Y	Y					Y	Y						
Diversion clear?		Y		Y	Y	Y		Y	Y					Y	Y						
No seepage?		Y		Y	Y	Y		Y	Y					Y	Y						
No failure?		Y		Y	Y	Y		Y	Y					Y	Y						
Safe for use next 24 hrs?		Y		Y	Y	Y		Y	Y					Y	Y						
Limits adhered to?		Y		Y	Y	Y		Y	Y					Y	Y						
Piping																					
No leaks?		Y		Y	Y	Y			Y						Y						
No sags or deformation?		Y		Y	Y	Y			Y						Y						

Comments (recommendations / corrective actions required):

Inspected By: **Date:**

N/A **MONTHLY** **WEEKLY**

APPENDIX B

DRY STACK TAILINGS FACILITY SURVEILLANCE AND PHYSICAL INSPECTION

Alexco Keno Hill Mining Corp.

REVISION 2010-1

OPERATION, MAINTENANCE, AND SURVEILLANCE MANUAL
DRY STACK TAILINGS FACILITY
KENO HILL DISTRICT MILL, YT

EBA FILE: W14101178.008

September 2010

PREPARED BY EBA ENGINEERING CONSULTANTS LTD

EBA Engineering Consultants Ltd.
p. 867.668.3068 • f. 867.668.4349
Calcite Business Centre • Unit 6, 151 Industrial Road • Whitehorse, Yukon Y1A 2V3 • CANADA

9.0 SURVEILLANCE

9.1 OBJECTIVE

Surveillance involves inspection and monitoring of the operation, structural integrity, and safety of the DSTF, and must be consistent with the life cycle and regulatory requirements of the facility. Surveillance of the DSTF consists of both routine and event-driven activities.

Key surveillance parameters and procedures must be identified for:

- Monitoring the operation, safety, and environmental performance of the DSTF;
- Promptly identifying and evaluating deviations from expected behaviour that affect operation safety, structural integrity, and environmental performance of the facility; and
- Reporting significant observations for response.

The DSTF surveillance program will continue to evolve as the facility changes in design or performance criteria, site conditions and/or the operation it is accommodating.

All personnel working at the DSTF will be involved in surveillance as a routine part of daily activities, maintaining visual awareness of the facility in the course of their regular and/or routine duties, in addition to surveillance-specific site engineering, instrument monitoring, analysis, inspection, periodic review and oversight.

It is the combination of all the regular inspections assisted by the eyes of all site personnel that ensures continued integrity and performance of the facility.

Outside consultants will also be on site periodically inspecting the facility as part of a regular program of expert review.

9.2 RESPONSIBILITY

A number of personnel conduct routine inspections of the DSTF. The Construction Monitor, or his designated replacement is assigned the responsibility of obtaining the monitoring information and preparing a monthly report for the facility designer and geotechnical consultant to review.

9.3 SURVEILLANCE PARAMETERS

Key parameters of surveillance are identified through identifying and describing potential failure modes of the DSTF.

Visual observations of the DSTF can indicate potential failure modes such as:

- Surface – cracking, bulging, depressions, sink holes;
- Seepage – new seepage areas, changes in seepage areas;
- Turbid water in the natural drainages around or downstream of the facility;
- Water or tailings flowing down the stack indicating improper grading; and

- A failure or breach of a component of the facility.

Routine monitoring for ensuring facility performance include:

- Checking for settlement or holes in embankment crest or benches;
- Checking for holes on the surface of the tailings indicating possible piping of material to outside;
- Checking for dust;
- Measuring water levels in monitoring wells located in the foundation soils during operation;
- Measuring ground temperatures using cables in the foundation soils during operation;
- Surveying DSTF components - displacements of survey monuments;
- Measuring slope inclinometers located in the foundation soils;
- Water sampling of Christal Creek; and
- Recording weather conditions.

These parameters are further described in the following sections.

9.4 SURVEILLANCE PROCEDURES

Table 13 summarizes surveillance requirements for the components of the DSTF. These surveillance requirements are the licensed monitoring requirements and conditions regarding the tailings presented in Alexco's Quartz Mining and Water Use licenses.

TABLE 13: OPERATIONAL MONITORING SCHEDULE FOR DSTF

Frequency	Provision	Source/Location	Personnel	Scope	Deliverable
Periodically During Construction	EBA Design Report and Quality Assurance Program	Entire Facility	Engineering Supervision	Follow monitoring and inspection procedures in Quality Assurance Program	Interim Reporting to Site Management with recommendations for construction process
Weekly	EBA Design Report and Quality Assurance Program	Structure of the tailings (toe, dam, tailings, etc.)	Operational personnel	Visual assessment of tailings, diversion berms, collection ditches, conveyance channel and water collection pond.	Daily Log, included in annual report.
Weekly	EBA Design Report and Quality Assurance Program	Tailings final runoff	Operational personnel	Visual inspection for suspended solids and erosion evidence.	Daily Log, included in annual report.

TABLE 13: OPERATIONAL MONITORING SCHEDULE FOR DSTF – CONT'D					
Weekly	EBA Design Report and Quality Assurance Program	Toe runoff collection ditches and conveyance channel	Operational personnel	Visual inspection for failures (possible or occurring) with more frequent checks during spring breakup period	Daily Log, included in annual report.
Weekly	EBA Design Report and Quality Assurance Program	Tailings Material	Operational personnel	Record tailings moisture content	Daily Log, included in annual report.
Weekly	Type A Water Licence Q209-092	Tailings Solids ABA Testing	Operational Personnel	Split a 200-500g sample from the daily 24-dried, metallurgical composite sample and retain in a plastic bag	Send a composite sample once per month to an accredited laboratory, as per Appendix C – evaluate results
Monthly	EBA Design Report	Groundwater Piezometer	Operational Personnel	Record readings and submit to VP Engineering for review	Results included in annual report.
Monthly	EBA Design Report	Ground Temperature Cable	Operational Personnel	Record readings and submit to VP Engineering for review	Results included in annual report.
Monthly	EBA Design Report	Settlement Monument Survey	Qualified Surveyor	Record elevations and submit to VP Engineering for review	Results included in annual report.
Monthly	Type A Water Licence Q209-092	Tailings Seepage	Operational Personnel	Sample and lab analysis of tailings supernatant, inspect for seepage, estimate flow	Representative samples shall be collected for laboratory analyses according to Set A[1] requirements outlined in the WUL.[2]
Monthly	EBA Design Report	Tailings Deposit	Operational Personnel	Confirm design moisture content density is being achieved	Results included in annual report.

TABLE 13: OPERATIONAL MONITORING SCHEDULE FOR DSTF – CONT'D					
Monthly	EBA Design Report	Tailings Disposal Basin	Qualified surveyor	A surface profile of the tailings along the centre line of the tailings disposal basin	Map and written description of profile.[2]
Annually	QML – Section 9.3.2	Tailings Disposal Basin	Professional engineer licensed to practice in the Yukon	Thorough visual assessment and physical inspection of the tailings, review of monitoring data to confirm design assumptions, preparation of inspection report	Representative samples shall be collected for laboratory analyses of grain size distribution, densities and moisture content.[2] Submission of inspection report.
Annually	Type A Water Licence Q209-092	Center Line of Tailings	Operational personnel	Full depth of tailings will be sampled at four stations along the center line.	Samples will be checked in the field for the presence of frozen tailings. Screen analyses will be done in the laboratory as a check on the homogeneity of the tailings and densities and moisture contents will be determined.[2]

Notes:

1 Set A - water quality analysis includes physical parameters, anions, nutrients, dissolved metals, total metals, and total suspended solids (Table 10.2 - WUL Application)

2 All results from the operation monitoring schedule will be included in the annual report to the Water Board

9.5 ADAPTIVE MANAGEMENT

Fundamental to successful adaptive management of the tailings production, handling and placement are triggers for management action. If the tailings handling and deposition is not meeting critical performance objectives according to specific conditions within either the WUL or the QML, the General Manager will be expected to follow Table 14 for appropriate corrective action. Close monitoring of the performance of the DSTF will be critical in determining if and when action will be required. It is expected that improvements will be made to the system on an ongoing basis once initial operating experience has been gained.

TABLE 14: TRIGGERS AND ACTIONS UNDER ADAPTIVE MANAGEMENT FOR TAILINGS MANAGEMENT			
Provision	Monitored Item	Triggers/Thresholds	Action
EBA Design Report	Groundwater Monitoring Wells	Tip @ 1.0 m or 1.7 m depth - Porewater pressure parameter (Ru) exceeds 0.15	Facility designer will review well data. Monitoring and review will be increased to semi-weekly until determined unnecessary.
		Tip @ 1.0 or 1.7 m depth - Porewater pressure parameter (Ru) exceeds 0.25	Facility designer will review existing well data Facility designer will conduct a site visit and determine if tailings placement and/or construction plan requires modification Monitoring and review will be increased to daily until determined unnecessary. Facility designer will determine if additional instrumentation is required. Facility designer will complete analysis of mitigative measures should exceedance continue.
EBA Design Report	Ground Temperature Cables	Temperature > 0°C at 1.5 m depth	Facility designer will review temperature data.
EBA Design Report	Ground Temperature Cables	Temperature > 0°C at 2.0 m depth and greater	Facility designer will review existing temperature data Facility designer will conduct a site visit and determine if tailings placement and/or construction plan requires modification Facility designer will determine if additional instrumentation or analysis is required. Facility designer will complete analysis of mitigative measures should exceedance continue. Alexco to complete survey of area of interest to monitor any future displacement, if any.

TABLE 13: TRIGGERS AND ACTIONS UNDER ADAPTIVE MANAGEMENT FOR TAILINGS MANAGEMENT – CONT.

Provision	Monitored Item	Triggers/Thresholds	Action
EBA Design Report	Survey Monuments and Slope Inclinometers	Displacements greater than 25 mm in any direction	Facility designer will review existing piezometer, temperature, and survey data. Facility designer will conduct a site visit and determine if tailings placement and/or construction plan requires modification. Monitoring and review will be increased to semi-weekly until determined unnecessary. Alexco to complete survey of area of interest to monitor any future displacement, if any. Facility designer will determine if additional instrumentation is required. Facility designer will complete analysis of mitigative measures should exceedance continue.
Water Licence Q209-092	Toe runoff collection ditches, conveyance channel and water collection pond	Presence of abnormal cracking or failure	Report to general manager, take corrective action as required
Water Licence Q209-092	Tailings Runoff	Visible turbidity in runoff and/or excessive erosion evidence	Address runoff at source; report to Water Board within 60 days Apply appropriate runoff, erosion or sediment control measures
Water Licence Q209-092	Tailings Solids	AML potential is indicated	Expand monitoring program Conduct study of options to minimize acid generation

9.6 DOCUMENTATION

Routine reporting of surveillance results is essential to provide time to make adjustments to existing systems or to initiate Emergency Response Plans. It is imperative that any unusual information (outliers) gathered from these undertakings be communicated to the facility designer, the General Manager and Chief Operating Officer.

Document control is vital to ensuring the ongoing performance of the facility. The topic was presented in Section 3.0.

Table 15 identifies the overall responsibilities for surveillance record keeping:

TABLE 15: DSTF SURVEILLANCE DOCUMENTATION		
Task	Responsible Party	Information Recipients
Daily Check Sheet	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
Monthly Placement As built	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server EBA - copy
Instrumentation Data	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server EBA – copy
Construction Photographs	Completed by Construction Monitor	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
ABA Testing	Completed by Geology Dept	General Manager – copy; Mill Manager – copy; Bellekeno Mine Engineering Server
Water Quality Monitoring	Completed by VP Corporate Affairs	General Manager, Mill Manager and Yukon Water Board Original reports located with General Manager

9.7 REPORTING

Observation of any unusual occurrence should be reported immediately to the General Manager, facility designer, and/or the Chief Operating Officer. Unusual occurrences include but are not limited to the following;

- Triggers/Thresholds outlined in Table 13;
- Any seismic event;
- Settlement, cracks or slumping of the tailings stack;
- Slope failure of any of the slopes;
- Abnormal seepage from any of the slopes;
- Increased or high turbidity flow from the drainage blanket; and
- Damage to any component of the DSTF.

All reports are to be maintained by the General Manager and filed in a suitable format and location for easy access by authorized mine personnel, and for review by government agencies. Annual performance reviews will be copied to the regulatory agencies.

The requirements of the consulting geotechnical engineer, other departments, or governmental agencies may dictate certain items that require inspection, monitoring, or reporting.

10.0 EMERGENCY PLANNING AND RESPONSE

10.1 BELLEKENO EMERGENCY PROCEDURES

The mine site has established procedures and response plans detailing in the following reports:

- A report by Access Consulting Group entitled "Alexco Keno Hill Mining Corp. Bellekeno Project, Monitoring and Surveillance Plan, QML-0009", dated November 2009 and submitted for the Type A Water Use License 2009.
- A report by Access Consulting Group entitled "Emergency Response Plan, QML-0009, Bellekeno Project", dated November 2009 and submitted for the Type A Water Use License 2009.
- MSDS documentation for any material used within the DSTF.

These documents provide the detailed plans on actions to be taken in case of an emergency. They also provide notification procedures.

10.2 DSTF EMERGENCY PROCEDURES

Daily visual and routine instrumentation monitoring programs outlined in Tables 12 and 13 are expected to forewarn of potential adverse conditions to the DSTF. Triggers/Thresholds presented in Table 13 must be adhered to and reported on as outlined.

The DSTF has been designed to maintain its structural integrity throughout its operational life; however, a number of conditions can affect the performance of the DSTF. Once the DSTF operations are being completed and instrumentation data is available, the requirement for additional emergency procedures will be reviewed as a part of the annual DSTF performance and OMS manual review.

10.3 ENVIRONMENTAL EMERGENCIES

Environmental emergencies of various natures and their specific response procedures are outlined in the project's Spill Contingency Plan. This document includes immediate response procedures and follow up and notification measures appropriate to the particular nature of the emergency.

10.4 KEY CONTACTS

Key contact information is detailed in Table A2, found in Appendix A.

APPENDIX C

Decision Document Compliance Tracker (SEPTEMBER 2023)

Number	Project	Document	Term/condition/license	How/Where they are addressed in plan
1	Flame and Moth Development and Production Program	Decision Document 2013-0161	The Proponent shall provide regulators with proposed site specific water quality objectives (SSWQOs) for all contaminants of potential concern at station KV-6, KV-7and KV- 81.	Section 2
2	Flame and Moth Development and Production Program	Decision Document 2013-0162	The Proponent shall provide regulators with proposed Effluent Quality Standards (EQS) for water quality station KV-104 reflecting the SSWQOs developed in mitigation number one (1).	KV-104c and KV-104L back calculated. suggest to be added to EMSRP
3	Flame and Moth Development and Production Program	Decision Document 2013-0163	The Proponent shall provide regulators with supporting rationale for site specific water quality objectives developed in term and condition #1	Section 2 and 3
4	Flame and Moth Development and Production Program	Decision Document 2013-0164	The Proponent shall provide regulators with the results of a sensitivity analysis of metal attenuation rates that are lower than predicted by column tests. This analysis shall include a model run assuming no attenuation of metals.	Done in the update to Christal Creek water quality model reports
5	Flame and Moth Development and Production Program	Decision Document 2013-0165	Post closure, the Proponent shall maintain a water treatment plant on site, until the mine achieves a static water level and the portal is not discharging, or until the bioreactor can be demonstrated to achieve necessary protection of aquatic life.	Will update the RCP
6	Flame and Moth Development and Production Program	Decision Document 2013-0166	The Proponent shall provide regulators with the results of groundwater monitoring with sufficient coverage to determine the groundwater flow in the area of the Flame and Moth Mine and define any groundwater divides that exist.	Section 9 - Reporing of the Groundwater Management Plan, this is met by Clause 85 of the License
7	Flame and Moth Development and Production Program	Decision Document 2013-0167	The Proponent shall provide regulators with the results of a sensitivity analysis of their water balance illustrating the effects of estimated maximum and minimum flows (dry and wet years) for all inflows and outflows of the water balance model.	Will be included in the next annual report
8	Flame and Moth Development and Production Program	Decision Document 2013-0168	The Proponent shall provide regulators with updated geochemical analysis comparing both non-mineralized and mineralized zones to provide certainty that all of potential contaminants of concern have been identified.	included in exibit 1.4.25
9	Flame and Moth Development and Production Program	Decision Document 2013-0169	The Proponent shall update their Adaptive Management Plan to include reference to the Flame and Moth Mine and corrective actions specific to the Flame and Moth Mine where applicable.	Completed (see AMP update May 2022)
10	Flame and Moth Development and Production Program	Decision Document 2013-0170	The Proponent shall update events 12 and 13 of their Adaptive Management Plan to trigger investigations of sources of contaminants that show trends of increasing contaminant loads before they exceed the water quality objectives to reduce the potential of exceedances and associated significant adverse effects.	Completed (see AMP update May 2022)
11	Flame and Moth Development and Production Program	Decision Document 2013-0171	In support of the licencing process, the Proponent shall provide regulators with an updated Reclamation and Closure Plan outlining actions to be taken in the event that potentially acid producing or metal leaching waste rock is left on surface during such events as a temporary shutdown of operations.	The RCP will be updated.
12	Flame and Moth Development and Production Program	Decision Document 2013-0172	Prior to construction of the Dry Stack Tailings Facility (DSTF) expansion, the Proponent shall provide regulators with the results of borehole logs from subsurface investigations in the footprint of the proposed DSTF expansion area. These subsurface investigations should be sufficient in number to provide representative sampling from across the footprint of the proposed DSTF expansion to support the conclusions of the DSTF design and stability analysis. This subsurface monitoring shall include the installation of stability monitoring equipment, ground temperature cables and groundwater monitoring wells to build adequate baseline data prior to construction. These monitoring systems shall be monitored throughout the design life of the facility.	Wells that are to be added to the program for the expansion of the DTSF are noted in Section 8 of the Groundwater Monitoring Plan

Number	Project	Document	Term/condition/license	How/Where they are addressed in plan
13	Flame and Moth Development and Production Program	Decision Document 2013-0173	In the event that water is observed in monitoring well BH39 in the existing dry stacked tailing storage facility, this water shall be collected and sent for full metals analysis to confirm its origin. The results of this analysis shall be reported to regulators in a timely manner.	Table 8-1 from the Groundwater Monitoring Plan
14	Flame and Moth Development and Production Program	Decision Document 2013-0174	The Proponent shall install a geosynthetic liner beneath the expanded DSTF to contain and capture any seepage that may occur from the facility in future and allow for treatment prior to release to the receiving environment.	Section 3.4.1 of the WMP, no mention of the explanded DSTF, just the DSTF
15	Flame and Moth Development and Production Program	Decision Document 2013-0175	The Proponent shall provide regulators with a discussion and analysis of the potential effects of blasting at the Flame and Moth Mine to the integrity of long-term monitoring wells and instrumentation in the area of the Mill and DSTF.	Section 4 - Permafrost Monitoring
16	Flame and Moth Development and Production Program	Decision Document 2013-0176	The Proponent shall implement the revised Dust Abatement and Monitoring Plan, which shall be reflected in an updated Monitoring and Surveillance Plan and Adaptive Management Plan.	Updated May 2022
17	Flame and Moth Development and Production Program	Decision Document 2013-0177	The Proponent shall monitor levels of TSP, PM10, PM2.5 and metals speciation of TSP.	Section 7 - Air Quality Monitoring
18	Flame and Moth Development and Production Program	Decision Document 2013-0178	The Proponent shall revise the trigger values for initiating the Adaptive Management Plan including the thresholds and triggers for metal levels in TSP.	Metal analysis is completed on TSP samples, section 4.17.3 of AMP
19	Flame and Moth Development and Production Program	Decision Document 2013-0179	In addition to notifications regarding traffic increases, the Proponent shall post and/or notify their operation schedules and potential dust-generating events.	Section 2.2 of the Dust Abatement Plan
20	Flame and Moth Development and Production Program	Decision Document 2013-0180	The DSTF shall be reclaimed in consideration of improving the visual amenity of the site in addition to long-term stability. Visual amenity objectives shall be identified by the community of Keno City.	Section 12 - Reclamation Effectiveness monitoring Program
21	Flame and Moth Development and Production Program	Decision Document 2013-0181	Prior to commencing operations, the Proponent shall install a noise reducing cover over the mill crusher.	The crusher was covered with a building that has ventilation and dust control
22	Flame and Moth Development and Production Program	Decision Document 2013-0182	To reduce impacts from low frequency noise, the Proponent shall not operate the crusher or DSTF packer between the hours of 19:00 and 07:00.	Section 4.1 of Noise Management Plan
23	Flame and Moth Development and Production Program	Decision Document 2013-0183	The Proponent shall engage the residents and property owners to develop a sound monitoring and mitigation plan; this plan shall be implemented by the Proponent and reported on annually in the Quartz Mining License. The plan shall include, but not be limited to, the following: monitoring of low frequency noise at sensitive receptors; noise monitoring stations in various locations on and off the mine site; list of additional mitigation measures available should current mitigation become ineffective; and noise complaint and resolution protocols.	Noise plan was developed with consultation from Keno City residents - Section 2 of Noise Monitoring Plan
24	Flame and Moth Development and Production Program	Decision Document 2013-0184	The Proponent shall engage the residents and property owners to develop the Keno City Socio-economic Mitigation Plan; this plan shall be implemented by the Proponent and reported on annually in the Quartz Mining License. The plan shall include, but not be limited to, the following: identification of socio-economic values important to Keno City residents; a communication protocol for activities and events to inform Keno City residents and property owners of company activities on a regular basis; a formal complaint resolution protocol; and initiatives and opportunities to enhance the community and local economy.	This plan is currently under development

Number	Project	Document	Term/condition/license	How/Where they are addressed in plan
25	Flame and Moth Development and Production Program	Decision Document 2013-0185	The Keno City Socio-economic Mitigation Plan shall be developed and implemented as soon as practical, and shall be reported on annually.	This plan is currently under development
26	Flame and Moth Development and Production Program	Proponent Commitments	All water discharged from mine de-watering shall be treated through the proposed water treatment plant prior to discharge to the receiving environmental at station KV-104	yes this is done
27	Flame and Moth Development and Production Program	Proponent Commitments	Any further discharge from the Mill Pond shall be treated through the proposed water treatment plant prior to realease.	Section 3.2.2 WMP
28	Flame and Moth Development and Production Program	Proponent Commitments	In support of the licencing process, the Proponent shall provide regulators with the results of additional depth discrete groundwater monitoring with sufficient coverate to determine the groundwater flow in the area of the Flame and Moth Mine and define any groundwater divides that exist.	Cited in flame and moth water quality models. look at hydrogeology work by interlogic as an exhibit on waterline for the flame and moth application
29	Flame and Moth Development and Production Program	Proponent Commitments	In support of the licencing process, the proponent shall provide regulators with updated geochemcial analysis comparing both non mineralized and mineralized zones to provide certainty that all protential contaminations of concern have been identified.	Cited in flame and moth water quality models. look at hydrogeology work by interlogic as an exhibit on waterline for the flame and moth application
30	Flame and Moth Development and Production Program	Proponent Commitments	The mitigations with respect to groundwater wells and monitoring identified in section 5.0 Aquatic Resources must be implemented.	Groundwater wells have been installed & monitoring is on-going.
31	Flame and Moth Development and Production Program	Proponent Commitments	The AMP event shall revised to include the potential for ground water contaminations from Flame and Moth, in addition to Onek 990, until such time as the groundwater flow can be adequately characterized to rule out this possibility. The wording of the AMP event shall be revised to allow for the AMP response to be initiated when there is uncertainty regarding the source of contamination.	we have done this under GW AMI 13, Onek 990 is no longer a licesning component
32	Flame and Moth Development and Production Program	Proponent Commitments	The narrative trigger in the AMP should capture increatsing trends in concentrations of a wider range of contaminants that proactively mitigates for exceedances to the Canadian Drinking Water Quality guidelines before they occur.	done in AMP AMI 13
33	Flame and Moth Development and Production Program	Proponent Commitments	In addition to notifying the Water Inspector, residents shall be immediately notified if there are exceedances to any parameters listed in the Canadian Drinking Water Quality guidelines. Notification shall also include instructions on where to obtain water, if necessary and other info on health realated risks, measures, and actions being taken.	ERDC responsibility not AKHM. since about 2015 have not been using municipal domestic well.
34	Flame and Moth Development and Production Program	Proponent Commitments	A suitable back up well shall be identified and monitored, in addition to other groundwater wells.	more gw wells have been installed at flame and moth
35	Flame and Moth Development and Production Program	Proponent Commitments	Blasting shall not be undertaken durign unfavourable weather contiditions to avoid deposition of dust on neighbours and the delayed dissipation of visible dust from the atmosphere. The conditions under which blasting shall not be undertaken shall be explicitly identified for the residents of Keno City.	Dust Management Plan
36	Flame and Moth Development and Production Program	Proponent Commitments	The Proponent shall include a section in their Annual Report for Social Impact Monitoring, in consideration of monitoring the implementation of mitigation for valued components identified in the Socio-economic Mitigation Plan, including visual aesthetic factors.	The Socio-Econonic Plan is currently being put together. Contained in Sections 8.1 and 8.2 of the QML annual report.

Number	Project	Document	Term/condition/license	How/Where they are addressed in plan
37	Flame and Moth Development and Production Program	Proponent Commitments	The Proponent shall engage the residents and property owners to develop a sound monitoring and mitigation plan; this plan shall be implemented by the Proponent and reported on annually in the Quartz Mining License. The plan shall include, but not be limited to, the following: monitoring of low frequency noise at sensitive receptors; noise monitoring stations in various locations on and off the mine site; list of additional mitigation measures available should current mitigation become ineffective; and noise complaint and resolution protocols.	Noise plan was developed with consultation from Keno City residents - Section 2 of Noise Monitoring Plan
38	Flame and Moth Development and Production Program	Proponent Commitments	The Proponent shall engage the residents and property owners to develop the Keno City Socio-economic Mitigation Plan; this plan shall be implemented by the Proponent and reported on annually in the Quartz Mining License. The plan shall include, but not be limited to, the following: identification of socio-economic values important to Keno City residents; a communication protocol for activities and events to inform Keno City residents and property owners of company activities on a regular basis; a formal complaint resolution protocol; and initiatives and opportunities to enhance the community and local economy.	This plan is currently being developed
39	Flame and Moth Development and Production Program	Proponent Commitments	To reduce uncertainty, the Proponent shall begin early engagement with the residents of Keno City, via a third-party mediator, to discuss the Proponent's preferred long-term regional plan/vision that includes a transparent assessment of potential future alternatives for tailings and mill site inrastructure. This engagment shall be documented and reported to the regulator.	The Socio-Econonic Plan is currently being put together. Contained in Sections 8.1 and 8.2 of the QML annual report.

Number	Project	Document	Term/condition/license	How/Where they are addressed in plan
1	Bermingham Development and Production Program	Decision Document 2017-0176	The closure plan shall be updated to include contingencies for water management, such as an active water treatment plant for the adit drainage if mine pool treatment does not achieve objectives	The RCP will be updated in 2023
2	Bermingham Development and Production Program	Decision Document 2017-0177	Non-acid metal leaching waste materials to be used for construction or segregated for other purposes outside the Waste Rock Storage Area, shall be subject to a revised waste rock screening criteria which incorporates consideration of the effective NP/AP value required to effectively maintain neutral pH conditions.	Section 4.1.1 of the Waste Rock Management Plan
3	Bermingham Development and Production Program	Decision Document 2017-0178	Water quality monitoring plans shall be developed and implemented to evaluate effects to Star Creek and South McQuesten River from the Project	KV-56 is monitored (Star Creek), KV-1 and 72 are upstream of mine outflow,KV-2 to 5 are downstream of Star and on the McQuesten
4	Bermingham Development and Production Program	Decision Document 2017-0179	A natural attenuation study specifically between KV-114 and KV-111 shall be developed, and a monitoring program established, that allows the Proponent to confirm that natural attenuation is occuring to the extent predicted in the load prediction model. This study should include determination of the overland flow path of effluent discharged from the proposed Bermingham decant pond, and an assessment of groundwater flow to determine the fate of contaminated surface water going to ground.	No Cash Attenuation Study
5	Bermingham Development and Production Program	Decision Document 2017-0180	Kinetic testing on tailings produced from the Bermingham deposit shall be completed. This should include testing of tailings produced from bench scale testing before production begins. Kinetic tests should include testing of tailings produced from milling of Bermingham ore, as described in the Tailings Characterization Plan.	Included in the tailings characterizaiton plan. Closure plan is up-to-date and is planned to be updated in 2023.
6	Bermingham Development and Production Program	Decision Document 2017-0181	The closure plan for the tailings storage facilites shall be updated once the kinetic results are available. The updated closure plan shall demonstrate how the kinetic results have been considered and addressed. The updated closure plan shall be subject to review and approval by the Chier Mining Land Use.	Closure plan mentions
7	Bermingham Development and Production Program	Decision Document 2017-0182	The noise monitoring plan shall be completed, in consultation with the residents of Keno City, prior to starting operations. Monitoring results shall be provided to residents on, at minimum annual basis.	Section 5.3 of Noise Monitoring Plan
8	Bermingham Development and Production Program	Decision Document 2017-0183	The dust management and abatement plan shall be updated, in consulation with the residents of Keno City, prior to starting operations.	Section 2.2 and Section 8 of the Dust Abatement Plan
9	Bermingham Development and Production Program	Decision Document 2017-0184	A complaint mechanism shall be in place for residents of Keno City and the public to provide an easily accessible means to report dust, noise and traffic related incidences. The mechanism shall include steps that will be taken to record, investigate, if warranted rectify and report back to the community and regulators.	Section 7 of Dust Abatement Plan
10	Bermingham Development and Production Program	Decision Document 2017-0185	The Keno City Socio-economic Mitigation Plan shall be developed and implemented as soon as practical, in consultation with the residents of Keno City and shall be reported on annually.	This plan is currently being developed
11	Bermingham Development and Production Program	Decision Document 2017-0186	No existing public roads shall be blocked for use except for temporary closures for safety reasons or during road construction.	Traffic management plan section 8
12	Bermingham Development and Production Program	Decision Document 2017-0187	All traffic related to the Bermingham Development shall remain a minimum of 550 m from the Keno City Campground.	Section 4.1 of Noise Management Plan
13	Bermingham Development and Production Program	Decision Document 2017-0188	Signage shall be provided at relevant intersections, informing visitors where active mining may be expected.	Section 2 of Traffic Management Plan
14	Bermingham Development and Production Program	Decision Document 2017-0189	All traffic related to project operations that must pass through Keno shall be limited to between 7AM and 7 PM and kept to the minimum for necessary care and maintenance, until the bypass road forming part of the project 2011-0315 is available. Once the bypass is complete, no traffic related to the operatrions shall enter Keno City, unless Keno City is the destination.	Section 7 of Traffic Management Plan
15	Bermingham Development and Production Program	Decision Document 2017-0190	The Proponent shall carry out all phases of the project in a manner that protects and avoids harming, killing or disturbing migratory birds or destroying or taking their nests or eggs.	Section 2, Table 3 of the Wildlife Protection Plan
16	Bermingham Development and Production Program	Decision Document 2017-0191	A heritage resource overview assessment shall be completed in advance of ground disturbing activities. Areas with elevated potential for the presence of archaelological or historic sites shall be avoided until such time as a heritage resource impact assessment can be completed.	Section 5 of Heritage Resources Protection Plan
17	Bermingham Development and Production Program	Decision Document 2017-0192	A heritage resource impact assessment shall be completed in advance of ground disturbing activities in areas with elevated potential for the presence of archaeological or historic sites.	Completed.
18	Bermingham Development and Production Program	Decision Document 2017-0193	Upon discoveryof a heritage resource,the Proponent shall notify the First Nation of Na-Cho Nyak Dun, in addition to Government of Yukon, Chief Mining Land Use.	Section 3 of Heritage Protection Plan
19	Bermingham Development and Production Program	Proponent Commitments	The Bellekeno criteria for management of waste rock from Bermingham shall be applied to waste rock generation by the Project	Contained in the Waste Rock management Plan (section 3.5.1)

Number	Project	Document	Term/condition/license	How/Where they are addressed in plan
20	Bermingham Development and Production Program	Proponent Commitments	The Adaptive Management Plan shall be updated to include a process of responding to complaints or input from keno City residents, or members of the public in general, in regard to dust, noise, and traffic.	Traffic Plan, Noise Plan
21	Bermingham Development and Production Program	Proponent Commitments	A neutral third party shall assist in the development and implementation of terms and conditions 8, 9, 10 and 12	All the plans were developed by consultants, noise, dust, and AMP development done by Ensero. The Socio-Economic Plan is being developed by a consultant.
22	Bermingham Development and Production Program	Proponent Commitments	The Proponent shall not undertake land clearing during the general nesting season from May 1 to August 15.	Wildlife Plan

Number	Project	Document	Area/Subject	Term/condition/license	How/Where they are addressed in plan
1	Bellekeno	Decision Document	Aquatic Resources	All road construction and upgrades that utilize non-AML waste rock shall be done in accordance with project specific developed quality assurance and quality control practices (i.e. periodic screening and sampling of waste rock used for road material) that govern the project's waste rock management plan and in a manner conductive to monitoring run-off as per the AMP.	Section 9 - Waste Rock Monitoring
1a	Bellekeno	Decision Document	Aquatic Resources	Run-off in areas utilizing non-AML waste rock shall be monitored	Section 11 - Adaptive Management Plan - AMI # 2
1b	Bellekeno	Decision Document	Aquatic Resources	Monitoring of these areas must be added to the AMP	Section 11 - Adaptive Management Plan
2	Bellekeno	Decision Document	Aquatic Resources	The key Best Management Practices (BMP) that will be implemented to protect fish and fish habitat when constructing the Lightening Creek clear span bridge include those listed in the Decision document	The bridge was constructed several years ago. There is a new Road Management Plan_2023 that contains these BMPs. The 2023 plan incorporates the Road construction plan_rev4 which also contains these requirements.
3	Bellekeno	Decision Document	Aquatic Resources	Install effective sediment and erosion control measures, such as silt fencing, temporary diversion berms, clear crush check dams or straw bales, before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if damage occurs. Work that will disturb soils shall be stopped during periods of higher precipitation if it is likely to lead to sediment deposition into Lightening Creek.	Section 3 - Sediment and Erosion Plan
4	Bellekeno	Decision Document	Aquatic Resources	Operate machinery on land (above the ordinary high water mark) and in a manner that minimizes disturbance to the banks of the watercourse. Minimize grading on steep water course approach slopes. Use approved access where available to limit equiptment and vehicle traffic on steep approaches. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks, invasive species and noxious weeds. Wash, refuel and service machinery ad store fuel and other materials for the matchinery at least 15 m away from the top-of-bank to prevent any deleterious substance from entering the water. Keep an emergency spill kit on site in case of fluid leasks or spills from machinery. Restore banks to original condition if any disturbance occurs.	Contained in the Road Management Plan
5	Bellekeno	Decision Document	Aquatic Resources	Use measures to prevent deleterious substances such as new concrete (i.e. it is pre-cast, cured and drived before use near the watercourse), grout, paint, ditch sediment and preservatives from entering the watercourse.	Spill contingency plan will be updated to include specific language
6	Bellekeno	Decision Document	Aquatic Resources	No debris shall remain within the high-water mark of placed into a stream.	Spill contingency plan will be updated to include specific language.
7	Bellekeno	Decision Document	Aquatic Resources	Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps, berms or planting them with preferably native grass or shrubs.	Sediment and Erosion Plan will be updated
8	Bellekeno	Decision Document	Aquatic Resources	Vegetate any disturbed areas by planting and seeding with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. All seeding and/or planting trees shall follow the DFO guidance on Riperian Revegetation. If there is insufficient time remaining in the growing season, the site shall be stabilized (eg . cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved.	Section 12 - Reclamation Effectiveness Monitoring Program
9	Bellekeno	Decision Document	Aquatic Resources	Instream turbidity leavels and sediment control measures shall be monitored during construction and following major storm events.	Bellekeno is no longer in use.
10	Bellekeno	Decision Document	Christal Creek	Baseline data must be collected from a site at Christal Creek pre-project.	Section 2 - Water Surveillance Network - speaks to WQOs only
11	Bellekeno	Decision Document	Christal Creek	Sample sediment and benthic invertebrates to characterize annual variation and the summer season during time of maximum biological activity	Table 3-2

Number	Project	Document	Area/Subject	Term/condition/license	How/Where they are addressed in plan
12	Bellekeno	Decision Document	Christal Creek	Methods shall follow the protocol used in the Keno Valley Stream Sediment and Benthic Invertebrate Monitoring Programs, 2007 (laberge 2008) and the BC Field Sampling Manual 2003.	Section 3 - EEM under MDMER
13	Bellekeno	Decision Document	Christal Creek	The Christal Creek site shall be added to the monitoring program and the AMP.	Section 2 - Water Surveillance Network Section 11 - Adaptive Management Plan
14	Bellekeno	Decision Document	Christal Lake	Conduct sediment sampling to characterize annual variation and the summer season during times of maximum biological activity (to be consistent with sediment sampling times at other stations).	Section 3 - EEM under MDMER
15	Bellekeno	Decision Document	Christal Lake	Sample phytoplankton (at spring overturn, mid summer and fall) and zooplankton (one time in late summer).	The Bellekeno mine is shut down and in the process of being reclaimed.
16	Bellekeno	Decision Document	Christal Lake	Methods must follow the protocol used in the Keno Valley Stream Sediment and Benthic Invertebrate Monitoring Programs, 2007 where possible (Laberge 2008) and the BC Field Sampling Manual 2003.	Section 3 - EEM under MDMER
17	Bellekeno	Decision Document	Christal Lake	Sites shall be added to the monitoring program and the AMP	older AMPs, superceded by current AMP, which has KV6
18	Bellekeno	Decision Document	Christal Lake	Conduct benthic invertebrate and fisheries sampling/monitoring of populations in Christal Creek, Flat Creek, South McQuesten River and Lightening Creek to confirm species presence and diversity over time throughout the life of project (annual sampling).	Completed under license QZ06-074 except for Lightening Creek site
19	Bellekeno	Decision Document	Christal Lake	The propoenent shall contine to develop and modify sampling and analysis procedures to characterize contaminant levels in treated effluent as part of the AMP.	Section 11 - Adaptive Management Plan - AMI # 1
20	Bellekeno	Decision Document	Christal Lake	Quarterly sampling shall continue at KV-37 (Lightening Creek u/s of Hope Gulch), KV-39 (Hope Gulch u/s of Lightening Creek) and KV-40 (Charity Gulch u/s of Lightening Creek) for flow, conductivity, pH, temperature, total and dissolved metals. These sites are relevant to activities at the mine.	Table 2-3
21	Bellekeno	Decision Document	Christal Lake	Water samples from treatment facilities at a minimum shall be collected end of pipe in addition to any sampling points required as per the AMP. Record and provide the approporiate regulator the following information (listed in Decision Document page 7)	The WTP operators collect and report this
22	Bellekeno	Decision Document	Christal Lake	The location for achieving the site specific water quality shall be determined by the appropriate regulator and based in part on consideration of: Point in receiving waters where significant fish habitat values exist as defined by the Department of Fisheries and Oceans; and initial dillution and mixing zones as defined by the appropriate regulator. Note that this location should also be based in part on considerations of the overall site Closure Plan being developed to deal with historic liabilities.	Section 2 - Water Surveillance Network
23	Bellekeno	Decision Document	Christal Lake	Construct and/or maintain water treatment and retention infastructure so that non-compliant water is not released into the enviornment.	Table 1-1 lists water treatment plants, and Section 5 - Physical Inspections and Reporting Plan speaks to water retention structures (but not specified)
24	Bellekeno	Decision Document	Christal Lake	Settling ponds shall have a freeboard of no less that 0.4 m to prevent risk of overtopping.	Minimum of .5 section 3 of WMP
25	Bellekeno	Decision Document	Christal Lake	Settling ponds shall have a high level of discharge (i.e spillway) to prevent destructive overtopping in the even of high water volumes.	Spill contingency plan will be updated
26	Bellekeno	Decision Document	Christal Lake	Ensure that all settling ponds are lined and monitored to prevent release of non-compliant water through ground.	Lined with HDPE
27	Bellekeno	Decision Document	Christal Lake	It will be necessary to begin, as soon as feasible (but prior to project construction and operation), baseline characterization of any groundwater resources that will be affected by the project site. This must include an evaluation of groundwater quality and quantity in the area, groundwater flow rates and directions	Monitoring wells established as per WUL QZ18-044
28	Bellekeno	Decision Document	Christal Lake	Additional on-going monitoring during operations will be required to determine: The effects of operations on groundwater resources in the area since historical baseline groundwater data are limited, establish an on-going groundwater monitoring strategy, which is scoped with on-going surface water monitoring programs, is required to assess overal project effects on local groundwater resources. This detailed information on current groundwater conditions will inform the final decisions on post-closure remediation activities at the sites adits.	Section 2 - Water Surveillance Network

Number	Project	Document	Area/Subject	Term/condition/license	How/Where they are addressed in plan
29	Bellekeno	Decision Document	Christal Lake	Design criteria and flow capacity for a channelized drainage system are required. Additionally, a flow control structure and monitoring program are required to demonstrate discharges from the pond and effectively managed, both during operations and post closure. Note that this pond is being taken to mean the	Section 2 - Water Surveillance Network
30	Bellekeno	Decision Document	Christal Lake	Design and installation of a channelized drainage system (eg. Pipe or stream channel) to drain the pond is required. Plans for the pond drainage system proposed at Christal Lake may be used to guide the implementation of a new system at the Flame and Moth site, however consideration for the differences in slope and distance to Upper Christal Lake must be included in the plan. The plan must be approved by a geotchnical engineer. When teh assessor specifies geotechnical enginner Government of Yukon will be asking for an "engineer licensed to practice in the Yukon".	The mill process pond is a zero discharge facility. Its not designed to discharge to the environment.
31	Bellekeno	Decision Document	Christal Lake	Complete water balance for the site must be developed and be continued throughout operations	Section 2 - Water Surveillance Network
32	Bellekeno	Decision Document	Christal Lake	Minimim and maximum flows for both wet and dry years must be annually re-assessed to assist planning the water extraction adaptive measures.	models are developed to run for both wet and dry, not annually reassessed, for water extraction, it is not extracted from Christal lake, more dewatering of mine workings. Could be added to WMP.
33	Bellekeno	Decision Document	Christal Lake	Characterize the local climate conditions and climate variability with locally derrived and recent climate data.	Section 6 - Meterological Monitoring
34	Bellekeno	Decision Document	Christal Lake	Climate station monitoring must be maintained througout mine operations. This information must be input to the water balance calculations for the site.	Section 6 - Meterological Monitoring
35	Bellekeno	Decision Document	Christal Lake	Prepare a detailed quality assurance/quality control plan as part of the overall Waste Rock Management Plan that stipulates regular and frequent checks (inlcuding land and field screening techniques) that will yield a high confidence for waste rock classifications. This might include the recording of information for all work related to the categorization of rock types from blast rounds including the results of field screensand geochemical characterizations; Subsequent rock managment (listed in detail in #38 of the Decision Document).	Section 9 - Waste Rock Monitoring
36	Bellekeno	Decision Document	Christal Lake	Provide all recorded information to the appropriate regulator	Section 9 - Reporting
37	Bellekeno	Decision Document	Christal Lake	Upon initating this project, the relationship between field observations (i.e. tests and geochemical characterization) and the proposed calcium, sulphur, lead and zinc thresholds shall be continuously confirmed by sampling and laboratory analysis of rock. The results of laboratory analysis shall either confirm thresholds and the rock categorization and segregation approach or require adjustment.	Section 9 - Waste Rock Monitoring
38	Bellekeno	Decision Document	Christal Lake	The Temporary Conditional Waste Rock Classification Platform area shall have lined pads that are sloped on order to facilitate gravity drainage and collection of runoff water. Drainage that is collected shall either be: Contained until analysis shows that it is within an acceptable standard for release; or sent to the Bellekeno 625 water treatment facility	The Bellekeno mine is shut down and in the process of being reclaimed.
39	Bellekeno	Decision Document	Christal Lake	Place all potential AML waste rock from underground exploration activities into Bellekeno Pit. Note that the Bellekeno pit is taken to mean the AML waste rock dump	The Bellekeno mine is shut-down and in the process of being reclaimed.
40	Bellekeno	Decision Document	Christal Lake	Create berms to divert surface run-off around Pit to minimize exposure to water, potential ARD and tthe requirement for frequent removal of accumulated effluent. Note that the Bellekeno Pit is taken to mean the AML waste rock dump.	Section 3.2.2 AML waste rock storage facilities
41	Bellekeno	Decision Document	Christal Lake	Store AML waste rock on impermeable liner with collection system to ensure that any noncompliant water draining from the waste rock may be properly treated prior to release to the recieving environment	Section 2.2.2 of the Waste Rock Management Plan

Number	Project	Document	Area/Subject	Term/condition/license	How/Where they are addressed in plan
42	Bellekeno	Decision Document	Christal Lake	Install a low permeable cover overtop AML waste rock at endof project to reduce/elimate water infiltration.	Section 12 - Reclamation Effectiveness Monitoring Program
43	Bellekeno	Decision Document	Christal Lake	Drainage from the waste rock placed in the Bellekeno Pit shall be contained until analysis shows that it is within an acceptable standard for release	Section 3.2.2 AML waste rock storage facilities
44	Bellekeno	Decision Document	Christal Lake	Location of Bellekeno Pit to be approved by a qualified geotechnical engineer.	Bellekino mine is shut-down and in the process of being reclaimed.
46	Bellekeno	Decision Document	Christal Lake	Groundwater conditions downgradient of the DSTF must be characterized to help demonstrate that the linear has not failed. This might include the use of monitoring wels to measure changes in water levels, sample water quality and run recovery tests to help evaluate flow directions and veolcities. Note that theyre is no liner proposed for the DSTF but we have already accepted this as groundwater monitoring as captured by term #29	Section 2 - Water Surveillance Network / Tables 2-2-3 & 2-4 outline SW and GW monitoring stations
47	Bellekeno	Decision Document	Christal Lake	A groundwater monitoring program must be initiated by the start of the mine operations. Information gained from this program will establish contemporary baseline conditions at the site and will assist with planning for post closure groundwater quality monitoring. The Maintenance and Monitoring program proposed for surface water at the site must incorporate flow monitoring (for quantity and quality) at all treatment ponds.	Section 2 - Water Surveillance Network
48	Bellekeno	Decision Document	Christal Lake	This plan must include maintenance of water diversion structures at all tailings stacks	The Bellekeno mine is shut down and in the process of being reclaimed.
49	Bellekeno	Decision Document	Christal Lake	Results will be reported to the regulators. Note that this is taken as reffering to the monitoring requirements under the AMP	Section 9 - Reporting
50	Bellekeno	Decision Document	Health and Safety	Conduct a noise impact study prior to project implementation. The study must also aim to achieve the following (listed in #65 of the Decision document)	Section 8 - Noise Monitoring
51	Bellekeno	Decision Document	Health and Safety	Develop a noise abatement and management plan based on the results of the noise impact study. The plan must aim to achieve the following: Identify appropriate measure to reduce noise emissions, incorporate these measures into project design and implementation	Section 8 - Noise Monitoring
52	Bellekeno	Decision Document	Health and Safety	Upon commencement of each block of operations (eg. Crusher; bypass construction; ore traffic), a verification study will be conducted. This will consist of continuous monitoring over a two week period. Monitoring will aim to capture the ambient noise levels at sensitive recievers, inclusive of what the project is contributing. If unacceptable noise levels are identified further meausres to reduce the noise levels are required.	The Bellekeno mine is shut down and in the process of being reclaimed.
53	Bellekeno	Decision Document	Health and Safety	Best management practives for the industry indicate that dust releases must be minimized through the application of a number of preventative measures, including the following noted in term #68 of the Decision document.	Section 7 - Air Quality Monitoring
54	Bellekeno	Decision Document	Health and Safety	Monitoring dust conditions is an important step in controlling dust impacts. Simple TSP (dustfall) monitoring is a simple and inexpensive way to determine dust deposition at the sampling locations. This test can be done at the site by the proponent with little cost or training necessary.	Section 7 - Air Quality Monitoring
55	Bellekeno	Decision Document	Health and Safety	If warranted by initial dustfall measurements indicating TSP concentrations in excess of 150 micrograms per cubic metre (the BC Air Quality Objectives and Standards Level A criteria) at the fence line, the proponent shall conduct more sophisticated monitoring wth high volume samples and re-evaluate and improve dust supression techniques to achieve the TSP objective.	Section 7 - Air Quality Monitoring
56	Bellekeno	Decision Document	Health and Safety	Potential dispersal of contaminants from Dry Stack Tailings Facility to Keno must be qualified based on wind dispersion models and local meteological conditions and provided to appropriate regulator/	Section 7 - Air Quality Monitoring

Number	Project	Document	Area/Subject	Term/condition/license	How/Where they are addressed in plan
57	Bellekeno	Decision Document	Health and Safety	The proponent shall ensure that the bridge is capable of supporting the weights that will be crossingit and provide documentation to that effect to the regulator	The Bellekeno mine is shut down and in the process of being reclaimed.
58	Bellekeno	Decision Document	Health and Safety	The proponent shall ensure the following is achieved with respect to health and safety of workers (#74 of Decision Document)	The Bellekeno mine is shut down and in the process of being reclaimed.
59	Bellekeno	Decision Document	Health and Safety	Complete details of all other camps to be used need to be provided to Environment Health Services. The details must include total population, accomodation, food services, potable water supply and sweage disposal.	The Bellekeno mine is shut down and in the process of being reclaimed.
60	Bellekeno	Decision Document	Health and Safety	Camps must comply with the requirements of the Public Health and Safety Act "Camp Sanitation Regulations".	The Bellekeno mine is shut down and in the process of being reclaimed.
61	Bellekeno	Decision Document	Environmental Quality	Prior to construction the new access road to the Flame and Moth Mill site and the Keno City bypass, the proponent must demonstrate that soil conditions beneath and in proximity to the proposed right of way are stable to support the intended construction and use.	Tetra Tech EBA report
62	Bellekeno	Decision Document	Environmental Quality	New road construction shall not cause degradation of permafrost	Road Development and Operations Plan
63	Bellekeno	Decision Document	Environmental Quality	All potential roadway design and construction must be signed off by a qualified geotechnical engineer. "Engineer Licensed to practice in the Yukon"	Road Development and Operations Plan
64	Bellekeno	Decision Document	Environmental Quality	From borehole drilling throughout the various sites surrounding Keno City region, evidence of permafrost was genearlly not encountered. It is acknowledged that the non-AML waste rock site is situated on a north facing slope more prone to permafrost, however the consequences of intermittent permafrost of altering the permafrost regime with teh placement of the non-AML waste rock could be severe given the design assumptions for the slope stability assessment. Additional boreholes must be drilled throughout the area of placement of the waste rock, especially throughout the lower toe area and extending westward along Lightning Creek. All boreholes must be extended to bedrock and several should be fitted with temperature reading devices to confirm the location and depth of permafrost. It would be expected that temperature monitoring would occur over several seasons. Several peizometers must also be installed to monitor supra-permafrost ground level conditions.	Section 4 - Permafrost Monitoring
65	Bellekeno	Decision Document	Environmental Quality	The detailed slope stability assessment discussed in Appendix E of the Project Proposal must be revised to include the additional geotechnical information. A discussion on the permafrost layer depth and how this may be altered by the placement of the waste rock must be given to document how the permafrost is to be protected and how the sheer strengh parameters could change with the degradation of the permafrost. A discussion of the rock placement protocol must be given, and should include a placement scenario from the bottom of the slope upwards so as not to create slope stability issues during fill placement. The detailed slope stability assessment must be presented in a comprehensive report signed off by a qualified geotechnical engineer licensed to practive in the Yukon.	The Bellekeno mine is shut down and in the process of being reclaimed.
66	Bellekeno	Decision Document	Environmental Quality	The sheer strength of the foundation soils as outlined in Appendix E of the Project Proposal must be clarified. Based upon the drilling program, the foundation soils in this area consist of silty, gravelly sand. The assumed shear strength parameter of an undrained shear strength of 10kPa refer to a cohesive material (i.e a material containing clay sized particles). Material such as sand are non-cohezive and generally have a corresponding cohesion of 0 kPa. These shear strength parameter assumptions may have significant inpact on the slope stability assessment , especially for very shallow potential slip surfaces (as likely in this case) with very low normal stresses.	The Bellekeno mine is shut down and in the process of being reclaimed.

Number	Project	Document	Area/Subject	Term/condition/license	How/Where they are addressed in plan
67	Bellekeno	Decision Document	Environmental Quality	The reports state "there is a terrace of mined placer tailings between the slope and Lightening Creek… (which) could lead to long term stability isues." Relative to this concern, the non-AML waste rock storage area should be designed such that it does not cause degradation of the underlying warm permafrost, and that design must be signed off by a Geotechnical engineer.	The Bellekeno mine is shut down and in the process of being reclaimed.
68	Bellekeno	Decision Document	Environmental Quality	The geotechnical investigation and final design must therefore be of sufficient detail to identify permafrost (ie. Temperature readings in both disturbed and non disturbed areas), identify the groundwater levels (piezomenters, and characterize the native soils (both within the non-disturbed and disturbed area)	Section 4 of the EMSRP
69	Bellekeno	Decision Document	Environmental Quality	The stability assessment must include potential settlements of the native soil caused by the tailings placement, site preparation required prior to tailings placement, stability assessment during tailings placement and the long term stability under design loading conditions. This refers to the DSTF.	Section 9, 11 and 12 of the ESRMP mention that the stability will need to be considered as part of the progressive reclamtion, the impact that it could have on workers and when it is monitored as clause 96 of WL QZ18-044
70	Bellekeno	Decision Document	Environmental Quality	Detailed design of the mill building so as not to disturb permafrost	The Bellekeno mine is shut down and in the process of being reclaimed.
71	Bellekeno	Decision Document	Environmental Quality	All placement methodologies must be signed off by a qualified engineer licensed to practive in the Yukon. This referes to the DSTF.	DSTF Construction and Operations Plan Revision 4 and DSTF Operation, Maintenance, and Surveillance Manual.
72	Bellekeno	Decision Document	Environmental Quality	To evaluate the potential risks associated with this site as a AML storage facility and the potential effects this may have on the environment, detailed design information will need to be supplied outlining existing site conditions (native soils, permafrost, groundwater conditions, etc.) and rock placement methodology and geometry. The generic waste containment documentation can then be tied to the placement methodology on the slope.	Tetra Tech EBA report
73	Bellekeno	Decision Document	Environmental Quality	All placement methodologies must be signed off by a qualified engineer licensedto practive in the Yukon. This referes to the DSTF. This refers to the AML waste rock disposal site.	This matter has been dealt with in #53 of the Decision Document
74	Bellekeno	Decision Document	Environmental Quality	Conduct water quality monitoring, including dissolved oxygen and temperature profiles, sampled at spring overturn, mid summer and fall.	Section 2 - EMSRP
75	Bellekeno	Decision Document	Environmental Quality	Sludge from settling ponds at the Flame and Moth Mill and Bellekeno 625 and sediment collected in Bellekeno East settling ponds shall be removed and transported to a site or paddy cell that has the prior approval of the regulator, and that will keep liabilities seperate.	The Bellekeno mine is shut down and in the process of being reclaimed.
76	Bellekeno	Decision Document	Environmental Quality	Groundwater information is needed to quantitatively assess the available groundwater resources (eg. Quantity and quality) at the site, to identify flow directions and rates, and to identify any existing contaminant levels of groundwater resources. Monitoring wells shall be estabilished at the site near the DSTF at Flame and Moth site and at the Christal Lake site.	Table 8-2 of the Groundwater Monitoring Plan
77	Bellekeno	Proponent Commitments	Christal Lake	Bulk sample material must be covered to the extent practical to reduce contact with precipitation.	The Bellekeno mine is shut down and in the process of being reclaimed.
78	Bellekeno	Proponent Commitments	Christal Lake	Bulk sample shall not be stored at the temporary facility for more than 6 months following removal from the excavation, unless a complete characterization and classification that demonstrates it to be non-AML rock is conducted.	The Bellekeno mine is shut down and in the process of being reclaimed.
79	Bellekeno	Proponent Commitments	Christal Lake	Prior to any excavation of Bellekeno East, an engineered design with sufficient details of the waste rock cover is to be submitted by the proponent to the appropriate regulator for approval.	The Bellekeno mine is shut down and in the process of being reclaimed.
80	Bellekeno	Proponent Commitments	Christal Lake	AML waste rock to be stored in a manner that eliminates exposure to air and water during placement, before capping and after capping.	The Bellekeno mine is shut down and in the process of being reclaimed.
81	Bellekeno	Proponent Commitments	Christal Lake	Effluent from Bellekeno Pit shall be monitored to document any potential changes to water quality resulting from AML waste rock storage in the Bellekeno pit.	The Bellekeno mine is shut down and in the process of being reclaimed.
82	Bellekeno	Proponent Commitments	Christal Lake	Berms must be constructed to divert surface run-off generated outside the waste rock storage area around the facility and to contain surface run-off generated within the storage area.	Section 2.2.2 of the Waste Rock Management Plan

Number	Project	Document	Area/Subject	Term/condition/license	How/Where they are addressed in plan
84	Bellekeno	Proponent Commitments	Christal Lake	sump, monitored and treated as necessary to meet water quality guidelines. Options for treating the effluent include the use of treatment ponds similar to the ones proposed for the Flame and Moth Mill Site and Bellekeno Mine Site or pumping the effluent to the nearby Bellekeno Mine site for treatment there. Management of the pond, including monitoring of untreated and treated water quality, flow rates and sediment removal will be as discussed above for the Flame and Moth Mill Site and Bellekeno Mine treatment ponds. Due to the level of uncertainty in the proposed waste rock storage plan, these measures are necessary to avoid a significant adverse effect on water quality in Lightning Creek.	The Bellekeno mine is shut down and in the process of being reclaimed.
86	Bellekeno	Proponent Commitments	Christal Lake	Hydrostatic pressure of the underground adits used for waste backfill must be monitored for as long as possible to demonstrate complete saturation of the tailings backfill.	The Bellekeno mine is shut down and in the process of being reclaimed.
87	Bellekeno	Proponent Commitments	Christal Lake	Incorporate monitoring results into ongoing adaptive management of the mine operations and monitoring programs.	This is the current AMP
88	Bellekeno	Proponent Commitments	Christal Lake	Water quality triggers should either be closer to baseline levels (perhaps 50% above baseline but still substantially under criteria) or monitoring must be done more often to detect trends sooner	generally covered in the most current AMP for receiving environment
89	Bellekeno	Proponent Commitments	Christal Lake	Water discharge thresholds must be developed from seasonal baseline data with prescribed thresholds based on effects rather than using arbitrary 24 month averages.	Covered under subsequent water license applications and AMPs
90	Bellekeno	Proponent Commitments	Health and Safety	Use an alternate Yukon Government regulated site for waste disposal as per guidance from Yukon Government.	Section 4.4 of the Waste Management Plan

APPENDIX D

Quartz Mining License Compliance Tracker (April 2023)

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		(1) Each subsequent study design shall be submitted to the Minister of the Environment (a) at least six months before the start of the biological monitoring studies that are set out in that study design; or (b) if no biological monitoring studies are required, not later than 12 months after the day on which the previous interpretative report was required to be submitted or would have been required to be submitted but for the application of subsection 16(3) (2) Each subsequent study design shall include (a) a summary of the information referred to in paragraph 10(a) and a description of any changes to that information since the submission of the most recent study design, as well as — in respect of each calendar year — any supporting data, including raw data, for the estimate referred to in subparagraph 10(a)(i), whether or not the estimate has changed; (b) the information referred to in paragraphs 10(b) to (e); (c) a summary of the results of any biological monitoring studies conducted after June 6, 2002; (d) if the study referred to in paragraph 9(1)(e) is required, (i) the month in which the study will start, and (ii) a description of how the study will be conducted that includes any field and laboratory methodologies that will be used to determine the cause of the effect; and (e) if the cause of an effect on the fish population, on fish tissue from mercury or on the benthic invertebrate community is known, the cause of the effect and any supporting data, including raw data	Reporting		
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		Subject to subsection 16(3), each subsequent study design shall be followed by a subsequent interpretative report that includes (a) for a study referred to in paragraphs 9(1)(a) to (d), the information referred to in paragraphs 12(1)(a) to (n) and (p) to (r); (b) a summary of the results of effluent characterization, sublethal toxicity testing and water quality monitoring reported under paragraph 8(e) after the day on which the previous interpretative report was required to be submitted or would have been required to be submitted but for the application of subsection 16(3); (c) if the study design includes the description required under paragraph 13(2)(d), (i) the cause of the effect, if determined, and any supporting data, including raw data, or (ii) if the cause of the effect was not determined, an explanation of why and a description of any steps that need to be taken in the next study to determine that cause.	Reporting		
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		(1) The owner or operator of a mine shall submit to the Minister of the Environment an effluent monitoring report for all tests and monitoring conducted during each calendar quarter not later than 45 days after the end of the quarter. Details regarding the content of this report is noted on pages 18-21.	Reporting	Annual	
MDMER SOR	Division 2 -Effluent Monitoring Conditions	Acute Lethality Testing - Fish			Required if the salinity value of the effliuent is greater than ten parts per thousand and the effluent is deposited into marine waters (Rainbow trout and Threespine Stickleback) Required if the salinity value of the effliuent is greater than four parts per thousand and the effluent is deposited into marine waters (Daphnia magna and Acartia tonsa). See details on page 13/14 for fish testing requirements	Sampling		
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		Identifying Information 1 Name of the mine 2 Address of the mine 3 Name of the operator of the mine 4 Operator's telephone number and e-mail address, if any 5 Reporting period 6 Date of report Test Results Respecting Each Final Discharge Point 1 Complete the table on page 86 of the MDMER SOR with the monthly mean concentration for the deleterious substances set out in the table for each final discharge point and identify the location of the final discharge point. 2 Any measurement not taken because there was no deposit from the final discharge point shall be identified by the letters "NDEP" (No Deposit). 3 Any measurement not taken because no measurement was required in accordance with the conditions set out in section 12 or 13 of these Regulations shall be identified by the letters "NMR" (No Measurement Required).	Reporting	Annual	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		(1) Effluent characterization is conducted by analyzing a sample of effluent and recording the hardness, alkalinity, electrical conductivity and temperature of the sample and the concentrations, in total values, of the following substances: (a) aluminum; (b) cadmium; (c) iron; (d) subject to subsection (4), mercury; (e) molybdenum; (f) selenium; (g) nitrate (concentration in units of nitrogen); (h) chloride; (i) chromium; (j) cobalt; (k) sulphate; (l) thallium; (m) uranium; (n) phosphorus (concentration in units of phosphorus); and (o) manganese. (p) [Repealed, SOR/2018-99, s. 33] (2) The analysis shall comply with the analytical requirements set out in Table 2 of Schedule 3 (3) The effluent characterization shall be conducted once per calendar quarter on an aliquot of effluent sample collected under sections 12 and 13 of these Regulations from each final discharge point at least one month after the sample on which the previous characterization was conducted. (4) The recording of the concentration of mercury in effluent referred to in paragraph (1)(d) may be discontinued if that concentration is less than 0.10 µg/L in 12 consecutive samples collected under subsection (3). (5) Quality assurance and quality control measures shall be implemented that will ensure the accuracy of the effluent characterization data.	Sampling	Quarterly	
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		Water quality monitoring is conducted by (a) collecting samples of water from (i) the exposure area surrounding the point of entry of effluent into water from each final discharge point and from the related reference areas, and (ii) the sampling areas that are selected under clauses 10(b)(i)(B) and 10(c)(i)(A); (b) recording the temperature of the water and the dissolved oxygen concentration in the water in the exposure and reference areas where the samples are collected; (c) recording the concentration of the substances set out in paragraphs 4(1)(a) to (p) and, (i) in the case of effluent that is deposited into fresh water, recording the pH, hardness, alkalinity and electrical conductivity of the water samples, (ii) in the case of effluent that is deposited into estuarine waters, recording the pH, hardness, alkalinity, electrical conductivity and salinity of the water samples, and (iii) in the case of effluent that is deposited into marine waters, recording the salinity of the water (ii) not recording the concentrations of radium 226 if the conditions of subsection 13(2) of these Regulations are met; and (e) implementing quality assurance and quality control measures that will ensure the accuracy of water quality monitoring data samples; (d) recording the concentration of the deleterious substances prescribed in section 3 of these Regulations, but (i) not recording the concentrations of cyanide if that substance is not used as a process reagent within the operations area, and	Sampling	Quarterly	
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		(1) The owner or operator of a mine that has ceased discharging effluent for a period of at least 36 months is not required to conduct environmental effects monitoring studies so long as the period of cessation continues. (2) The requirement to conduct environmental effects monitoring studies shall resume, as the case may be, on (a) the day on which effluent discharge resumes; or (b) the day on which a notice referred to in paragraph 32(1)(a) of these Regulations is received by the Minister of the Environment. The owner or operator of a mine that has ceased discharging effluent for a period of at least 36 months is not required to conduct environmental effects monitoring studies so long as the period of cessation continues. (2) The requirement to conduct environmental effects monitoring studies shall resume, as the case may be, on (a) the day on which effluent discharge resumes; or (b) the day on which a notice referred to in paragraph 32(1)(a) of these Regulations is received by the Minister of the Environment.	Reporting and Sampling	See details	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		Sublethal toxicity testing shall, in the case of effluent deposited into fresh waters, be conducted using the following test methodologies, as amended from time to time: a) in the case of a fish species (reference page 51), b) in the case of invertebrate species (reference page 51), c) in the case of plant and algal species (reference page 51). Sublethal toxicity testing shall, in the case of effluent deposited into marine or estuarine waters, be conducted for fish species, invertebrate species and algal species using the following test methodologies, as amended from time to time, as applicable to each species (page 52). The sublethal toxicity tests shall be conducted on aliquots of the same effluent sample collected for effluent characterization collected from the mine's final discharge point that has potentially the most adverse environmental impact on the environment, taking into account (a) the loading of the deleterious substances contained in the effluent as determined under subsection 20(2) of these Regulations; and (b) the manner in which the effluent mixes within the exposure area. The sublethal toxicity tests shall be conducted on]the species referred to in subsections 5(1) and (2) two times each calendar year for three years and each test shall be conducted on an aliquot of effluent sample collected at least one month after the collection of the sample used in the previous tests. However, if effluent is discharged for 31 consecutive days or less in a calendar year, the tests may be conducted only once in that year. (3) After three years, the tests shall be conducted once per calendar quarter on the species referred to in subsection 5(1) or (2), as the case may be, whose results for all the tests conducted in accordance with subsections (1) and (2) — including such tests conducted in addition to the number required by those subsections — produce the lowest geometric mean, taking into account the inhibition concentration that produces a 25% effect or an effective concentration of 25%.	Sampling	Bi-annual	
QZ18-044	Monitoring and Surveillance	MDMER	Monitoring and Surveillance Plan		16 (1) Subject to subsection (2), each subsequent interpretative report shall be submitted to the Minister of the Environment not later than 36 months after the day on which the previous interpretative report was required to be submitted or would have been required to be submitted but for the application of subsection 16(3). (2) The interpretative report following a resumption of effluent discharge referred to in subsection 17(2) shall be submitted not later than 36 months after the day on which effluent discharge resumes. (3) An interpretative report is not required in respect of a 36-month period if no biological monitoring studies are required in respect of that period.	Reporting	See details	
QZ18-044	Water Use and Deposit of Waste	Water Use			The Licensee is hereby authorized to obtain and use water for a quartz mining undertaking, milling, and supporting domestic camp purposes, at a maximum combined rate of 664 cubic meters per day as detailed in the following: BK: 245.5 F&M: 140.1 Berm: 140.1 Camp: 57 Mill: 81	Constraint	Daily	
QZ18-044	Water Use and Deposit of Waste	Deposit of Waste			The Licensee is hereby authorized to discharge effluent (cubic meters per day) that meets the standards of this Licence as detailed in the following: BK: 864 F&M: 3,024 Berm: 1,200 Mill: 864	Constraint	Daily	
QZ18-044	Water Use and Deposit of Waste	Deposit of Waste			The Licensee must not deposit a Waste to any Watercourse, except as authorized by this Licence	Constraint	Daily	
QZ18-044	Water Use and Deposit of Waste	Mill Site			The Licensee is hereby authorized to deposit treated effluent to a land disposal system up-gradient of Christal Creekat a rate not exceeding 10 L/s and a total monthly volume not exceeding 0.8% of the corresponding total monthly volume of flow passing monitoring station KV-6 on Christal Creek	Constraint	Monthly	
QZ18-044	Water Use and Deposit of Waste	Mill Site			The Licensee is hereby authorized to deposit up to a maximum of 907,000 tonnes of Keno Hill Silver District Mill dewatered tailings from the Bellekeno, Flame and Moth and New Bermingham Mines and treatment sludge from the Flame and Moth and District Mill water treatment plants in the DSTF	Constraint	Annually	
QZ18-044	Creation of Production Unit				The Licensee must notify the Board that a Production Unit has been created within 30 days of the date of creation of the Production Unit. The notice must include the following: a) a three-dimensional spatial description which includes a metes and bounds description of the geographical area of the Production Unit; b)a description of the interaction between the current and existing workings associated with the extraction and processing of ore both above and underground, (including stopes, declines, adits, shafts, drillings, waste rock,etc.); and c)a statement that liability for a Production Unit has been transferred to the Licensee as a result of the creation of the Production Unit.	Reporting	Conditional	
QZ18-044	Design, Construction and Modification	Design			At least 30 days prior to the commencement of construction, the Licensee must submit to the Board final detailed designs, including all construction specifications, of the Engineered Structures. Each submission must be sealed by a professional engineerlicensed to practice in Yukon.	Reporting	Conditional	
QZ18-044	Design, Construction and Modification	Design			The Licensee must submit as-constructed (record) drawings and construction reports,including quality assurance and quality control documentation, for all structures and facilities to the Board within 120 days of the completion of construction. Each submission must be sealed by a professional engineer licensed to practice in Yukon.	Reporting	Conditional	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Design, Construction and Modification	Design			Where site conditions require Minor Modifications to the final detailed design submitted to the Board, the Licensee must submit to the Board with the as-built drawings: a) written details of the minor modifications made to the specifications and quality assurance/quality control procedures previously submitted to the Board as part of the Application; and b) an explanation, signed by a professional engineer licensed to practice in Yukon, for the change, including an assessment of the potential impact on the performance of the field modification. c) written evidence that there has not been any fundamental changes to the original design criteria as presented in the Application.	Reporting	Conditional	
QZ18-044	Design, Construction and Modification	Construction and Maintenance			By April 1 of each year, the Licensee must submit to the Board and Inspector detailed construction plans including the construction schedule for the coming 12 month period.	Reporting	Annually	
QZ18-044	Design, Construction and Modification	Construction and Maintenance			The Licensee must submit in writing the name and phone number of the field supervisor to the Board and Inspector, 10 days prior to the start of construction.	Reporting	Conditional	
QZ18-044	Design, Construction and Modification	Construction and Maintenance			The Licensee must ensure construction is supervised by technically qualified personnel and inspected and certified by a professional engineer.	Task	Daily	
QZ18-044	Design, Construction and Modification	Construction and Maintenance			The Licensee must not operate heavy equipment within the Wetted Perimeter of any Watercourse	Constraint	Daily	
QZ18-044	Design, Construction and Modification	Construction and Maintenance			The Licensee must stabilize disturbed ground surfaces in such a manner as to prevent erosion and surface runoff from carrying sediment into any Watercourse	Task	Daily	
QZ18-044	Design, Construction and Modification	Construction and Maintenance			The Licensee must ensure construction and maintenance equipment is mechanically sound and free of leaks	Task	Daily	
QZ18-044	Design, Construction and Modification	Water Pumps			The Licensee must ensure all engine driven water pumps are contained within an impermeable liner/structure that has the capacity to contain 110% of the maximum combined volumetric capacity of the fuel, lubricants and coolants within the engine of the water pump	Task	Daily	
QZ18-044	Design, Construction and Modification	Water Pumps			The Licensee must provide barriers consisting of fish guards, screens, coverings or netson all water intakes as follows: a) screens or nets must have a minimum of 3.5 openings per centimetre and openings no greater than 3.2 millimetres along any given side; b) if a punch plate or similar material is used, the opening must be no greater than 3.2 millimetres in length or width; there must be no less than 929 square centimetres of open screen for every 205 litres per minute being withdrawn; d) the barriers must be monitored and maintained to ensure that they function effectively at all times when water is being withdrawn; e) the barriers must be designed and installed in such a manner that the screen is submerged and a uniform flow distribution is maintained through the total screen area; f) water must not be withdrawn when the barrier is removed for renewal, repair or inspection; and g) the Licensee must cease pumping or decanting and take remedial action if there is alteration to the bed or bank of the water channel as a result of the pumping or decanting.	Task	Daily	
QZ18-044	Design, Construction and Modification	DSTF Expansion			Prior to construction of the DSTF expansion, the Licensee must conduct a subsurface investigation program and submit the results of that investigation to the Board. The program must provide for representative sampling from the entire footprint of the DSTF expansion and include, but not be limited to: a) a minimum of 12 holes advanced to bedrock using a drill capable of recovering undisturbed frozen overburden samples; b) installation of sub-surface monitoring instrumentation including slope indicators and ground temperature cables; and c) laboratory testing of samples for shear strength, particle size and moisture content, as described in exhibit 1.5.2 of Register QZ18-044.	Reporting	Conditional	
QZ18-044	Design, Construction and Modification	DSTF Expansion			90 prior to construction of the DSTF expansion, the Licensee must submit to the Board final detailed design drawings for the DSTF expansion that are consistent with thepreliminary design drawings submitted as part of exhibit 1.5.2, Dry Stacked Tailings Facility – Phase II Expansion, Keno Hill District Mill Site, Yukon. The final detailed design must be sealed by a professional engineer licensed to practice in Yukon and must consider: a) the results of the subsurface investigation program specified in Clause 18; b) further characterization of the subgrade below the location of the DSTF, for the purpose of managing slope stability, and to determine specific locations of the drainage layers, ditches, and other up-gradient water diversions; c) the subgrade characterization must include field determination of the shallow soil profile including the nature and thickness of organics, and the nature and thickness of ice rich permafrost. The spatial density of characterization locations must be supported by an appropriate rationale; d) completed slope stability sensitivity studies related to potential excess porewater pressure that may develop during thawing of ice rich permafrost underlying the facility. The sensitivity analysis must identify triggers for monitoring of pore pressure during operations; e) the potential impacts of differential settlement resulting from thawing of underlying heterogeneous ice rich permafrost; and f) the installation of a geosynthetic liner beneath the expanded DSTF to containand capture any seepage that may occur from the facility in future and allow for treatment prior to release to the receiving environment.	Reporting	Conditional	
QZ18-044	Operating Conditions				By March 31 of each year, the Licensee must ensure all ditches and culverts are cleared of ice, snow and debris that would affect their operational capacity and be maintained free of such obstructions until at least October 31 of each year.	Task	Annually	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Operating Conditions	Waste Rock			Deposition of Waste Rock must be in accordance with the following: Bellekeno Mine: 2,073 tonnes of P-AML to Bellekeno P-AML Waste Rock Storage Facility Flame and Moth Mine: 12,000 tonnes of P-AML to Flame and Moth P-AML Waste Rock Storage Facility Flame and Moth Mine: 125,000 tonnes of N-AML to Keno Hill Silver District Mill Site New Bermingham Mine: 16,000 tonnes of P-AML to New Bermingham P-AML Waste Rock Storage Facility New Bermingham Mine: 190,000 tonnes of N-AML to New Bermingham Mine N-AML Waste Rock Disposal Area	Constraint	Daily	
QZ18-044	Operating Conditions	Waste Rock			The Licensee must segregate Waste Rock into N-AML Waste Rock and P-AML Waste Rock in accordance with the exhibit 1.5.3, Waste Rock Management Plan (WRMP) until such time as Clause 43 is fulfilled, after which time the Licensee must segregate Waste Rock into N-AML Waste Rock and P-AML Waste Rock in accordance with the updated WRMP	Task	Daily	
QZ18-044	Operating Conditions	Waste Rock			The Licensee must only deposit N-AML Waste Rock in accordance with Clause 21 unless N-AML Waste Rock is used for construction purposes as described in exhibit 1.5.3,WRMP and as updated in accordance with Clause 43.	Task	Daily	
QZ18-044	Operating Conditions	Waste Rock			Prior to the end of activities associated with processing ore, the Licensee must return all P-AML Waste Rock underground as mine backfill in accordance with the following: Bellekeno Mine: Materials - waste rock, tailings, cement; Max Amount (tonnes) - 21,904; Disposal location - Bellekeno. Fkame and Moth Mine: Materials - waste rock, tailings, cement; Max Amount (tonnes) 422,675; Disposal location - Flame and Moth. New Bermingham Mine: Materials - waste rock, tailings, cement; Max Amount (tonnes) 147,115; Disposal location - New Bermingham.	Constraint	Daily	
QZ18-044	Operating Conditions	Mill Pond			The Licensee must ensure that the Mill Pond has 2,750 cubic meters of available water storage capacity by April 1 each year.	Task	Annually	
QZ18-044	Plans		Water Treatment System Operation Manuals		Within 90 days of commissioning any new water treatment systems or amending existing water treatment systems, the Licensee must submit to the Board the water treatment systems operation manual or updated manual. The manual must include: a) details of all system components including: piping, tanks, treatment building, additives storage, flow capacity, filtration system, pond design details, pond volumes, discharge controls and details; b) description of treatment operations, including lime dosing and basis, mixing procedures, polymer additions, filtration, expected retention times in the ponds and basis for these times, bypass events, cold weather operations; c) maintenance activities being undertaken to keep the facility in good operating condition and minimize breakdowns, along with a schedule for these activities; d) monitoring that will be undertaken to determine influent quality and volumes and to confirm that discharge criteria are met; e) details on treatment of contaminants other than metals; and f) details about contingency plans and system flexibility to adapt to greater flows and poorer water quality than the system was designed for.	Reporting	Conditional	
QZ18-044	Plans		Tailings Characterization Plan		If a change to the TCP is required, the Licensee must submit the updated version to the Board prior to implementing the change.	Reporting	Conditional	
QZ18-044	Plans		Detailed Water Balance Report		The Licensee must update annually, and submit as part of the annual report, the detailed site-wide water balance report for the Keno Hill Silver District Mill Site and the Bellekeno and Flame and Moth and New Bermingham Mines. The updated report must include: a) a range of input hydrology scenarios which are based on an update of meteorological, stream flow, and groundwater parameters for the site areas including: i. updated meteorological inputs including precipitation, snowmelt, evaporation, and evapo-transpiration; ii. stream flow monitoring results; and iii. short-term and long-term mine inflow predictions. b) a water balance model capable of modelling all key phases of the project, accounting for production changes, changing surface and underground developments, surface and underground storage volumes, and changing water use requirements associated with the operations and closure phases of the Keno Hill Silver District Undertaking. i. a subset of the water balance model must specifically investigate and report on the groundwater, groundwater-surface water interactions and thefate of contaminated seepage/discharges which do not report directly tosurface water. ii. a subset of the water balance model must specifically investigate and report on the water balance of the DSTF that accounts for potential runoff, infiltration, and draindown seepage that may occur at this facility during operations and closure.	Reporting	Annually	
QZ18-044	Plans		Receiving Environment Study		The Licensee must report on the findings of the RES as part of the annual report.	Reporting	Annually	
QZ18-044	Plans		Receiving Environment Study		The study must be consistent with the goal of biological recovery of the Lightning Creek, Christal Creek and No Cash Creek drainages	Task	Annually	
QML-0009	Plans		Access Management Plan		Between May and October of each year, Alexco will inspect all roads constructed from N-AML which in this caseapply to the road because N-AML waste rock is to be used as construction material. Inspections will include: a) any physical instability including erosion; b) upstream ponding of water and downstream seepage; c) the location of ponding and seepage; d) the volume of flow, field pH and conductivity of ponding or seepage; e) visual evidence of sulphide oxidation including snow melt areas or the presence of oxidationproducts; and f) trends in pH, and conductivity for any recurring seepage or ponding location. The Adaptive Management Plan stipulates that seepage from all structures constructed of N-AML waste rockshall be sampled for field pH and conductivity and flow. Additional water quality analysis is to be conducted ifthe seepage quantity is sufficient	Inspection	Annually	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009	Plans		Access Management Plan		Pre-season reports will outline the amount of road and trails anticipated to be built and the associated amount of clearings. The post-season report will include quantities of trails and roads established and/or reclaimed along with the associated shape files for the roads and trails. Additionally, the report will also include sections of existing road upgraded. Photos of road and trail work will be included in the post-season report.	Reporting	Bi-annually	
QML-0009	Plans		Access Management Plan		Estimates of materials to be cleared will be provided in the pre-season report and actual amounts reported in the postseason report.	Reporting	Bi-annually	
QZ18-044	Plans		Receiving Environment Study		The Licensee must implement recommendations resulting from the RES	Task	Annually	
QZ18-044	Plans		Attenuation Study Plans		The Licensee must continue to implement exhibit 1.4.48, the No Cash Creek Attenuation Study Plan: Keno Hill Silver District Mining Operations (NCCASP)	Task	Annually	
QZ18-044	Plans		Attenuation Study Plans		The Licensee must submit interim results of the CCASP and NCCASP to the Board as part of the annual report.	Reporting	Annually	
QZ18-044	Plans		Hydrogeology Plan		The Licensee must submit all documentation and data produced by the HMP as part of the annual report and ensure all monitoring and reporting is certified by a professional hydrogeologist registered with a provincial regulatory organization.	Reporting	Annually	
QZ18-044	Plans		Hydrogeology Plan		The Licensee must submit to the Board site groundwater contour maps as part of the annual report. This submission must include a detailed assessment of flow patterns, including seasonal variability and underground mine influences	Reporting	Annually	
QZ18-044	Plans		Hydrogeology Plan		If the assessment carried out as per Clause 50 identifies any significant deviations from modelled values, the Licensee must update and submit the conceptual site groundwater model as part of the annual report.	Reporting	Annually	
QZ18-044	Plans		Hydrogeology Plan		Within 180 days prior to Permanent Closure, the Licensee must submit to the Board, a Keno Hill Silver District Mine Closure Hydrogeological Assessment report. The report must include the following: a) the results of the hydrogeological monitoring completed at the Keno Hill Silver District Undertaking; b) the predicted static water elevation underground after closure c) the predicted rate of discharge from the mines after closure; d) the predicted water quality discharging from the mines after closure; and e) the basis for these determinations.	Reporting	Conditional	
QZ18-044	Plans		Hydrogeology Plan		The Licensee must submit interim reports on the Keno Hill Silver District Mine Closure Hydrogeological Assessment as part of the updated RCP required in Clause 133.	Reporting	Annually	
QZ18-044	Plans		Bioreactor Design and Operation Plan		The Licensee must update the BDOP annually to account for any changes to the predicted closure water quantity or quality of discharges from the Bellekeno or Flame and Moth Mines.	Reporting	Annually	
QZ18-044			Hydrogeology Plan		Monitor groundwater wells based on Table 5.1 of the Hydrogeology Plan.	Sampling	Monthly	
QZ18-044	Plans		Bioreactor Design and Operation Plan		The Licensee must submit all documentation and data associated with the BDOP as part of the annual report.	Reporting	Annually	
QZ18-044	Plans		Adapative Management Plan		The Licensee must submit to the Board results of any activity related to the AMP being triggered, as part of the annual report.	Reporting	Annually	
QZ18-044	Plans		Environmental Monitoring, Surveillance and Reporting Plan	Physical Inspections and Reporting	The Licensee must implement the PIRP for all Engineered Structures associated with the Bellekeno 625 settling ponds, the Flame and Moth water treatment pond, New Bermingham settling ponds, the Historic Bermingham SW Open Pit, the VTBSSA, all N-AML Waste Rock disposal areas and all P-AML Waste Rock storage facilities, the access roads, the Flame and Moth Christal Creek and Lightning Creek discharge areas, DSTF, and Mill Pond.	Task	Annually	
QZ18-044	Plans		Environmental Monitoring, Surveillance and Reporting Plan	Physical Inspections and Reporting	The Licensee must inspect weekly, all structures identified in Clause 61 and submit inspection reports quarterly as part of the associated monthly report.	Reporting	Monthly	
QZ18-044	Effluent Quality Standards	Bellekeno			Discharge from the Bellekeno 625 water treatment systems at KV-43 must not exceed the following limits: Parameter,Maximum Concentration in a Grab Sample (in mg/L unless otherwise noted) pH 6.5 to 9.5 pH units Total Suspended Solids 25 Ammonia Nitrogen as N 5 Arsenic (total) 0.1 Cadmium (total) 0.01 Copper (total) 0.1 Lead (total) 0.2 Nickel (total) 0.5 Radium 226 0.37 Bq/L Silver (total) 0.01 Zinc (total) 0.5 96-hour Rainbow Trout LC50 at 100% concentration Non-toxic	Constraint	Daily	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Effluent Quality Standards	Flame and Moth			Discharge from the Flame and Moth water treatment systems at KV-104C must not exceed the following limits: Parameter Maximum Concentration in a Grab Sample(in mg/L unless otherwise noted) Discharge Rate 0-10 L/s 10.1-20 L/s 20.1-30 L/s 30.1-35 L/s pH 6.5 to 9.5 pH units Total Suspended Solids 15 Ammonia Nitrogen as N 6.5 3.7 2.7 2.4 Arsenic (total) 0.042 0.022 0.017 0.012 Cadmium (total) 0.0080 0.0060 0.0044 0.0042 Copper (total) 0.043 0.026 0.021 0.019 Lead (total) 0.043 0.023 0.018 0.016 Nickel (total) 0.5 Radium 226 0.37 Bq/L Silver (total) 0.001 0.00064 0.00053 0.00052 Zinc (total) 0.5 0.46 0.42 0.40 96-hour Rainbow TroutLC50 at 100% concentration Non-toxic This table can be found on page 25 of the water license QZ18-044.	Constraint	Daily	
QZ18-044	Effluent Quality Standards	New Bermingham			Discharge from the New Bermingham water treatment systems at KV-114 must not exceed the following limits: Parameter Maximum Concentration in a Grab Sample (in mg/L unless otherwise noted) pH 6.5 to 9.5 pH units Total Suspended Solids 25 Ammonia Nitrogen as N 5 Arsenic (dissolved) 0.061 Cadmium (dissolved) 0.01 Copper (dissolved) 0.024 Lead (dissolved) 0.048 Nickel (total) 0.37 Radium 226 0.37 Bq/L Silver (dissolved) 0.00062 Zinc (dissolved) 0.5 96-hour Rainbow Trout LC50 at 100% concentration Non-toxic This table can be found on page 26 of the water license QZ18-044.	Constraint	Daily	
QZ18-044	Effluent Quality Standards	KH District Mill Site			Discharge from the Keno Hill Silver District Mill Site water treatment systems at KV-83 must not exceed the following limits: Parameter Maximum Concentration in aGrab Sample (in mg/L unless otherwise noted) pH 6.5 to 9.5 pH units Total Suspended Solids 25 Ammonia Nitrogen as N 5 Arsenic (total) 0.1 Cadmium (total) 0.01 Copper (total) 0.1 Lead (total) 0.2 Nickel (total) 0.5 Radium 226 0.37 Bq/L Silver (total) 0.02 Zinc (total) 0.5 96-hour Rainbow Trout LC50at 100% concentration Non-toxic This table can be found on page 26 of the water license QZ18-044.	Constraint	Daily	
QZ18-044	Effluent Quality Standards				If the analysis of a water quality sample indicates an exceedance of the maximum concentrations for effluent quality standards, the Licensee must notify the Inspector and the Board in writing, within 24 hours of detecting the exceedance.	Reporting	Conditional	
QZ18-044	Monitoring and Surveillance	Monitoring Program			The Licensee must, in accordance with Schedule B3, monitor at the stations listed, for the parameters and at the frequency identified.	Sampling	Weekly	
QZ18-044	Monitoring and Surveillance	Monitoring Program			Laboratory analyses must be performed by a laboratory accredited under the International Organization for Standardization ISO/IEC 17025:2005 standard and the accreditation must include the actual tests being performed by the laboratory	Constraint	Conditional	
QZ18-044	Monitoring and Surveillance	Flow and Level Monitoring			The Licensee must record continuous stream flow water level data onto data loggers which are downloaded at least monthly with data submitted as part of the monthly report.	Reporting	Monthly	
QZ18-044	Monitoring and Surveillance	Flow and Level Monitoring			The Licensee must monitor KV-111 and KV-118 monthly for flow. If flow is present, manual measurements must be completed and data must be submitted as part of the monthly report.	Reporting	Monthly	
QZ18-044	Monitoring and Surveillance	Flow and Level Monitoring			The Licensee must maintain a staff gauge at the Keno Hill Silver District Mill Pond, record the pond level daily between April 1 and November 30 and submit data as part of the monthly report	Reporting	Monthly	
QZ18-044	Monitoring and Surveillance	Flow and Level Monitoring			The Licensee must install and maintain flow meters for all water withdrawals from surface and ground water sources, record the cumulative daily volume withdrawn from each water source and submit data as part of the monthly report	Reporting	Monthly	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Monitoring and Surveillance	Flow and Level Monitoring			The Licensee must monitor the total daily volume of discharge released from the mill to the Keno Hill Silver District Mill Pond and submit data as part of the monthly report	Reporting	Monthly	
QZ18-044	Monitoring and Surveillance	Flow and Level Monitoring			The Licensee must complete manual calibration of the continuous stream flow gauging stations which includes water level loggers, barometric loggers, staff gauges and/or weirs at least quarterly by a qualified professional	Sampling	Quarterly	
QZ18-044	Monitoring and Surveillance	Meteorological Monitoring		Meteorological Monitoring	The Licensee must maintain a meteorological monitoring station at the Keno Hill Silver District Mill Site. At a minimum, the station must collect data on precipitation, temperature, and wind speed and direction. Data collected must be submitted as part of the annual report	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Meteorological Monitoring		Meteorological Monitoring	The Licensee must establish snow survey courses at Keno Hill Silver District Mill Site, Bellekeno and New Bermingham sites, collect standard snow survey information from each site and submit data as part of the annual report.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Groundwater Monitoring			The Licensee must compare groundwater monitoring data to the Yukon Contaminated Sites Regulation (YCSR) Schedule 3: Generic Numerical Water Standards (Aquatic Life) and submit the data and analysis as part of the annual report.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Groundwater Monitoring	Groundwater Monitoring Plan		The Licensee must compare data from wells screened in the potable, or potentially potable aquifer near Keno City to the YCSR Schedule 3: Generic Numerical Water Standards (Drinking Water Standards) and submit the data and analysis as part of the annual report.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Groundwater Monitoring			The Licensee must submit all documentation and data produced by the Groundwater Monitoring Plan (GMP) as part of the monthly report and ensure all monitoring and reporting is certified by a professional hydrogeologist registered with a provincial regulatory organization.	Reporting	Monthly	
QZ18-044	Monitoring and Surveillance	Groundwater Monitoring			The Licensee must provide the Board with a summary of hydrogeological monitoring which interprets the sources of inflows and contaminant loads into the underground mine workings as part of the annual report.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Groundwater Monitoring			For those wells subject to freezing, pressure transducers must be installed as soon as wells are ice-free.	Task	Bi-annually	
QZ18-044	Monitoring and Surveillance	Sediment and Benthic Invertabrate Monitoring			The Licensee must submit to the Board as part of the annual report, data and results generated from the environmental effects monitoring program required by the Metal and Diamond Mines Effluent Regulation.	Reporting	Annually	
QZ18-044	General Conditions				The Licensee must submit an annual report to the Board for the period of January 1 to December 31 of each year. Annual reports are to be submitted on or before March 31 of the year following the year reported. The annual report must include the information required by the Regulation as well as: f. documentation and data produced by the HMP as required by Clause 49; g. updated site groundwater contour maps as required by Clause 50; h. if required by Clause 50, an update to the conceptual site groundwater model as required by Clause 51; x. all data generated as a result of the monitoring requirements of this licence, including analysis and interpretation by a qualified individual or firm and a discussion of any variances from baseline conditions or from previous years' data; analysis of predictions vs real data model trajectory; z. a discussion of any proposed changes to the monitoring programs or WQOs	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Sediment and Benthic Invertabrate Monitoring	Monitoring and Surveillance Plan		The Licensee must conduct sediment sampling as follows: a) sediment samples must be collected in replicates of three from the active channel, directly into high density plastic sample jars, using an aluminum or Teflon scoop; b) samples must be dried and screened, using sieves at ASTM mesh numbers 10, 20, 40, 60, 100, 140 and 270 (ASTM-E11-61) and the fraction weights must be recorded; and c) sub-samples composed of material passing and retained on the 100 mesh number sieve must be analyzed for metals by a 33 element ICP scan. Loss on ignition must also be determined by heating the sample to 600°C.	Sampling		
QZ18-044	Monitoring and Surveillance	Sediment and Benthic Invertabrate Monitoring	Monitoring and Surveillance Plan		The Licensee must conduct benthic invertebrate sampling as follows: a) three replicate samples must be taken from each station/area following the CABIN protocol; b) samples must be preserved with 10% formalin solution, and identified to the lowest possible taxon (usually genus) and counted; and c) stream information collected at the time of the benthos collection must include velocity, depth, temperature, substrate conditions and riparian conditions.	Sampling		
QZ18-044	Monitoring and Surveillance	Physical Inspections and Monitoring		Physical Inspections and Reporting	The Licensee must conduct weekly physical inspections of water retaining and conveyance structures, and associated mine waste and earthworks structures in accordance with the Keno Hill Silver District Physical Inspection and Reporting Plan and provide a summary as part of the annual report.	Inspection	Weekly	
QZ18-044	Monitoring and Surveillance	Physical Inspections and Monitoring		Physical Inspections and Reporting	If the Licensee identifies seepage from any water retaining structures, the Licensee must: a) report on the seepage as part of the next monthly report in accordance with the Keno Hill Silver District Physical Inspection and Reporting Plan; and b) provide a summary of any new seepage or ponding locations identified through inspection and assign a unique identifier consistent with monitoring stations in this Licence as part of the annual report.	Reporting	Conditional	
QZ18-044	Monitoring and Surveillance	Physical Inspections and Monitoring		Physical Inspections and Reporting	The Licensee must, within 60 days of the discovery of seepage from any water retaining structures, submit to the Board and implement a plan for collecting, testing, containing or managing the seepage. Reporting on the plan and any proposed mitiagtive actions are to be submitted as part of the annual report.	Reporting	Conditional	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Monitoring and Surveillance	Physical Inspections and Monitoring		Physical Inspections and Reporting	The Licensee must conduct an annual physical inspection of all Engineered Structures. The inspection must be conducted by a professional engineer licensed to practice in the Yukon. A report prepared by the professional engineer must be submitted as a part of each annual report and include: a) documentation of the inspection locations and methodologies; b) the results of the inspection; c) all problems identified; d) remedial measures recommended; e) the status of any remedial measures recommended in the previous year's report with an explanation regarding any recommendation not implemented; and f) actions taken or planned in response to any identified issues and/or to prevent recurrence.	Inspection	Annually	
QZ18-044	Monitoring and Surveillance	Physical Inspections and Monitoring		Physical Inspections and Reporting	The Licensee must monitor and complete Waste Rock inspection and monitoring as described in the WRMP. Data must be submitted as part of the annual report and include: a) a record the following during all inspections and provide the details as part of the annual report: b) any physical instability including erosion; c) upstream ponding of water and downstream seepage; d) the location of ponding and seepage; e) the rate of flow, field pH, conductivity and concentrations of ICP metals of ponding or seepage; f) visual evidence of sulphide oxidation including snow melt areas or the presence of oxidation products; and g) trends in pH, conductivity, and concentrations of ICP metals for any recurring seepage or ponding.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Waste Rock Monitoring		Waste Rock Monitoring	Between May and October of each year, the Licensee must inspect monthly the Waste Rock storage facilities, as described in the WRMP and submit data as part of the annual report.	Inspection	Monthly	
QZ18-044	Monitoring and Surveillance	Waste Rock Monitoring		Waste Rock Monitoring	The Licensee must provide to the Board a summary of the annual amount of Waste Rock, in tonnage that was brought to the surface and a percentage breakdown of the P-AML vs. N-AML for each mine as part of the annual report	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Co-mingled Tailings Monitoring			The Licensee must implement long term humidity cell tests of Co-mingled Tailings to ensure adequate representation of the Co-mingled Tailings deposited in the DSTF as each new ore body is mined, and shall be continued until the make up of the DSTF at the end of operations is known and a steady-state has been established. Results of the long term humidity cell tests must be submitted as part of the annual report.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Closure Water Treatment			The Licensee must submit to the Board a performance evaluation report for all closure treatment options as part of the annual report. The report must include: a) a summary of any ongoing mine pool treatment studies which includes: i. carbon injection frequency, volume, material used and dates of injections; ii. water quality comparison with previous years; iii. integrity of the injection system; iv. results of inspections; v. cost of labour/materials; and b) a summary of any ongoing natural attenuation treatment studies which includes: i. stream load capacity projections; and ii. effluent quality comparison with previous years.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance	Water Treatment Plants			The Licensee must submit a performance evaluation report for all water treatment plants as part of the annual report. The evaluation must be completed by a qualified person and include: a) an analysis of the plants' performances in terms of treatment efficiency, capacity, and compliance; b) a review of operators' daily logs, field monitoring data; and c) any recommended remedial actions and any actions taken by the Licensee.	Reporting	Annually	
QZ18-044	General Conditions	General			Where any direction, notice, order or report under this licence is required to be in writing, it shall be given to the Licensee, if delivered, e-mailed or mailed by registered mail, to the address identified on page 1 of this licence, and shall be deemed to have been given to the Licensee on the day it was delivered or e-mailed or 7 days after the day it was mailed, as the case may be.	Reporting	Conditional	
QZ18-044	General Conditions	Spills and Unauthorized Discharges			Where a spill or an unauthorized discharge occurs that is of a reportable quantity under the Yukon Spills Regulations, the Licensee must immediately contact the 24-hour Yukon Spill Report number, (867) 667-7244 and implement the Spill Contingency Plan. A detailed written report on any such event including, but not limited to, dates, quantities, parameters, causes and other relevant details and explanations, must be submitted to the Board not later than 10 days after the occurrence.	Reporting	Conditional	
QZ18-044	General Conditions	Spills and Unauthorized Discharges			The Licensee must review the Spill Contingency Plan annually and must provide a summary of that review, including any revisions to the plan, as a component of the annual report.	Reporting	Annually	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	General Conditions	Spills and Unauthorized Discharges			The Licensee must maintain a log book of all spills or unauthorized discharge occurrences, including spills that are less than the reportable quantities under the Yukon Spills Regulations. The log book must be made available at the request of an Inspector. The log book must include, but not necessarily be limited to the: a) date and time of the spill; b) substance spilt or discharged; c) approximate amount spilt or discharged; d) location of the spill; e) distance between the spill or discharge and the nearest Watercourse; and f) remedial measures taken to contain and clean-up the spill area or to cease the unauthorized discharge.	Task	Conditional	
QZ18-044	General Conditions	Spills and Unauthorized Discharges			The Licensee must include a summary of all spills or unauthorized discharges that occur, as part of the monthly reports, within 30 days of the spill occurrence	Reporting	Monthly	
QZ18-044	General Conditions	Spills and Unauthorized Discharges			The Licensee must ensure all relevant personnel are trained in procedures to be followed and the equipment to be used in the containment of a spill.	Task	Daily	
QZ18-044	General Conditions	Spills and Unauthorized Discharges			The Licensee must post the Spill Contingency Plan on site for the duration of the project	Task	Daily	
QZ18-044	General Conditions	Fuel and Hazardous Materials Storage and Transfer			The Licensee must maintain an inventory, complete with Safety Data Sheets of all chemicals, fuels, oils, lubricants and other hazardous materials used in the undertaking. This inventory must be submitted to the Board as part of the annual report.	Reporting	Annually	
QZ18-044	General Conditions	Fuel and Hazardous Materials Storage and Transfer			The Licensee must store and/or transfer fuel, lubricants, hydraulic fluids, coolants and similar substances a minimum of 30 metres from the Natural Boundary of any Watercourse, in such a way that said substances are not deposited in or allowed to be deposited in waters.	Constraint	Daily	
QZ18-044	General Conditions	Annual Reports			The Licensee must submit an annual report to the Board for the period of January 1 to December 31 of each year. Annual reports are to be submitted on or before March 31 of the year following the year reported. The annual report must include the information required by the Regulation as well as: a) a description of the water use operations carried out during the year reported; b) the quantity of water used each day from each identified water source; c) the annual update to the detailed water balance report as required by Clause 32; d) the findings of the RES as required by Clause 35; e) interim results of the CCASP and NCCASP as required by Clause 40; f) documentation and data produced by the HMP as required by Clause 49; g) updated site groundwater contour maps as required by Clause 50; h) if required by Clause 50, an update to the conceptual site groundwater model as required by Clause 51; i) documentation and data produced by the BDOP as required by Clause 57; j) a description of any work carried out or planned to be carried out under the AMP as required by Clause 59; k) an annual update on the Operation and Maintenance Plan as required by Clause 63; l) meteorological monitoring data as required by Clause 80-81; m) sediment and benthic invertebrate monitoring data as required by Clause 88; n) a detailed record of any major maintenance work carried out or planned to be carried out that could have an impact on water; o) a summary of physical inspections and monitoring as required by Clause 91, 92b, 94 and 95; p) A summary of the results of implementing the seepage containment plan as required by Clause 93; q) waste rock monitoring data as required by Clause 96 and 97; r) Co-mingled Tailings monitoring as required by Clause 98; s) a performance evaluation report for closure water treatment options as required by Clause 99; t) a performance evaluation report for all water treatment plants as required by Clause 100; u) a summary of any revisions to the Spill Contingency Plan as required by Clause 111; v) any updates to the fuel and hazardous materials inventory or SCP as required by Clause 116; w) a report on the status of the RCP and any updates to the RCP that have occurred since the previous submission which include: i. an update based on information available at the time of report which includes the actual progress on execution of the Mine Plan and the best judgement of mine management; and, ii. the current liability for closure of the mine exceeds or does not exceed the security held at the end of the year for which the annual report has been prepared. x) all data generated as a result of the monitoring requirements of this licence, including analysis and interpretation by a qualified individual or firm and a discussion of any	Reporting	Annually	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	General Conditions				Unless otherwise specified in this Licence, the Licensee must submit to the Board a copy of all monitoring data no more than 30 days after the conclusion of the month in which that data was collected. Monthly reports must include: a) a summary of recent groundwater monitoring well(s) installation as required by Clause 47, when applicable; b) a summary of all surface water level and flow monitoring as required by Clauses 73-78; c) a summary of the weekly inspections as outlined in the Keno Hill Silver District Physical Inspections and Reporting Plan which are submitted quarterly as required by Clause 62; d) a summary of any identified seepage as required by Clause 92a; e) a summary of all spills or unauthorized discharges as required by Clause 113; and f) all data collected in accordance with Schedule B3.	Reporting	Monthly	
QZ18-044	General Conditions	Deliverables			The Licensee shall provide to the Board, one unbound, single-sided, paper copy of all deliverables required by this Licence. All deliverables, with the exception of design drawings, must be reproducible by standard photocopier	Reporting	Conditional	
QZ18-044	General Conditions	Deliverables			The Licensee must upload electronic copies of all deliverables required by this Licence to the Yukon Water Board's online licensing registry. Electronic copies must be submitted in one of the following formats: MS Word, MS Excel, or Adobe .pdf format. Water quality results must be in the format outlined in the Laboratory Data Submission Standards for Water Quality, as amended from time to time and available on the Board website.	Reporting	Conditional	
QZ18-044	Reclamation and Closure	Deliverables	Reclamation and Closure Plan		The Licensee must updated and submit to the Board the RCP and Cost Estimate every two years (after 2021) on or before November 27 of the second year	Reporting	Bi-annually	
QML-0009	Part III - Development and Implementation of Plans	Reclamation and Closure Plan	Reclamation and Closure Plan		7.2 The Licensee must submit to the director an updated reclamation and closure plan on every second anniversary of the effective date of the QML	Reporting	Bi-annually	
QML-0009	Part III - Development and Implementation of Plans	Design			9.1 At least sixty (60) days prior to commencing any construction of an engineered structure, the Licensee must submit to the Director detailed designs of the structure stamped or sealed by an engineer.	Reporting	Conditional	
QML-0009	Part V - Financial Security				11.2 The Licensee acknowledges that the amount of security to be furnished and maintained will be reviewed and adjusted by the Minister no less than once every two years in accordance with the Security Regulations, OIC 2007/77.	Reporting	Annually	
QML-0009	Part VI - Audits and Reporting	Environmental Audit			12.1 The Licensee must carry out an environmental audit, to be undertaken by an independent contractor acceptable to the Director, no later than September 1st in every second (2nd) year from the effective date, to determine if the environmental protection plans and regulatory controls set out in this License are sufficient to ensure that the environmental quality at, in and around the mine is being protected and that the environmental management systems and controls are functioning as intended.	Reporting	Annually	
QML-0009	Part VI - Audits and Reporting	Environmental Audit			12.3 Within sixty (60) days of an environmental audit being completed, the Licensee must provide the Director with a copy of the audit and a report detailing any remedial action to be undertaken by the Licensee in response to the audit.	Reporting	Conditional	
QML-0009	Part VI - Audits and Reporting	Reporting and Inspections			13.1 The site characterization report must be submitted by the Licensee on or before March 31, 2020. The report must be updated every three (3) years from the effective date of this License, unless the Director directs, in writing, that the report must be updated on a more frequent basis. Descriptions of the environmental conditions at the site must be accompanied by supporting data and analysis demonstrating a suitable understanding of site-specific environmental conditions.	Reporting	Annually	
QML-0009	Part VI - Audits and Reporting	Physical Inspections and Monitoring			13.2 The Licensee must ensure that an inspection of the physical stability of all engineered structures, works and installations located at the site is condcted by an independent engineer by September 1 of each year of the term of this License, including the dry stack tailings facility, the waste rock and overburden storage facilities, the underground workings, ore stockpiles, mill site, camp sites, any diversion structures or dams and any other engineered facilities or works assoicated with the Undertaking.	Inspection	Annually	
QML-0009	Part VI - Audits and Reporting	Reporting and Inspections			13.3 Within ninety (90) days of the inspection referred to in paragraph 13.2, the Licensee must submit to the Director and the Inspector a written report prepared by the engineer that conducted the annual inspection documenting the results of the inspection, including a (a) summary of the stability, integrity and status of all of the inspected structures, works, and installations; and (b) any recommendations for remedial actions made as a result of the investigations and evaluations.	Reporting	Conditional	
QML-0009	Part VI - Audits and Reporting	Reporting and Inspections			13.4 The Licensee must take immediate steps to implement any of the recommendations for remedial action made as a result of the inspection referred to in paragraph 13.2 of this License and provide to the Director and the Inspector a written statement detailing how and when each of the recommendations for remedial action will be addressed.	Reporting	Conditional	
QML-0009	Part VI - Audits and Reporting	Reporting and Inspections			13.5 The Licensee must (a) evaluate data gathered as a result of implementation of the monitoring and surveillance plan twice per year; (b) develop and implement a program to take immediate steps to address any results from the monitoring and surveillance activities that indicate any change in environmental performance of the Undertaking or non-compliance with the Act, the Regulation, this License or any of the approved plans; and (c) provide the Director with a statement detailing the program referred to in paragraph and summarizing the action taken to address the change or non-compliance.	Reporting	Bi-annually	
QML-0009	Part VI - Audits and Reporting	Reporting and Inspections			13.6 Within sixty (60) days of completing construction of any engineered facilities, the Licensee must submit a report to the Director containing: (a) as-built drawings of all structures, works and installations constructed; and November 27, 2019 Alexco Keno Hill Mining Corp Quartz Mining License QML-0009 Page 13 of 29 (b) a summary and results of any quality assurance or quality control monitoring conducted by or for the Licensee in the course of constructing the structures, works and installations.	Reporting	Conditional	
QML-0009	Part VI - Audits and Reporting	Reporting and Inspections			13.7 On or before March 31 of each year of the term of this License, the Licensee must submit an annual report, in writing, containing the information set out in Schedule D covering the period of January 1 to December 31 of the prior year	Reporting	Annually	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009		Annual Reports			Schedule D - Annual Report must following info for Site Activities: (a) a summary of construction activities associated with the Undertaking; (b) a summary of mining activities; (c) a map showing the status of all structures, works, and installations associated with the Undertaking; (d) the total amount of ore and waste removed from the underground workings for the year and for the life of the Undertaking; (e) the total amount and the average head grade of ore milled; (f) the total amount of concentrate produced and removed from the Undertaking; (g) the total amount of tailings deposited in the dry stack tailings facilities; (h) the amount of pyritic and other tailings disposed of underground and the location of its deposition; (i) the total amount of waste rock removed from the mine and the amount deposited into each deposit location; (j) the total amount of waste rock stored in each waste rock storage facility; (k) a summary of the previous and projected use of mine site and access roads, including maintenance work conducted; (l) details respecting any action taken as a result of the recommendations made by the engineer in relation to the inspection referred to in section 13.2 of QML -0009; (m) details respecting the results of the ground conditions and support audit, for each mine area; (n) a summary of any updates to estimates of ore reserves and the life of the mine, including reserve category, tonnage and grade; (o) the total amount and the average grade of each ore stockpiled; and (p) the remaining reserve life of the mine.	Reporting	Annually	
QML-0009		Annual Reports			Schedule D - Annual Report must following info for Environmental Monitoring: (a) a summary of the programs undertaken for environmental monitoring and surveillance as outlined in the Environmental Monitoring, Surveillance and Reporting Plan and the Wildlife Protection Plan, including an analysis of these data and any action taken or adaptive management strategies implemented to monitor or address any changes in environmental performance; (b) a summary of humidity cell or other geochemical tests undertaken on waste rock; (c) a summary of the results of the waste rock quality assurance/quality control monitoring for the past year; (d) a summary of results on the DSTF cover performance: specifically addressing seeps collected from the toe of the DSTF, volume of the seeps monitored, and an estimate of the reduction in precipitation infiltration from the area of the DSTF that was covered (e) a summary of invasive plants that have been identified on site and measures taken to control or remove invasive plants; (f) a summary of all spills and accidents that occurred at the site and measures taken respond to any spills or accidents, whether reported to the Yukon spills line or another Yukon government authority; (g) a summary of the level of traffic, access control issues, wildlife incidents and other; accidents, and any upgrade or maintenance work planned for the upcoming year; and (h) a summary of all dust, noise, and traffic related incidences as reported by the public and residents of Keno City; and (i) a summary of any site improvements undertaken to address sediment and erosion control	Reporting	Annually	
QML-0009		Annual Reports			Schedule D - Annual Report must following info for Physical Monitoring: (a) a summary of any underground stability incidents; (b) a summary of data collected to date as part of the Physical Monitoring Program; (c) details of results, including data collected, for the physical monitoring program;	Reporting	Annually	
QML-0009		Annual Reports			Schedule D - Annual Report must following info for Reclamation and Closure: (a) any temporary closure or permanent closure that has occurred during the year; (b) a summary of activities related to care and maintenance of the Undertaking, including any temporary closure activities if applicable; (c) a summary of progressive and ongoing reclamation activities; (d) a summary of proposed development and production and reclamation activities for the coming year; and (e) a summary of reclamation research and results.	Reporting	Annually	
QML-0009		Annual Reports			Schedule D - Annual Report must following info for Socio-Economic Monitoring: (a) a summary of action taken by the Licensee with respect to implementation of the “Keno City Socio-Economic Mitigation Plan” described in YESAB 2013-0161 Decision Document condition 33; and (b) a summary of action taken by the Licensee with respect to engagement with Keno City residents in developing the Noise Monitoring and Mitigation Plan.	Reporting	Annually	
QML-0009	Schedule C	Physical Inspections and Monitoring	Mine Development and Operations Plan		A ground conditions and support audit, for each mine area, must be carried out by an independent engineer on an annual basis and the results of this audit shall be reported in the inspection required in 13.2 of the License (by September 1 of each year)	Reporting	Annually	
QML-0009	Schedule C		Adapative Management Plan		When the treatment ponds are discharging, daily water quality samples are taken at the mine sites and analyzed on-site for zinc, ammonia, turbidity, total suspended solids (TSS), temperature, conductivity, and pH as well visual observations of the settling ponds are made, and equipment operating status verified. Results of on-site testing and measurements are recorded in a daily tracking spreadsheet which incorporates predefined set point triggers that flag conditions where changes to plant settings are required.	Sampling	Daily	
QML-0009	Schedule C		Adapative Management Plan		Weekly water quality samples of effluent discharge and untreated mine water are submitted to an external laboratory for analysis of inductively coupled plasma (ICP) metals analysis (total and dissolved), Ammonia-N, Nitrite-N, Nitrate-N, phosphorous, sulphate, dissolved organic carbon (DOC), hardness, alkalinity, TSS, pH and conductivity. Tests to determine acute lethality of effluent discharge on rainbow trout, 96-h LC50 (median lethal concentration) at 100% concentration, are conducted monthly. The frequency of sublethal toxicity testing and Radium 266 on the effluent discharge is in accordance with federal Metal and Diamond Mine Effluent Regulations (MDMER).	Sampling	Weekly	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009	Schedule C		Adapative Management Plan		All data for water sample stations required in the WL QZ18-044 are stored in an EQWin database that allows water quality and quantity to be tracked at each site such that conditions can be identified at any point in the season. Results of the evaluation are reported to the Environment Department immediately	Reporting	Weekly	WTP
QML-0009	Schedule C		Adapative Management Plan		Discharge flow rates from the underground workings at each mine are monitored continuously via a totalizer flow meter. The data from the flowmeter and totalizer is downloaded daily and analyzed monthly. The average daily totalized flow for each month will be compared with the trailing 24 months of water flow to establish trends and to determine significant deviation from the trends.	Reporting	Monthly	
QML-0009	Schedule C		Adapative Management Plan		All monthly and annual reports are provided to FNNND.	Reporting	Monthly	
QML-0009	Schedule C		Adapative Management Plan		An annual report is also submitted under QML-0009 and with Environment Canada as required under the MDMER	Reporting	Annually	
QML-0009	Schedule C		Adapative Management Plan		Review and data quality checks are completed following each monitoring event. Set point triggers are in place in the site tracking spreadsheet and EQWin database so that response parameters are flagged for notification and action. Any thresholds crossed or triggers activated would be identified and the relevant parties notified as listed in Table 3-2 and Table 3-8, of AMP, and management's response and next steps to be taken included in monthly reports.	Reporting	Weekly	Ensero
QML-0009	Schedule C		Adapative Management Plan		Any seeps below the Bermingham SW pit or VTBSSA observed between May and October will be monitored for estimated flow volume, field pH and conductivity. This monitoring occurs in conjunction with the monthly regional surface and groundwater monitoring program which is carried out by competent, trained field operators.	Sampling	Monthly	
QML-0009	Schedule C		Adapative Management Plan		The toe of the New Bermingham water rock disposal area and those sections of the Keno City Bypass Road constructed of waste rock are monitored to detect seeps during the seasonal monthly monitoring program. Should seeps be detected, monitoring stations will be established. These stations will be monitored monthly between May and October for flow, pH, temperature, conductivity, and zinc. Runoff accumulating with the DSTF diversion ditch following freshet is also monitored and sampled.	Reporting	Monthly	
QML-0009	Schedule C		Adapative Management Plan		Inspections of waste rock disposal facilities are conducted monthly between May and October by the Engineering Department to ensure their structural integrity and that runoff and discharge is being appropriately managed.	Inspection	Monthly	
QML-0009	Schedule C		Adapative Management Plan		Should soil erosion be observed at a WTP or Mill Pond discharge site that results in flow path channelization, depression with defined edges or impaired plant growth observed below a discharge to ground, site or at the Flame and Moth discharge site into Lightening Creek results in degradation of the uphill slope, the specific water quality indicators that should be mointored at the receiving environment sites include sulphate, arsenic, cadmium, copper, nickel, lead, silver, and zinc. The results are to be compared to site specific WQOs (Table 3-18) of the AMP.	Inspection	Daily	
QML-0009	Schedule C		Adapative Management Plan		In Q2 2023 a statistical analysis will be completed of dust monitoring data to evaluate the appropriate monitoring frequency.			
QML-0009	Schedule C		Adapative Management Plan		Annual reports are submitted as part of Water Licence QZ18-044 and the Quartz Mining License QML-009. The annual reports include summaries of all activities carried out under the AMP including a summary of the comparisons and inspections conducted and any actions taken. Detailed comparisons of monitoring results to action levels, the status of responses to AMI triggers are reported in the Water Licence monthly reports. The annual reports include a description of any work carried out or planned to be carried out under the AMP. All monthly and annual reports are provided to the FNNND.	Reporting	Annually	
QML-0009	Schedule C		Adapative Management Plan		Annual reporting would include the rationale for modifying the AMP if site conditions were to change. The AMP should be modified whenever monitoring data demonstrate a sustained deviation from previous trends in the data or there is an identification of physical conditions of mine workings or infrastructure that may lead to adverse effects. Technological developments, system changes and changing environmental conditions warrant a modification to the AMP.	Reporting	Annually	
QZ18-044			Birmingham WTF Operations Manual		Monthly LT50 bioassay sampling of settling pond decant (KV-114);	Sampling	Monthly	
QZ18-044			Birmingham WTF Operations Manual		Weekly sampling of settling pond decant (KV-114) and adit discharge (KV-110) for external lab analysis;	Sampling	Weekly	
QZ18-044			Birmingham WTF Operations Manual		Checking the plant is operating effectively on a daily basis: • Sampling and internal assays for zinc using the atomic absorbance spectroscopy machine from the plant feed (KV-110) and settling pond decant (KV-114); • Sampling and internal assays for TSS using filtration equipment; • Sampling and internal assays for ammonia using the site Hach HQ40d from the plant feed (KV-110) and settling pond decant (KV-114); • Sampling and internal assays for free and total chlorine using the site Hach DR300 from the plant feed (KV-110) and settling pond decant (KV-114); • Check that there is flow into the reactor tank from the lime and floc lines; • Check the plant is discharging into the settling pond and no obvious leeks are present near the plant or pond; • Calibration of the pH probes within the plant; • Periodically checking the PLC to ensure no alarms are present; and • Check reagent levels	Sampling	Daily	
QML-0009	Schedule C		Dust Abatement and Monitoring Plan		AKHM will notify Keno City residents regarding traffic increases, operation schedules and potential dust generating events.	Reporting	Conditional	
QML-0009	Schedule C		Dust Abatement and Monitoring Plan		AKHM will record the dust disturbance claim in the Dust Disturbance Register and will notify the complainant that the claim has been recorded	Reporting	Conditional	
QML-0009	Schedule C		Dust Abatement and Monitoring Plan		Any entries received will be summarized in the quarterly air quality monitoring reports and the annual reporting for the Quartz Mining License	Reporting	Quarterly	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009	Schedule C		Dust Abatement and Monitoring Plan		Results from the dust monitoring will be summarised and compared against the Yukon Ambient Air Quality Standards and will summarise any actions taken in response to thresholds outlined in the Adaptive Management Plan	Reporting	Annually	
QML-0009	Schedule C		Dust Abatement and Monitoring Plan		Chemical dust suppressant (calcium chloride or similar) will be applied to the roads when required in addition to the road watering that will be carried between chemical dust suppressant applications	Sampling	Conditional	
QML-0009	Schedule C		Dust Abatement and Monitoring Plan		Dust suppressant could be applied to the DSTF. Including the application of a tackifier product to the exposed tailings surfaces (as final slopes or benches are completed), to reduce potential wind erosion prior to progressive reclamation	Sampling	Conditional	
QML-0009	Schedule C		Dust Abatement and Monitoring Plan		On a monthly basis a total of nine samples are collected at each site (3 samples for each filter inlet size) and sent to Bureau Veritas Laboratories for gravimetric analysis and ICP metals mass spectrometry for the TSP jet sample only	Sampling	Monthly	
QML-0009	Schedule C		Explosives Management Plan		A register for the list of authorized personnel will be developed, and a daily sign-in/out log for persons entering the magazine will be maintained.	Reporting	Daily	Manager of Mines
QML-0009	Schedule C		Explosives Management Plan		Agreement to jointly develop the detailed Emergency Response Plan and Security Plan. The Emergency Response Plan will provide details on emergency responses to instances involving explosives and the materials used to manufacture explosives on-site. The Security Plan will address security measures for the project's explosives facilities.	Reporting	Conditional	
QML-0009	Schedule C		Explosives Management Plan		As required by the regulatory and permitting requirements for explosives use, the following records will be maintained at the mine site: • Blasting and explosives related permits and licences; • Training records and certificates from blasting crew and mine development contractor; • Records of the inventory inspections on the explosives storage facilities and magazines; • Records of explosive withdrawals from explosives storage facilities and magazines; • Design plans of the explosives storage areas and magazines; • Records of the explosives delivery; • Climate data for explosive storage facilities and magazines to ensure that temperature thresholds have not been exceeded; • Blaster's log indicating the pre-blast loading details and results of the post-blast site inspection (i.e., date, blast number, blast layout, explosive quantities used and name of person initiating the blast); and • Records of any disposal of explosives.	Reporting	Daily	Manager of Mines
QML-0009	Schedule C		Explosives Management Plan		Both the contractor and AKHM will keep records of the inventories and inspections, and provide weekly reports to Mine Manager	Reporting	Weekly	Manager of Mines
QML-0009	Schedule C		Explosives Management Plan		Mine development contractor and AKHM will be responsible to perform weekly inventories at the explosives storage areas and magazines that store ammonium nitrate, emulsion, dynamite, boosters, delays, lead-in lines and detonating cords	Reporting	Weekly	Metallurgist
QML-0009	Schedule C		Explosives Management Plan		Record in the daily examination and report book the location of any misfired shot remaining at the end of the shift.	Reporting	Conditional	
QML-0009	Schedule C		Explosives Management Plan		Records of quantity of each explosive issued to the mine site including the dates of shipments and quantity of each explosive on-site will be maintained.	Reporting	Daily	Manager of Mines
QML-0009	Schedule C		Explosives Management Plan		The blaster will be responsible for noting and reporting any modifications due to field conditions and filing all paperwork for any explosives delivery including quantity information and each blast undertaken.	Reporting	Conditional	
QML-0009	Schedule C		Explosives Management Plan		AKHM will determine and monitor water quality monitoring locations to evaluate the downstream effect of explosives use; and water samples will be collected and analyzed to ensure all water leaving the mine site is in accordance with the most current water use license if a spill occurs.	Sampling	Conditional	
QZ18-044			Groundwater Monitoring Plan		Groundwater monitoring will follow the schedule as described in Table 8-1 in the Groundwater Monitoring Plan.	Sampling	Monthly	
QML-0009	Schedule C		Heritage Resource Protection Plan		A summary of heritage activities will be included as part of the annual reporting for the Quartz Mining License. The summary will include any activities recommended by the HROA including HRIA's conducted, as well as any other activities related to heritage within the district.	Reporting	Annually	
QML-0009	Schedule C		Heritage Resource Protection Plan		With the possible aforementioned exception, no activities will occur in the vicinity of known heritage resources unless approved in writing by the appropriate authorities. Before commencing any project activities that may disturb known heritage resources, the area would be appropriately marked in the field. Development is prohibited within 30 m of a known or suspected heritage site.	Constraint		
QZ18-044			Hydrogeology Plan		If well permeable tests are conducted during the calendar year, documentation in the annual report for each test will include: • Type of test performed and description of the test procedure; • Relevant time – drawdown plots used for analysis; • Interpretation of data plots with regard hydrologic characteristics such as well loss, wellbore storage, significance of fracture flow, presence of hydrologic boundaries, delayed yield, etc.; and • Calculations used to estimate transmissivity and average hydraulic conductivity of geologic materials within the test interval	Reporting	Conditional	
QML-0009	Schedule C		Management Health and Safety Program		Alexco operates a fleet of equipment, hand and electrical tools. Each piece of equipment has an Equipment Log Book. When each unit has been serviced or any work performed there will be an entry place in the logbook	Reporting	Conditional	
QML-0009	Schedule C		Management Health and Safety Program		All accident/incidents resulting in injury must be reported to immediate supervisor. If an injury is severe enough to require medical attention this report must be forwarded to Workers Compensation Board within three days of the accident as per legislation.	Reporting	Conditional	
QML-0009	Schedule C		Management Health and Safety Program		The Hazard Identification Checklist is completed during the initial inspection	Reporting	Conditional	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009	Schedule C		Explosives Management Plan		Records of quantity of each explosive issued to the mine site including the dates of shipments and quantity of each explosive on-site will be maintained. The following management practices will be implemented: • Mine development contractor and AKHM will be responsible to perform weekly inventories at the explosives storage areas and magazines that store ammonium nitrate, emulsion, dynamite, boosters, delays, lead-in lines and detonating cords; • The amounts of blasting materials used and remaining available will be provided to the Mine Manager on a daily and weekly basis; and • Both the contractor and AKHM will keep records of the inventories and inspections, and provide weekly reports to Mine Manager	Inspection	Weekly	
QML-0009	Schedule C		Management Health and Safety Program		The joint worksite health and safety committee hold meetings once per month. Minutes of the committee meetings will be kept with a copy posted on the message board located in the camp kitchen common area.	Reporting	Monthly	
QML-0009	Schedule C		Management Health and Safety Program		Should a spill of reportable quantity occur, under federal and territorial regulations, we are required to immediately notify the 24-hour Yukon Spill Report line: telephone number 867-667-7244. A detailed written report on any such event including, but not limited to, dates, quantities, parameters, causes and other relevant details and explanations, must be submitted to the Board not later than 10 days after the occurrence.	Reporting	Conditional	
QML-0009	Schedule C		Management Health and Safety Program		On a three times per annual basis the bucking room will be monitored for respirable dust and total dust.	Sampling	Bi-annually	
QML-0009	Schedule C		Management Health and Safety Program		On a three times per annual basis the crusher plant will be monitored for respirable dust and total dust.	Sampling	Bi-annually	
QML-0009	Schedule C		Management Health and Safety Program		On a three times per annual basis the Mill Building and ore handling areas will be monitored for respirable dust and total dust.	Sampling	Bi-annually	
QML-0009	Schedule C		Management Health and Safety Program		On a three times per annual basis underground workings will be sampled for respirable dust, total respirable dust and respirable combustible dust.	Sampling	Bi-annually	
QML-0009	Schedule C		Emergency Response Plan		It is the responsibility of the IMT Leaders to audit this plan regularly, suggest amendments where necessary and liaise with Keno Hill Health & Safety for implementation	Task	Monthly	
QML-0009	Schedule C		Emergency Response Plan		Following notification of a disaster of a magnitude requiring the assembly of the IMT, the General Manager or Mine Manager will call the Department Manager or their designate of the affected area and the personnel below. The sequence of calls should be: • Mine General Manager (if it was not the General Manager who called the IMT initially); • Department Manager or designate of the affected area; • Additional Department Managers as required; and • Emergency Response Coordinator.	Task	Conditional	HS
QML-0009	Schedule C		Emergency Response Plan		It is the responsibility of the Manager, H&S to ensure all sections of the plan are kept current, are being implemented and concurrent training activities are taking place. The plan is to be reviewed annually to ensure the accuracy of information	Task	Annually	HS
QML-0009	Schedule C		Emergency Response Plan		The Health and Safety Manager is responsible for coordinating the development of and initiating of drills and exercises.	Task	Bi-annually	HS
QML-0009	Schedule C		Emergency Response Plan		Life support equipment (i.e. self-contained breathing apparatus) is to be tested in accordance with the manufacturer's specifications to ensure its reliability, and records of all tests are to be maintained by the ERT Coordinator.	Task	Annually	HS
QML-0009	Schedule C		Emergency Response Plan		A list of vendors capable of providing immediate emergency re-supply of items expended during sustained operations is to be maintained by the ERT Coordinator.	Task	Annually	HS
QML-0009	Schedule C		Emergency Response Plan		The Mine Emergency Response Plan will be reviewed annually by the Mine General Manager, Health & Safety Manager, ERT Coordinator(s) and OHSC	Task	Annually	HS
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Physical Inspections and Reporting	All monthly and annual reports are provided to FNNND	Reporting	Monthly	Environment
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Waste Rock Monitoring	As part of annual reports for the Quartz Mining License and Water Licence a waste rock management summary report will be submitted presenting the results for all of the static and kinetic data generated from the Waste Rock Management Plan in a given year.	Reporting	Annually	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Reclamation Effectiveness Monitoring Program	Monthly and annual reporting will be carried out during mine development activities and through the implementation of site decommissioning until it can be demonstrated through the monitoring results that the final closure objectives have been achieved	Reporting	Monthly	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Physical Inspections and Reporting	The Licensee must conduct an annual physical inspection of all Engineered Structures. The inspection must be conducted by a professional engineer licensed to practice in the Yukon.	Reporting	Annually	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Noise Monitoring	AKHM will conduct instantaneous noise monitoring at specific locations, if it is warranted by a noise complaint.	Sampling	Conditional	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	EEM	Effluent Characterization: Quarterly sampling from final discharge point includes extra parameters	Sampling	Quarterly	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	EEM	Fish Tissue Studies: Only required if concentrations in effluent is equal to or greater than 0.1 µg/l or ppb – as determined by the effluent characterization program)	Sampling	Conditional	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	Water Surveillance Network	Groundwater wells are scheduled for monthly monitoring for both water level and quality for 12 months to establish well conditions, followed by quarterly sampling thereafter for the duration of the project, as per Clause 87(a).	Sampling	Monthly	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	Physical Inspections and Reporting	If any seepage is noted from any water retaining structures it will be noted on the next monthly inspection report and a plan will be in place sample, test and manage the discharge within 60 days of the discovery.	Sampling	Conditional	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Reclamation Effectiveness Monitoring Program	Monitoring will be completed to assess the effectiveness of the progressive reclamation activities completed on an annual basis.	Sampling	Conditional	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Water Surveillance Network	One field blank is collected per monthly event and is completed by taking de-ionized water (analyte free media) to the sample station, opening it and exposing it to ambient air and 'collecting' it in the sample bottles.	Sampling	Monthly	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	Water Surveillance Network	One travel blank will accompany the samples for each monthly event and will be analysed for the same parameters as the routine samples.	Sampling	Monthly	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Permafrost Monitoring	Prior to construction of the DSTF expansion, the Licensee must conduct a subsurface investigation program and submit the results of that investigation to the Board. The program must provide for representative sampling from the entire footprint of the DSTF expansion and include, but not be limited to: a)a minimum of 12 holes advanced to bedrock using a drill capable of recovering undisturbed frozen overburden samples; b)installation of sub-surface monitoring instrumentation including slope indicators and ground temperature cables; and c)laboratory testing of samples for shear strength, particle size and moisture content,	Sampling	Conditional	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	EEM	Sediment sampling: see table 3-2 Station/Sediment Sampling/Benthic Sampling KV-38/Annual/ Annual KV-41/ Annual /Annual KV-6 /Biannual /Biannual KV-21 /Annual/ Annual KV-42 /Annual/ - KV-82 /Annual /- KV-104L /Annual/ - KV-104C/ Annual/ - KV-111/ Annual/ Annual	Sampling	Annually	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	Water Surveillance Network	Should flow be present at site KV-11 and KV-118, manual measurements will be completed, and data submitted as part of monthly report, as per part H, Clause 75. Instantaneous measurements of flow are also collected during monthly/quarterly sample events at all stations possible.	Sampling	Conditional	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	EEM	Sublethal Toxicity Testing: Semi-annual sampling required at each final discharge point and analysis of effects on reproduction or growth of a fish species, a plant species, an invertebrate species and an algal species as acceptable to MDMER.	Sampling	Bi-annually	
QZ18-044	Monitoring and Surveillance		Environmental Monitoring, Surveillance and Reporting Plan	Permafrost Monitoring	Specifically, for the final design, construction and operations of the phase 2 of the DSTF permafrost characterization and monitoring will be undertaken per Water Licence Clause 18 (below) and subsurface investigation program listed in Schedule C 1.5 (d) in the Quartz Mining Licence. 18. Prior to construction of the DSTF expansion, the Licensee must conduct a subsurface investigation program and submit the results of that investigation to the Board. The program must provide for representative sampling from the entire footprint of the DSTF expansion and include, but not be limited to: a) a minimum of 12 holes advanced to bedrock using a drill capable of recovering undisturbed frozen overburden samples; b) installation of sub-surface monitoring instrumentation including slope indicators and ground temperature cables; and c) laboratory testing of samples for shear strength, particle size and moisture content, as described in the Application in exhibit 1.13 .4 of Register QZ09-092-2.	Reporting	Conditional	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Permafrost Monitoring	Monitoring outlined in the analysis will be undertaken as part of the plan to ensure the integrity of the instrumentation is not compromised. Similarly, permafrost monitoring will be implemented should it be encountered during construction of facilities for new mine development in the District. Monitoring activities will consider the use of ground temperature and slope indicator monitoring devices to track potential changes in the ground conditions.	Sampling		
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	Water Surveillance Network	The groundwater levels collected as part of this program will be used to prepare groundwater contours maps twice per year and refinements to the groundwater models as required.	Sampling	Bi-annually	
QML-0009	Schedule C		Environmental Monitoring, Surveillance and Reporting Plan	EEM	Water Quality Monitoring: Quarterly sampling of sites within reference and exposure areas	Sampling	Quarterly	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009	Schedule C		Mine Development and Operations Plan		Specific ground support requirements are subject to change as more knowledge of the ground is acquired throughout the development of the district. To account for these changes, the Ground Control Management Plan is to be reviewed yearly.	Reporting	Annually	
QML-0009	Schedule C		Mine Development and Operations Plan		Internal Mill and Mine Month End Report	Reporting	Monthly	
QML-0009	Schedule C		Mine Development and Operations Plan		Internal Mine Mill Daily Report	Reporting	Daily	
QML-0009	Schedule C		Mine Development and Operations Plan		Internal Weekly Mine Ventilation Report	Reporting	Weekly	
QML-0009	Schedule C		Noise Monitoring and Management Plan		Consultation with Keno City residents includes both formal community meetings and posters, as well as informal communications in town	Reporting	Conditional	
QML-0009	Schedule C		Noise Monitoring and Management Plan		Keeping record of any noise complaints filed by area residents. In the event that a valid noise complaint is received, respond promptly through the completion of a noise complaint investigation. If warranted, AKHM will conduct a follow-up visit over the duration of the noise generating event to determine whether the noise levels have been sufficiently decreased; and AKHM will then report back to the community and regulators.	Reporting	Conditional	
QML-0009	Schedule C		Noise Monitoring and Management Plan		Noise monitoring results are summarized and reported on a quarterly basis and provided to Keno City residents and YG Energy, Mines and Resources	Reporting	Quarterly	
QML-0009	Schedule C		Noise Monitoring and Management Plan		Taking regular sound level measurements at the facility and mining areas to determine if there are any significant changes to sound emanating from the facility; (twice a month at six stations according to SOP)	Sampling	Bi-monthly	
QZ18-044			Operations and Maintenance Manual for Flame and Moth		On site internal daily measurements of the water treatment plant influent and effluentwill be completed for zinc, ammonia, turbidity, pH temperature and conductivity	Sampling	Daily	
QML-0009	Schedule C		Road Construction Plan		Between May and October of each year, Alexco will inspect all unlined waste rock locations, which in this case apply to the road because N-AML waste rock is to be used as construction material and submit data as part of the annual report	Reporting	Monthly	
QML-0009	Schedule C		Sludge Management Plan		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	Reporting	Annually	
QML-0009	Schedule C		Sludge Management Plan		The annual WL reports will include a monthly 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	Reporting	Monthly	
QML-0009	Schedule C		Sludge Management Plan		Collecting annual sludge samples for analytical and grainsize testing	Sampling	Annually	
QML-0009	Schedule C		Sludge Management Plan		Groundwater will be monitored around the Bermingham Southwest open pit at three location KV-122, KV-123 and KV-124. Surface water will be monitored in No Cash Creek at KV-21, KV-111 and KV-118	Sampling	Monthly	
QZ18-044	Monitoring and Surveillance		Sludge Management Plan		Annual reports are submitted as part of WL QZ18-044 and QML-009. The annual WL reports will include a monthly 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. The annual QML reports will include details about disposal of sludge within the DSTF. All monthly and annual reports are provided to the FNNND.	Reporting	Annually	
QZ18-044	Monitoring and Surveillance		Sludge Management Plan		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.	Reporting	Every 2 Years	
QML-0009	Schedule C		Sludge Management Plan		Sludge volumes will be recorded in the Operator's Logbook for each load of sludge pulled from the Water Treatment retention ponds	Sampling	Monthly	
QML-0009	Schedule C		Spill Contingency Plan		All spills occurrences regardless of size must be reported internally. The supervisor or area manager is responsible for the reporting the spill internally to the applicable departments and initiating any actions.	Reporting	Conditional	
QML-0009	Schedule C		Spill Contingency Plan		As per the WL, a summary of all spills will be reported as a part of the monthly report.	Reporting	Monthly	
QML-0009	Schedule C		Spill Contingency Plan		A spill of reportable quantity must be reported to an Environmental Protection Officer via the Yukon Spills Report Centre. This is to be completed by immediately notifying the 24-hour Yukon Spill Report line: telephone number 867-667-7244.	Reporting	Conditional	
QML-0009	Schedule C		Spill Contingency Plan		It is the responsibility of the Area Supervisor / Manager to ensure that the spill kits are located at the key locations and stocked to enough supplies to respond to a spill.	Task	Monthly	
QML-0009	Schedule C		Spill Contingency Plan		The Safety Coordinator/Officer position is also charged with ensuring continued training and skill development for all personnel and ensuring that the lists of hazardous materials on site are up to date, as are the corresponding SDS.	Task	Monthly	HS
QML-0009	Schedule C		Tailings Characterization Plan		Alexco will review the data semi-annually with their consultants to determine if any modifications of the plan are required.	Reporting	Bi-annually	
QML-0009	Schedule C		Tailings Characterization Plan		The results of the tailings characterization program will be included with the annual report for Water Licence QZ18-044 according to Clauses 119, 121 and 122	Reporting	Annually	
QML-0009	Schedule C		Tailings Characterization Plan		Water Licence QZ18-044 was issued on July 23, 2020 as renewal of the previous Water Licence (QZ09-092), Within 90 days of the effective date of this Licence, the Licensee must update exhibit 1.5.4, Tailings Characterization Plan (TCP) submit it to the Board	Reporting	Conditional	
QML-0009	Schedule C		Tailings Characterization Plan		A split of the monthly composite sample will be submitted for determination of the average monthly gradation.	Sampling	Monthly	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009	Schedule C		Tailings Characterization Plan		Additional long term humidity cell tests as well as saturated column tests will be initiated from co-mingled tailings sourced from Bellekeno, Flame and Moth, and New Bermingham ore. A humidity cell will be started if: • There is a substantial change in the feed source for the District mill (e.g., the feed changes from 100% from a single mine to a blend of two or more mines or new ore body); or • There is a marked change in the geochemical characteristics of the static monthly data (e.g., the sulphur or metals content of the tailings is significantly higher than usual or the neutralization potential is much lower). The 95th or 5th percentile of the dataset collected to date may be used as the statistic against which such marked increases or decreases can be determined, respectively. The humidity cells will operate for a minimum of 40 weeks. They will be terminated when the concentrations of constituents of potential concern (COPCs; e.g., sulphate, arsenic, antimony, cadmium, copper, lead, nickel, selenium, silver, zinc) have stabilized or are declining and lower than those observed in previous humidity cell testing. Saturated column tests will operate for a minimum of 20 weeks and will be terminated when COPC concentrations or weekly loading rates have stabilized.	Sampling	Conditional	
QML-0009	Schedule C		Tailings Characterization Plan		Quarterly and annual composites required for mineralogical and kinetic testing, respectively, will be prepared from equally weighted splits of the monthly composites.	Sampling	Quarterly	
QML-0009	Schedule C		Tailings Characterization Plan		Quarterly direct shear testing will be resumed if gradation results indicate a deviation of 10% or greater from the results obtained to date.	Sampling	Conditional	
QML-0009	Schedule C		Tailings Characterization Plan		Tailings gradation	Sampling	Monthly	
QML-0009	Schedule C		Tailings Characterization Plan		Tailings pore water chemistry will be determined through monthly monitoring of the DSTF collection sump.	Sampling	Monthly	
QML-0009	Schedule C		Tailings Characterization Plan		Tailings samples will be collected on a weekly basis to prepare a representative monthly composite	Sampling	Weekly	
QML-0009	Schedule C		Tailings Characterization Plan		The data will be compared to historical results to calculate variance from existing data. Should the variance exceed the accepted 10% range for each quarter, testing to determine the drained and undrained shear strength of the placed tailings will be conducted using quarterly composite samples created from the monthly composites.	Sampling	Conditional	
QML-0009	Schedule C		Tailings Characterization Plan		The geochemical static testing will typically be conducted on a monthly composite. Weekly composite analysis will be conducted if: • A new mine is brought into production; or • There is a marked change in the geochemical characteristics of the static monthly data (e.g., the sulphur or metals content of the tailings is significantly higher than usual or the neutralization potential is much lower). The 95th or 5th percentile of the dataset collected to date may be used as the statistic against which such marked increases or decreases can be determined, respectively Weekly splits will be analyzed for ABA and aqua regia metals for at least four consecutive weeks to assess the geochemistry of the new mine or the variability in the parameter(s) that triggered the change in analytical frequency.	Sampling	Monthly	
QML-0009	Schedule C		Tailings Characterization Plan		The Mill metallurgist for Alexco Keno Hill Mining Corp. (AKHM) will be responsible for preparing the representative monthly composites for testing	Sampling	Monthly	
QML-0009	Schedule C		Tailings Characterization Plan		When a new mine comes into production, the first monthly composite will be tested to characterize the parameters specified in Table 1 of Appendix 3, including gradation, soil-water characteristic curve, specific gravity, shear strength. Weekly samples may also be tested if there is a marked change in the ore or milling process which would change tailings physical characteristics.	Sampling	Conditional	
QML-0009	Schedule C		Traffic Management Plan		Traffic disturbance incidents are investigated on a case-by-case basis. Responses to a traffic disturbance claim will be based on the nature of the claim and may include (but are not limited to): • AKHM will record the traffic disturbance claim in the Traffic Disturbance Register and will notify the complainant that the claim has been recorded; • If warranted, AKHM personnel will conduct an onsite visit to further investigate the incidence; • AKHM personnel will attempt to link the identified traffic disturbance with a source (a specific event or activity conducted as part of mining or construction), and will determine measures that may be taken to lessen the traffic; and • AKHM will then report back to the community and regulators.	Reporting	Conditional	
QML-0009	Schedule C		Tailings Characterization Plan		To satisfy Clause 30 (e) of Water Licence QZ18-044, the full suite of physical and geochemical testing described in Sections 4.1 to 4.5 will be conducted for tailings produced for each new ore body that is brought into production (i.e., Flame and Moth, and New Bermingham).	Sampling	Conditional	
QML-0009	Schedule C		Tailings Characterization Plan		As required by Clause 30 (b) of the Licence, additional long term humidity cell tests as well as saturated column tests will be initiated from co-mingled tailings sourced from Bellekeno, Flame and Moth, and New Bermingham ore. A humidity cell will be started if: • There is a substantial change in the feed source for the District mill (e.g., the feed changes from 100% from a single mine to a blend of two or more mines or new ore body); or • There is a marked change in the geochemical characteristics of the static monthly data (e.g., the sulphur or metals content of the tailings is significantly higher than usual or the neutralization potential is much lower). The 95th or 5th percentile of the dataset collected to date may be used as the statistic against which such marked increases or decreases can be determined, respectively	Sampling	Conditional	
QML-0009	Schedule C		Tailings Characterization Plan		While in operations, mineralogical testing of the tailings will be conducted quarterly	Sampling	Quarterly	
QML-0009	Schedule C		Waste Rock Management Plan		Clause 13.2 of QML-0009 requires that the physical stability of all engineered structures, which includes waste rock storage facilities, must be inspected by an independent engineer by September 1 of each year.	Sampling	Annually	
QML-0009	Schedule C		Waste Rock Management Plan		If geotechnical inspections are required, they will be carried out during the summer months when the surface and sides of the various rock-fill structures are not obscured by snow.	Sampling	Conditional	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QML-0009	Schedule C		Waste Rock Management Plan		Inspection checklists will be filled out on a monthly basis to ensure structural integrity of mine components and that runoff and discharge is being appropriately managed	Reporting	Monthly	
QML-0009	Schedule C				As required by Clause 30 (b) of the Licence, additional long term humidity cell tests as well as saturated column tests will be initiated from co-mingled tailings sourced from Bellekeno, Flame and Moth, and New Bermingham ore. A humidity cell will be started if: • There is a substantial change in the feed source for the District mill (e.g., the feed changes from 100% from a single mine to a blend of two or more mines or new ore body); or • There is a marked change in the geochemical characteristics of the static monthly data (e.g., the sulphur or metals content of the tailings is significantly higher than usual or the neutralization potential is much lower). The 95th or 5th percentile of the dataset collected to date may be used as the statistic against which such marked increases or decreases can be determined, respectively	Sampling		
QML-0009	Schedule C		Tailings Characterization Plan		The Licensee must implement long term humidity cell tests of Co-mingled Tailings to ensure adequate representation of the Co-mingled Tailings deposited in the DSTF as each new ore body is mined, and shall be continued until the make up of the DSTF at the end of operations is known and a steady-state has been established. Results of the long term humidity cell tests must be submitted as part of the annual report.	Task		
QML-0009	Schedule C		Waste Rock Management Plan		QML-0009 Clause 13.3 requires that the results of the independent engineer's annual review of the physical stability of all engineered structures, works and installations, which includes the waste rock storage facilities, be reported within 90 days of inspection	Reporting	Annually	
QML-0009	Schedule C		Waste Rock Management Plan		The Licensee must provide to the Board a summary of annual amount of Waste Rock, in tonnage that was brought to the surface and a percentage breakdown of the P-AML vs N-AML for each mine as part of the annual report.	Reporting	Annually	
QML-0009			Waste Rock Management Plan		Documentation of waste rock management activities including operational field screening, segregation, handling, management and ongoing geochemical monitoring and analyses will be compiled and included in the annual mining land use, Quartz Mining License and Water Licence annual reports. Water Licence QZ18-044 deliverables will meet the requirements set out in Clauses 121 and 122: 121. The Licensee shall provide to the Board one unbound, single-sided, paper copy of all deliverables required by this Licence. All deliverables, with the exception of design drawings, must be reproducible by standard photocopier. 122. The Licensee must upload electronic copies of all deliverables required by this Licence to the Yukon Water Board's online licensing registry. Electronic copies must be submitted in one of the following formats: MS Word, MS Excel, or Adobe .pdf format. Water quality results must be in the format outlined in the "Laboratory Data Submission Standards for Water Quality", as amended from time to time and available on the Board website.	Reporting	Annually	
QML-0009	Schedule C		Waste Rock Management Plan		Within 90 days of the effective date of this Licence, the Licensee must submit to the Board an update to exhibit 1.5.3, WRMP.	Reporting	Conditional	
QML-0009	Schedule C		Waste Rock Management Plan		Providing there is sufficient water accumulation, samples will be collected and a full suite of water quality analyses conducted at least twice per year	Sampling	Bi-annually	
QML-0009	Schedule C		Waste Rock Management Plan		Clauses 96 and 97 of QZ18-044 require that: 96. Between May and October of each year, the Licensee must inspect monthly the Waste Rock storage facilities, as described in the WRMP and submit data as part of the annual report. 97. The Licensee must provide to the Board a summary of annual amount of Waste Rock, in tonnage that was brought to the surface and a percentage breakdown of the P-AML vs N-AML for each mine as part of the annual report.	Inspection	Annually	
QML-0009	Schedule C		Waste Rock Management Plan		The lined P-AML storage pad areas will be monitored for drainage volume with field parameters (pH and conductivity, temperature) measured on a monthly basis from May to October.	Sampling	Monthly	
QML-0009	Schedule C		Waste Rock Management Plan		Water quality representing accumulated meteoric water combined with pore water within these facilities (e.g. KV-78b KV-106, KV-115, and KV-119) are required by the water licence to be monitored monthly between May and October for field parameters including pH, temperature, conductivity, and water level within the facility. A more detailed external laboratory suite is required quarterly, and includes total and dissolved ICP metals, phosphorus, sulphate, dissolved organic carbon, alkalinity, pH, conductivity, total suspended solids, and hardness.	Sampling	Monthly	
QML-0009	Schedule C		Waste Rock Management Plan		Within 3 months of resumption of commercial production, Alexco commits to initiation of kinetic testing of representative samples of N-AML resulting from excavation of Bellekeno, Flame & Moth, and Bermingham, Mines	Sampling	Conditional	
QZ18-044			Water Management Plan		All water intakes will have barriers consisting of fish guards, screens, covering or nets.	Task	Conditional	
QZ18-044			Water Management Plan		All water management ponds designs have a freeboard of 0.5m, at all times during operations, to ensure collection of the 1 in 100 year 24 hour maximum rain event.	Constraint	Conditional	
QML-0009	Schedule C		Waste Rock Management Plan		If issues are identified during the monthly inspections of waste rock storage areas, the site manager will be informed immediately and the appropriate mitigative measures will be implemented. An inspection by a qualified geotechnical engineer would be undertaken for physical stability if necessary. Additional erosion and sediment controls may need to be implemented as required. Appropriate mitigative measures will be implemented should acidic or metal rich drainage be detected in order to prevent adverse impacts to receiving waters. If geotechnical inspections are required, they will be carried out during the summer months when the surface and sides of the various rock-fill structures are not obscured by snow.	Inspection	Conditional	
QML-0009	Schedule C		Waste Rock Management Plan		Physical surveillance of waste rock storage areas will occur on a monthly basis at the following locations: • All P-AML waste rock storage facility or equivalents; and • All N-AML waste rock disposal areas or areas where N-AML will be used for construction including roads between Bellekeno East Portal and Bellekeno 625, roads between Bermingham and the District Mill, the 'power line road' that runs along the north slope of Sourdough Hill, the bypass road constructed along the north side of Keno City, the Bellekeno and Bermingham waste rock disposal areas, and all other locations where N-AML rock is used as fill or construction material.	Inspection	Monthly	
QZ18-044			Water Management Plan		All water use sources are fitted with a totaliser to collect daily withdrawal rates.	Task	Conditional	
QZ18-044			Water Management Plan		If excess water accumulates in the Bellekeno P-AML waste rock storage facility the water will be collected by a Vac truck and transported to the Bellekeno water treatment plant.	Task	Conditional	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044			Water Management Plan		The combined water sourcing rate from the underground workings, Thunder Gulch, Lightning Creek and the Bellekeno water treatment plan for use at the Bellekeno Mine will not exceed the currently licenced maximum rate of 245.5 m3/day licenced under QZ18-044.	Constraint	Conditional	
QZ18-044			Water Management Plan		If excess water accumulates in the Flame and Moth P-AML waste rock storage facility the water will be collected by a Vac truck and transported to the Mill Pond or the Flame and Moth water treatment plant	Task	Conditional	
QZ18-044			Water Management Plan		Effective sediment and erosion control measures will be installed before starting construction to reduce the potential for introduction of sediment into watercourses and waterbodies. Mitigation of sediment and erosion will be proactive at disturbance site by implementing the following best management practices: Control runoff and manage stormwater (e.g., rainfall or snow melt) and direct it away from construction areas where excavation, soil placement, and staging activities occur.	Task	Conditional	
QZ18-044			Water Management Plan		Sediment and erosion control measures will be continually monitored and maintained until the mechanism has stabilized and there is no longer a potential risk. Once the risk is mitigated excess sediment and control measures will be removed.	Task	Conditional	
QZ18-044			Water Management Plan		The water management plan and associagted data will be reviewed semi-annually with their consultants to determine if any modifications of the plan are required	Task	Bi-annually	
QZ18-044			Water Management Plan		The Licensee shall provide to the Board one unbound, single-sided, paper copy of all deliverable required by this Licence. All deliverables, with the exception of design drawings, must be reproducible by standard photocopier. a) a description of the water use operations carried out during the year reported; b) the quantity of water used each day from each identified water source;	Reporting	Annually	
QZ18-044			Water Management Plan		The Licensee shall provide to the Board one unbound, single-sided, paper copy of all deliverable required by this Licence. All deliverables, with the exception of design drawings, must be reproducible by standard photocopier	Reporting	Annually	
QZ18-044			Water Management Plan		The Licensee must upload electronic copies of all deliverables required by this Licence to the Yukon Water Board's online licensing registry. Electronic copies must be submitted in one of the following formats: MS Word, MS Excel, or Adobe .pdf format. Water quality results must be in the format outlined in the "Laboratory Data Submission Standards for Water Quality", as amended from time to time and available on the Board website	Reporting	Annually	
QML-0009	Schedule C		Wildlife Protection Plan		Sightings of wildlife will be recorded. Sightings of wildlife will be recorded by all employees and contractors on the wildlife sightings sheets provided. This information will be reported to Environment Yukon: Conservation Data Centre (CDC) and NND on an annual basis.	Reporting	Annually	
					A wildlife report will be submitted to Environment Yukon and NND, which incorporates the following: • Wildlife sightings on the Alexco claims Property; • Wildlife management issues/ wildlife incidents (e.g. bears in camp); • Comments on the effectiveness of wildlife protocols and mitigation measures and proposed modifications to improve their effectiveness; and • Results of any surveys or studies conducted.	Reporting	Annually	
QZ18-044	Part H - Monitoring and Surveliance	MDMER	Monitoring and Surveilance Plan		A study respecting fish population, if the highest concentration of effluent in the exposure area, during a period in which there are deposits, is greater than 1% at any location that is 250 m from a point at which the effluent enters the area from a final discharge point, unless the results of the previous two biological monitoring studies indicate (i) for all effect indicators with no assigned critical effect size, no effect on the fish population, and (ii) for all effect indicators with an assigned critical effect size, no effect on the fish population or an effect on the fish population the absolute value of the magnitude of which is less than the absolute value of its assigned critical effect size;	Studies	Conditional	
QZ18-044	Part H - Monitoring and Surveliance	MDMER	Monitoring and Surveilance Plan		A study respecting the benthic invertebrate community, if the highest concentration of effluent in the exposure area, during a period in which there are deposits, is greater than 1% at any location that is 100 m from a point at which the effluent enters the area from a final discharge point, unless the results of the previous two biological monitoring studies indicate (i) for all effect indicators with no assigned critical effect size, no effect on the benthic invertebrate community, and (ii) for all effect indicators with an assigned critical effect size, no effect on the benthic invertebrate community or an effect on the benthic invertebrate community the absolute value of the magnitude of which is less than the absolute value of its assigned critical effect size.	Studies	Conditional	
QZ18-044	Part H - Monitoring and Surveliance	MDMER	Monitoring and Surveilance Plan		Required if (i) effluent characterization reveals an annual mean concentration of total mercury in the effluent that is equal to or greater than 0.10 µg/L, based on a calendar year, unless the results of the previous two biological monitoring studies indicate no effect on fish tissue from mercury, or (ii) the method detection limit used in respect of mercury for the analysis of at least two of four effluent samples in a calendar year is equal to or greater than 0.10 µg/L;	Studies	Conditional	
QZ18-044	Part H - Monitoring and Surveliance	MDMER	Monitoring and Surveilance Plan		Required if (i) effluent characterization reveals a concentration of total selenium in the effluent that is equal to or greater than 10 µg/L, (ii) effluent characterization reveals an annual mean concentration of total selenium in the effluent that is equal to or greater than 5 µg/L, based on a calendar year, or (iii) the method detection limit used in respect of selenium for the analysis of any effluent sample is equal to or greater than 10 µg/L, or the method detection limit used in respect of selenium for the analysis of at least two of four effluent samples in a calendar year is equal to or greater than 5 µg/L; and	Studies	Conditional	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Part H - Monitoring and Surveliance	MDMER	Monitoring and Surveilance Plan		(e) if the cause of any effect on the fish population, on fish tissue from mercury or on the benthic invertebrate community is not known, a study that will be used to determine the cause of the effect if (i) the results of the previous two biological monitoring studies indicate a similar type of effect, and (ii) for an effect indicator with an assigned critical effect size, the absolute value of the magnitude of the effect is equal to or greater than the absolute value of its critical effect size in either of those studies	Studies	Conditional	
QZ18-044	Part H - Monitoring and Surveliance	MDMER	Monitoring and Surveilance Plan		(a) the dates on which samples were collected for effluent characterization, sublethal toxicity testing and water quality monitoring; (b) for each sample collected for effluent characterization, the location of the final discharge point from which samples were collected for effluent characterization; (c) the location of the final discharge point from which samples were collected for sublethal toxicity testing and the data used in selecting the final discharge point in accordance with subsection 5(3); (d) the latitude and longitude of sampling areas for water quality monitoring and a description that is sufficient to identify the location of the sampling areas; (e) the results of effluent characterization, sublethal toxicity testing and water quality monitoring; (f) the methodologies used to conduct effluent characterization and water quality monitoring, and the related method detection limits; (g) a description of the quality assurance and quality control measures that were implemented and the data related to the implementation of those measures; and (h) with respect to every effluent sample collected at each final discharge point, the annual mean concentration of mercury and selenium.	Reporting	See details	
QZ18-044	Part H - Monitoring and Surveliance	MDMER	Monitoring and Surveilance plan		(1)The owner or operator of a mine shall, not less than once per week and at least 24 hours apart, collect from each final discharge point (a) a grab sample or composite sample of effluent and record the pH of the sample at the time of its collection and record, without delay after collecting the sample, the concentrations of the deleterious substances prescribed in section 3 except un-ionized ammonia; and (b) a grab sample of effluent and record the temperature and the pH of the sample at the time of its collection and record, without delay after collecting the sample, the concentrations of total ammonia expressed as nitrogen (N). (2) Testing conducted under subsection (1) shall comply with the analytical requirements set out in Table 1 of Schedule 3 and shall be done in accordance with generally accepted standards of good scientific practice at the time of the sampling using documented and validated methods. (3) Despite subsection (1), the owner or operator of a mine is not required to collect samples for the purpose of recording the concentrations of cyanide if cyanide has never been used as a process reagent at the mine. (4) The owner or operator of a mine shall determine and record the concentration of un-ionized ammonia, using the temperature, pH and concentration of total ammonia recorded under paragraph (1)(b), in accordance with the formula on page 11. (5) If the owner or operator of a mine changes the location of a final discharge point, the owner or operator shall increase the frequency of conducting tests relating to the concentration of a deleterious substance at that final discharge point to the frequency prescribed in section 12 for all the deleterious substances mentioned in subsections (1) and (2). (6) The owner or operator of a mine who reduces the frequency of conducting tests under subsection (1) or (2) shall: (a) notify the Minister of the Environment, in writing, at least 30 days in advance, of that fact; (b) select and record the sampling dates not less than 30 days in advance of collecting the samples of effluent; and (c) collect the sample on the selected day except if, owing to unforeseen circumstances, they cannot sample on that day, in which case, they shall do so as soon as practicable after that day.	Sampling	Weekly	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Part H - Monitoring and Surveliance	MDMER			1) If an effluent sample is determined to be acutely lethal by an acute lethality test, the owner or operator of a mine shall (a) without delay, (i) conduct the effluent characterization set out in subsection 4(1) of Schedule 5 on the aliquot of each grab sample collected under subsection 14(1), (ii) record the concentration of total ammonia and, using that concentration and using the temperature and pH recorded under paragraph 14(3)(b), determine the concentration of un-ionized ammonia in accordance with the formula set out in subsection 12(4), and (iii) record the concentrations of the deleterious substances prescribed in section 3; (b) collect a grab sample twice a month from the final discharge point from which the effluent sample determined to be acutely lethal was collected, record the temperature and the pH of each sample at the time of its collection and, without delay, conduct the acute lethality test that determined the effluent sample to be acutely lethal on each grab sample in accordance with the procedure set out in section 6 of the applicable reference method and, if the sample is determined to be acutely lethal, without delay, (i) conduct the effluent characterization set out in subsection 4(1) of Schedule 5 on the aliquot of each grab sample, (ii) record the concentration of total ammonia and, using that concentration and using the temperature and pH recorded under this paragraph, determine the concentration of un-ionized ammonia in accordance with the formula set out in subsection 12(4), and (iii) record the concentrations of the deleterious substances prescribed in section 3; and (c) collect the grab samples not less than seven days apart. (2) The owner or operator may resume sampling and testing at the frequency prescribed in section 14 if the effluent is determined not to be acutely lethal in three consecutive tests conducted under paragraph (1)(b). Despite paragraph 15(1)(c), if an effluent sample is determined to be acutely lethal when tested using the acute lethality test set out in section 14.3, the owner or operator of a mine shall, without delay, collect the first grab sample required by paragraph 15(1)(b) and comply with the requirements of that paragraph	Sampling	Conditional	
QML-0009	Schedule C	Reduced Frequency of Acute Lethality Testing			(1) The owner or operator of a mine may reduce the frequency of conducting an acute lethality test at a final discharge point to once in each calendar quarter if the effluent from that final discharge point is determined not to be acutely lethal by that acute lethality test for 12 consecutive months. (2) For the purpose of determining whether that effluent is acutely lethal for the 12-month period referred to in subsection (1), the owner or operator of a mine shall use the results of the acute lethality tests conducted under subsection 14(1). (3) The owner or operator of a mine shall notify the Minister of the Environment in writing at least 30 days before the reduction of the frequency of acute lethality testing. (4) The owner or operator who reduces the frequency of conducting acute lethality testing under subsection (1) shall (a) select and record the sampling date not less than 30 days in advance of collecting the grab samples; and (b) collect the grab samples not less than 45 days apart. (5) If a grab sample is determined to be acutely lethal by an acute lethality test when the owner or operator of a mine is testing at the frequency prescribed in subsection (1), the owner or operator shall increase the frequency of conducting that test to the frequency prescribed in section 15 and conduct that test in accordance with that section. (6) If the location of a final discharge point is changed, the owner or operator of a mine shall, at that final discharge point, increase the frequency of conducting all the acute lethality tests to the frequency prescribed in subsection 14(1) and conduct those tests in accordance with that subsection.	Reporting and Sampling	Conditional	
QML-0009	Division 2 -Effluent Monitoring Conditions	Obligation to Record all Test Results			The owner or operator of a mine shall record without delay the data referred to in section 9.1 of Reference Method EPS 1/RM/10, section 8.1 of Reference Method EPS 1/RM/13, section 8.1 of Reference Method EPS 1/RM/14 and section 9.1 of Reference Method STB 1/RM/60 for each acute lethality test.	Task		
QML-0009	Division 2 -Effluent Monitoring Conditions	Volume of Effluent			(1) The owner or operator of a mine shall record, in cubic metres, the total monthly volume of effluent deposited from each final discharge point for each month during which there was a deposit. (2) The total monthly volume of effluent deposited shall be either (a) determined on the basis of the average of the flow rates, expressed in cubic metres per day, measured and calculated as follows: (i) by measuring the flow rate at the same time as samples are collected under section 12, (ii) by calculating the average monthly flow rate by adding the flow rate measurements taken during the month and dividing the total by the number of times the flow rate was measured, and (iii) by multiplying the average monthly flow rateby the number of days during the month that effluent was deposited; or (b) determined by using a monitoring system that provides a continuous measure of the volume of effluent deposited. (3) The owner or operator shall (a) measure the flow rate or volume of effluent deposited by using a monitoring system that is accurate to within 15% of measured flow rate or volume; and (b) maintain and calibrate the monitoring system at least once in each year and record the results, as well as the date on which and the manner in which the requirement to maintain and calibrate has been met.	Reporting	Variable*	

Licence	Section	Subcategory	Management Plan	Subplan	Obligation	Type	Frequency	Responsibility
QZ18-044	Part H - Monitoring and Surveliance	MDMER			(1) With respect to the deleterious substances that are contained in the effluent deposited from each final discharge point, the owner or operator of a mine shall, for each month during which there is a deposit and during which samples are collected, record the monthly mean concentration (a) in mg/L for deleterious substances referred to inparagraphs 3(a) to (g) and (i); and (2) If the analytical result from any test conducted under section 12 or 13 is less than the method detection limit used for that test, the test result shall be considered to be equal to one half of the detection limit used for the purpose of calculating the monthly mean concentration. (1) With respect to the deleterious substances that are contained in the effluent deposited from each final discharge point, the owner or operator of a mine shall, for each month and for each calendar quarter during which there was a deposit and during which a sample is collected, record the loading (a) in kg for deleterious substances referred to paragraphs 3(a) to (g) and (i); and (b) in MBq for a deleterious substance referred to inparagraph 3(h). (2) The owner or operator shall determine the loading for each month using the following formula on page 18. (3) The owner or operator shall determine the loading for each calendar quarter using the formula on page 18.	Sampling	Monthly	
QML-0009	Division 2 -Effluent Monitoring Conditions	Relief			Any time period specified for collecting samples of effluent referred to in this Division may be extended if (a) unforeseen circumstances cause safety concerns oraccess problems and render the collection of samplesof effluent impracticable; and (b) the owner or operator of a mine notifies an inspector, without delay, of the circumstances and indicateswhen they expect to be able to collect the samples. The owner or operator shall collect the samples of effluent without delay when the circumstances permit.		Conditional	

*1) If an effluent sample is determined to be acutely lethal by an acute lethality test, the owner or operator of a mine shall
(a) without delay,
(i) conduct the effluent characterization set out in subsection 4(1) of Schedule 5 on the aliquot of each grab sample collected under subsection 14(1),
(ii) record the Frequency concentration of total ammonia and, using that concentration and using the temperature and pH recorded under paragraph 14(3)(b), determine the concentration of un-ionized ammonia in accordance with the formula set out in subsection 12(4), and
(iii) record the concentrations of the deleterious substances prescribed in section 3;
(b) collect a grab sample twice a month from the final discharge point from which the effluent sample determined to be acutely lethal was collected, record the temperature and the pH of each sample at the time of its collection and, without delay, conduct the acute lethality test that determined the effluent sample to be acutely lethal on each grab sample in accordance with the procedure set out in section 6 of the applicable reference method and, if the sample is determined to be acutely lethal, without delay,
(i) conduct the effluent characterization set out in subsection 4(1) of Schedule 5 on the aliquot of each grab sample,
(ii) record the concentration of total ammonia and, using that concentration and using the temperature and pH recorded under this paragraph, determine the concentration of un-ionized ammonia in accordance with the formula set out in subsection 12(4), and
(iii) record the concentrations of the deleterious substances prescribed in section 3; and
(c) collect the grab samples not less than seven days apart. (2) The owner or operator may resume sampling and testing at the frequency prescribed in section 14 if the effluent is determined not to be acutely lethal in three consecutive tests conducted under paragraph (1)(b).
Despite paragraph 15(1)(c), if an effluent sample is determined to be acutely lethal when tested using the acute lethality test set out in section 14.3, the owner or operator of a mine shall, without delay, collect the first grab sample required by paragraph 15(1)(b) and comply with the requirements of that paragraph.