# MINE DEVELOPMENT AND OPERATIONS PLAN

# BERMINGHAM – KENO HILL SILVER DISTRICT

## Revision 0

August 2019

**ALEXCO KENO HILL MINING CORP.**

# TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

# 1 INTRODUCTION

## 1.1 PROJECT BACKGROUND

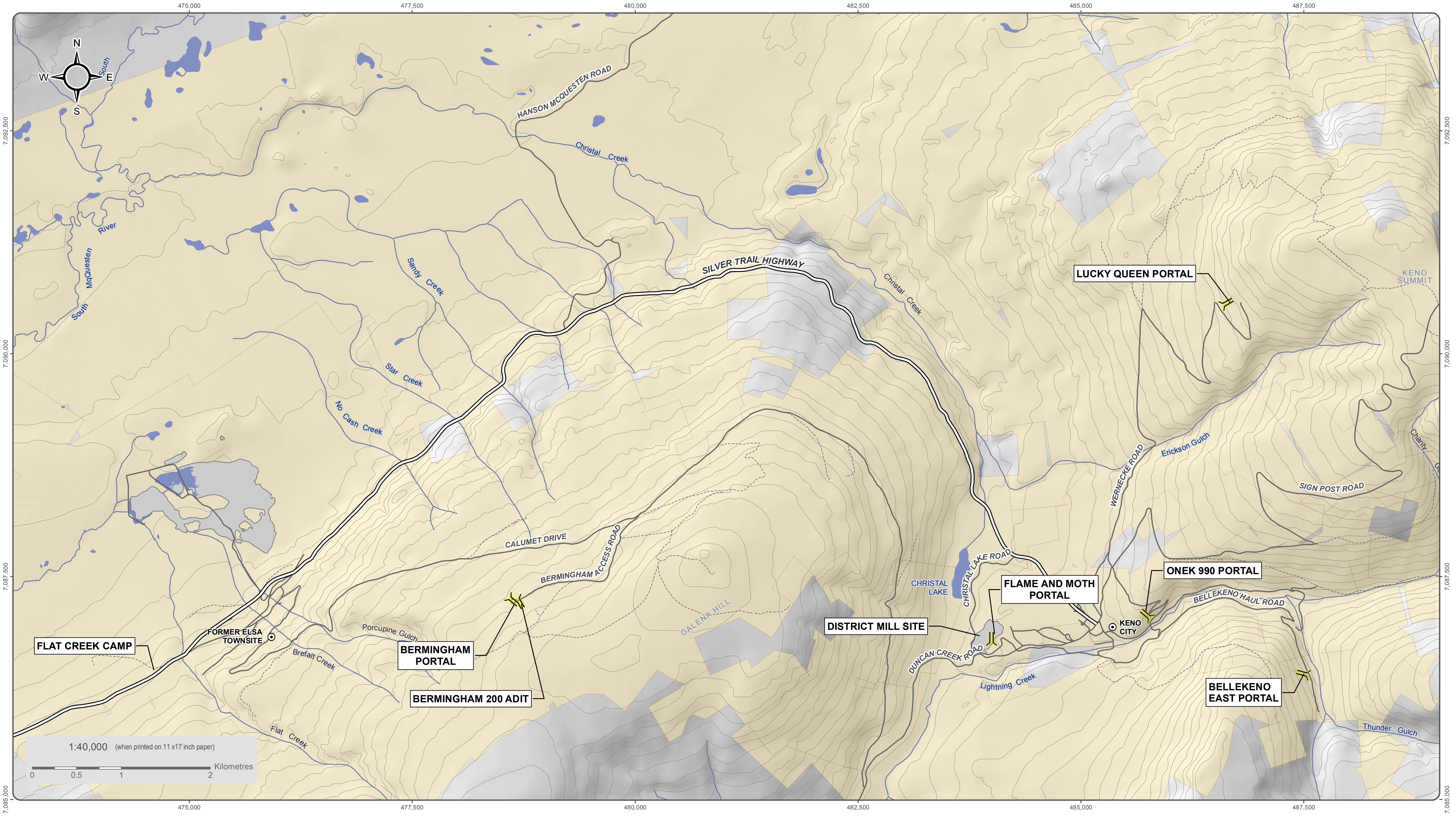
Alexco Keno Hill Mining Corp. (AKHM) continues to develop the mineral resources of the Keno Hill Silver District. Alexco proposes to bring the Bermingham deposit into production to provide a sustainable ore feed to the Keno District Mill, supplemented by the additional mines already permitted in the district including Flame and Moth, Bellekeno, Lucky Queen and Onek. The Bermingham deposit is located on Galena Hill within the Keno Hill District. The development and operations program for the Bermingham deposit includes the development of underground primary and secondary ore access declines and drifts, construction of surface and underground support facilities, mining and milling ore in the Keno District Mill, depositing waste rock on surface and depositing tailings in the DSTF. A 550 m underground exploration decline was completed in May 2018 and a 4,200 meter underground definition drilling program was completed in August 2018. This document serves as the Bermingham Mine Development and Operations Plan as a requirement for amendment of Alexco Keno Hill Mining Corp. (AKHM) Quartz Mining License.

## 1.2 PROPERTY LOCATION

The Bermingham property is located in the Mayo Mining District approximately 350 kilometres (“km”) north of Whitehorse, Yukon within the Keno Hill Silver District (Figure 1-1). Access to the property is via a paved, two-lane highway 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 area is covered by NTS map sheets 105M/14. The Bermingham deposit is located on Galena Hill, within the Keno Hill Silver District as is shown in Figure 1-1.

### 1.2.1 Bermingham Location

The Bermingham adit is located at UTM 7,087,231N and 478,612E zone 8.



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 2017

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

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| | | | | | |
|---|---|---|---|---|---|
| ⊙ | Place of Interest | ▨ | Valley Tailings | ― | Watercourse |
| Y | Adit | ▨ | Alexco/ERDC Quartz Claims | ═ | Silver Trail Highway |
| | | ■ | Waterbody | ― | Other Road |
| | | | | ┄ | Limited-Use Road |

AKHM

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## FIGURE 1-1

## KENO HILL SILVER DISTRICT MINING OPERATIONS AREA OVERVIEW

OCTOBER 2017

D:\Project\AllProjects\Keno_Area_Mines\BERM\Maps\01-Overview\03-Overview\SilverDistrictOverview\Berm_overview_20170925.mxd
(*Last edited by: amatlashevska;26/10/2017/08:41 AM*)

# 2 SITE DESCRIPTION

The Bermingham deposit is within the historic Keno Hill Silver District (KHSD), located in central Yukon Territory. The closest town outside of Keno City is Mayo, located on the Stewart River, approximately 55 km to the south. Mayo is accessible from Whitehorse via a 460 km all weather road; the town is also serviced by Mayo airport, which is located just to the north. A gravel road leads from Mayo to the project areas. Historically, the KHSD was linked by river route to the outside world; since 1950 the all-weather Silver Trail Highway, which was also used for transporting the ore, has been the main link.

The central Yukon Territory is characterized by a sub-arctic continental climate with cold winters and warm summers. Average temperatures in the winter are between minus fifteen and minus twenty degrees Celsius but can reach minus sixty degrees Celsius. The summers are moderately warm with average temperatures in July around fifteen degrees Celsius. Mining operations are carried out year-round.

Because of its northern latitude, winter days are short; north-facing slopes experience ten weeks without direct sunlight around the winter solstice. Conversely, summer days are very long, especially in early summer around the summer solstice. Annual precipitation averages twenty-eight centimetres ("cm"); half of this amount falls as snow, which starts to accumulate in October and remains into May or June.

Three phase power is available in many parts of the district as well as telephone and internet service. A large number of roads constructed for past mining operations are still serviceable. The old company town of Elsa, located toward the western end of the district, comprises several buildings that are currently being used by AKHM for storage, maintenance work, housing and offices. The main camp and kitchen are located at Flat Creek, just west of Elsa.

The landscape around the Bermingham deposit is characterized by rolling hills and mountains with a relief of up to 1,600 masl. The highest elevation is Keno Hill at 1,975 masl. Slopes are gentle except the north slopes of Keno Hill and Sourdough Hill.

## 2.1 HISTORY

The first claims in the Bermingham area were staked in 1921, within a decade of commercial production starting in the Keno Hill district. Shallow underground workings were initiated in 1923 with the discovery of vein float and limited production of high grade silver and lead from the Bermingham Vein ensued. The Treadwell Yukon Company optioned the ground in 1928 and completed additional underground workings and identified a fault offset vein portion but dropped the lease in 1930 due to low silver prices and a lack of ore grade material. United Keno Hill Mines (UKHM) purchased the property as part of the district consolidation, and between 1948 and 1951 drove an adit and drift about 30 foot (ft) below the Treadwell workings where considerable milling ore appeared available. In 1952, many of the old Treadwell workings were surveyed and sampled, but the adit level was subsequently abandoned in 1954 after very little ore grade material was realized. During this time, UKHM milled 5165 ton of ore at 47.3 oz/ton (opt) Ag, 8% Pb, and 1.3% Zn, of which all but 60 ton was recovered from the old dumps.

Between 1965 and 1982, 874 overburden drill-holes totalling 65,390 ft (19,931 m), and 27 core holes totalling 7898 ft (2407 m) were drilled in the Bermingham area, a small portion of which occurred in the present resource area. Poor ground conditions prevented many of these holes from adequately penetrating the vein zone, however they outlined an open pit resource and stripping began in 1977. The open pit mine produced 91,104 tons at 16.7 opt Ag. The southwest extension of the Bermingham Vein, as offset by the Mastiff Fault, was tested by several historic shafts sunk by the Treadwell Yukon Company Ltd. The vein was reported to be 8 ft (2.44 m) wide and to consist mainly of siderite with small bunches of galena, although no mineable ore was encountered. A small open pit was operated on this segment of the vein by UKHM in the mid-1980s. A further 150 m along strike to the southwest, an intended second pit with an estimate resource of 274,000 oz silver was stripped to bedrock in 1983. The historical mineral resource estimate does not use mineral resource categories stipulated by NI43-101. SRK is not aware of the parameters and assumptions used in preparing this estimate. The historical estimate should not be relied upon; it is only stated here for historical completeness. Although drilling indicated shallow mineralization exists, the exposed veins appeared weak and un-mineralised, and the pit was never initiated. In total, the Bermingham property produced 186,266 ton at 20.3 opt Ag, 4.2% Pb, and 0.6% zinc, or, 3,777,932 oz of silver (Cathro, 2006).

The exploration conducted by Alexco is the first comprehensive exploration effort in the district since 1997. The first holes drilled by Alexco in the Bermingham area were in 2009 (two core holes totalling 523m), targeting the Bermingham Vein at depth in the hangingwall of the Mastiff Fault below an area with a historic shallow open pit resource. Results of this drilling were sufficiently encouraging to continue exploration in 2010 and 2011. Alexco conducted surface diamond drilling programs at Bermingham in 2012 and again in 2014, with 61 holes drilled totaling 18,699 m. In 2015 and 2016 a further 20,018 m were drilled in 58 holes and in 2017 13,000 m were drilled in the Bermingham deposit and surrounding area. In August 2017 construction of an exploration decline began for the purpose of underground definition drilling. 545 meters of decline was completed in May 2018 and 4,200 meters of underground definition drilling was completed in August 2018.

## 2.2 GEOLOGICAL

### 2.2.1 District Geology

The Keno Hill Silver District geology is dominated by the Mississippian Keno Hill Quartzite comprising the Basal Quartzite Member and conformably overlying Sourdough Hill Member. The unit is overthrust in the south by the Upper Proterozoic Hyland Group Yusezyu Formation and is conformably underlain in the north by the Devonian Earn Group (McOnie and Read, 2009) as shown in the local stratigraphic column in Figure 2-1.

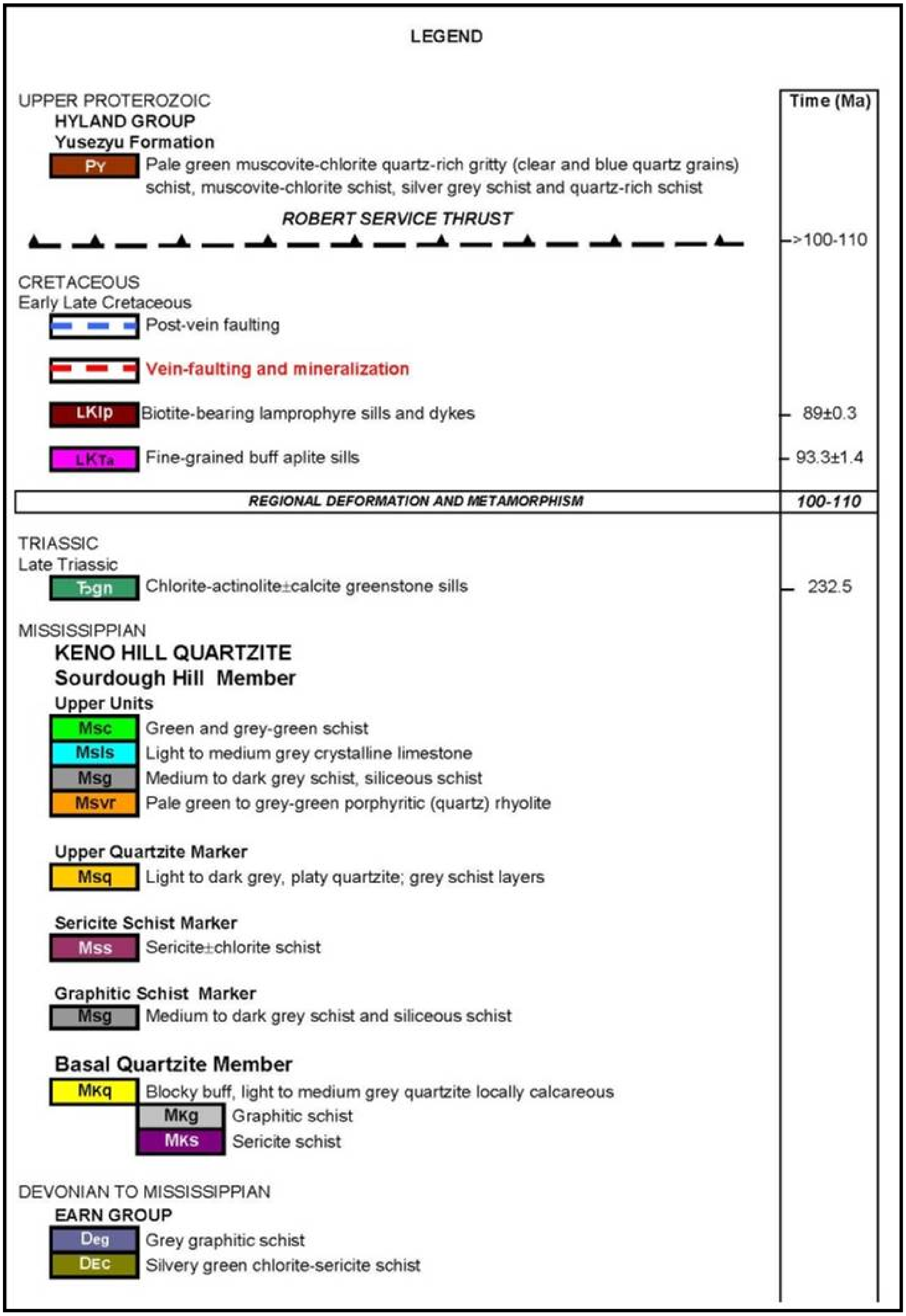


**Figure 2-1: Keno Hill Silver District Simplified Stratigraphy (light yellow is alluvial cover)**

The Yusezyu Formation of the Precambrian Hyland Group that comprises greenish quartz-rich chlorite-muscovite schist with locally clear and blue quartz-grain gritty schist is separated from the Keno Hill sequence by the Robert Service Thrust Fault.

The Earn Group formerly mapped as the "lower schist formation" (Boyle, 1965) is typically composed of recessive weathering grey graphitic schist and green chlorite-sericite schist with an upper siliceous graphitic schist found locally.

Within the Keno Hill Quartzite, the Basal Quartzite Member is up to 1,100 m thick where structurally thickened and comprises thick to thin-bedded quartzite and graphitic phyllite (schist). This is the dominant host to the silver mineralization in the Keno Hill Silver District. The overlying Sourdough Hill Member, formerly mapped as the "upper schist formation" (Boyle, 1965) is up to approximately 900 m in thickness and comprises predominantly graphitic and sericitic phyllite, chloritic quartz augen phyllite, and minor thin limestone.

The Earn Group and Keno Hill Quartzite are locally intruded by Middle Triassic greenstone sills. The sequence was metamorphosed to greenschist facies assemblages during Cretaceous regional deformation, and later intruded by quartz-feldspar aplite sills or dikes that are correlated with the 92 My Tombstone intrusive suite found elsewhere in the Keno Hill Silver District.

Three phases of folding are identified in the Keno Hill Silver District. The two earliest phases consist of isoclinal folding with subhorizontal, east- or west-trending fold axes. The later phase consists of a subvertical axial plane and moderate southeast-trending and plunging fold axis. In the Keno Hill Silver District, the first phases of folding formed structurally dismembered isoclinal folds of which the Basal Quartzite Member outlines synforms at Monument Hill where the Lucky Queen mine is located and at Caribou Hill, while between Galena Hill and Sourdough Hill the Bellekeno mine and the Flame & Moth mine are located on the upper limb of a large scale anticline that closes to the north.

Within the Keno Hill Silver District, up to four main periods of faulting are recognized. The oldest fault set consists of south-dipping foliation-parallel structures that developed contemporaneously with the first phase folding. The Robert Service Thrust Fault truncates the top of the Keno Hill Quartzite and sets the Precambrian schist of the Yusezyu Formation above the Mississippian Sourdough Hill Member. The silver mineralization in the Keno Hill Silver District is hosted by a series of north-east–trending pre- and syn- mineral vein-faults that display apparent left lateral normal displacement locally referred to as longitudinal veins that, depending on the competency of the host rock, can be up to 30 m wide with an anastomosing system of subveins. A related set of faults, known as transverse faults that strike north-northeast and dip moderately to the southeast, can reach up to 5 m in thickness.

High angle cross faults, low angle faults, and bedding faults offset veins and comprise post-mineralization faults. Most commonly, these comprise northwest-striking cross faults recognized by offset veins that show apparent right-lateral displacement. The geology of the KHSD area is shown in Figure 2-2.

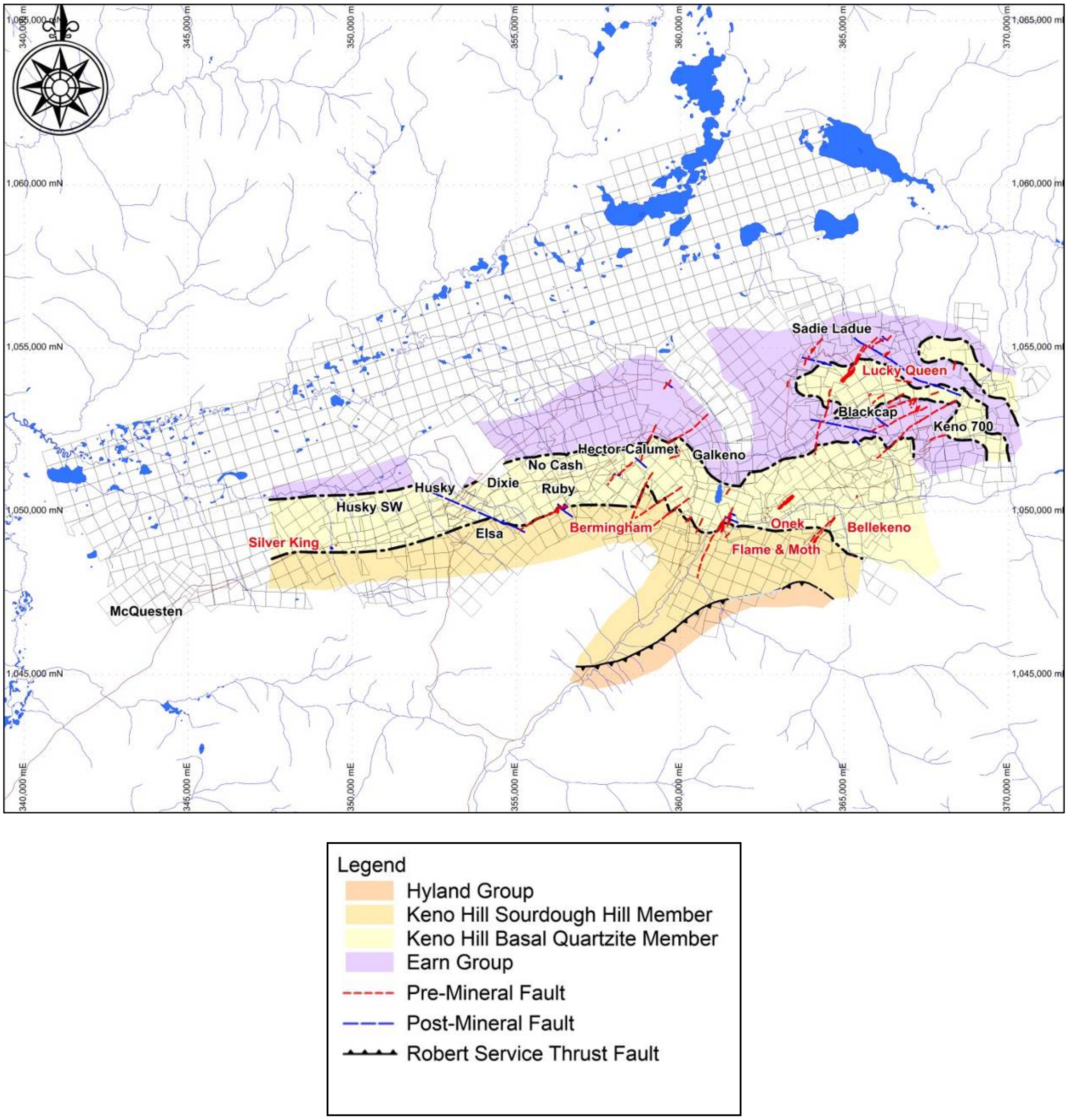


**Figure 2-2: Geology of the Keno Hill Silver District**

## 2.2.2 Bermingham Geology and Mineralization

In the Bermingham area, five mineralized veins have been identified (Aho, Bermingham, Bear, Bermingham Footwall, and West Dipper veins) within a structurally complex network of fault and vein structures related to the through-going northeast striking, southeast dipping, Bermingham vein-fault system. Less extensive north-

northeast striking vein geometries are also observed within the mineralized system. The combined displacement of the Bermingham, Bermingham, Bear and West Dipper veins has displaced the hangingwall of the vein system approximately 165 metres along a vector 095°/ -60° to the southeast, while dip separation of stratigraphy across the Aho vein ranges from 50 to 80 metres. The mineralized veins are affected by numerous post-mineral faults. The early Aho vein comprises predominantly quartz, and occurs over several metres width within a wide halo of structurally damaged rocks. Minor sulphides are present with arsenopyrite and pyrite being the most abundant, with accessory galena and sphalerite.

The Bermingham vein has a strike between 029° and 042° and dips between 40° and 64° to the southeast. The structure accommodates approximately 65 m of the total Bermingham displacement. In the Etta Zone (in the hangingwall of the post-mineral Mastiff fault), the Bermingham vein at its most southwestern extent, is observed to converge with the Aho vein structure, while to the northeast, it converges with the Bermingham Footwall vein.

The Bermingham Footwall vein has a strike of between 040° and 060°, and dips between 67° and 73° to the southeast. The structure accommodates approximately 70m of the total Bermingham displacement. In the Etta Zone, the Bermingham Footwall vein terminates against the Bermingham vein up-dip and this intersection plunges moderately-steeply to the northeast into the Arctic Zone (in the footwall of the post-mineral Mastiff fault). At depth the Bermingham Footwall vein terminates against the Aho vein along a steep plunging northeasterly trajectory.

The Bermingham Vein and Bermingham Footwall Vein typically exist within a wide 5 m to 10 m wide structurally damaged zone containing numerous stringers, veinlets, breccias, and gouge. In most cases, a discrete vein 0.5 m to 2.5 m wide exists within this zone, consisting predominantly of carbonate (dolomite, ankerite, and siderite), quartz and calcite gangue, and sulphides: sphalerite, galena, pyrite, and arsenopyrite, with accessory, chalcopyrite, argentian tetrahedrite (freibergite), jamesonite, ruby silver, and native silver.

The Bear vein strikes between 010°and 050° and dips between 65°and 80° to the southeast. The structure accommodates approximately 30 m of the total Bermingham displacement. It occupies a position in the footwall of the system beneath a major flexure in the Bermingham vein, to which it joins up dip. At depth and to the southwest, the Bear vein junctions with the Bermingham Footwall vein. Early phase mineralization is absent and the Bear structure is considered a late response to the slip-impeding flexure in the Bermingham vein noted above. Wide high grade mineralization is positioned on more northerly striking and steeper dipping areas.

First recognized in 2016, the West-Dipping vein strikes 020° and dips 50° to the west, it is situated between the Bear and Bermingham veins. It displays only minor displacement and is considered to represent an adjustment in the Bear vein hangingwall to a pronounced curvature in the sliding path. Similarly, oriented veins were observed historically in the Keno Hill district at Elsa, Husky, Runer, Black Cap, and are also interpreted at Hector-Calumet and Lucky Queen (Boyle, 1965; Cathro 2006; UKHM, unpublished). The Bear and West dipping veins are structurally and mineralogically similar to the Bermingham veins but quartz and calcite (considered early mineral phases) are less abundant or absent whilst sulphosalts are more abundant. This difference is considered a product of a shorter duration of activity on both the Bear and West Dipper veins allowing for deposition of only the later stages of the mineralization. Wide, high grade veining is spatially associated with vein-fault domains exhibiting steeper dip and/or more northerly strike. The post-mineral faults that are recognized within the resource area include the Mastiff, Hangingwall, Cross and Super faults. The attitudes of post-mineral faults appear bimodal, with one set striking between 280° and 293°, and the other at 314° to 317°, although they may represent end members of a single fault set. These northwest trending structures cut and displace all mineralized veins, and while they are typically non-mineralized, it is sometimes observed that mineralization may have been drawn into the later fault.

The Mastiff fault strikes at 137°, dips 51° to the southwest, and displaces the hangingwall obliquely 131 m down to the northwest along a vector 302° / -23°. The location of the Mastiff fault is well constrained by drilling and exposure in the main pit. When discussing the Bermingham, Bermingham Footwall and Aho veins, the vein zones located in the footwall of the Mastiff fault are referred to as the “Arctic” Zone (to the west) and “Etta” Zone in the hangingwall (to the east).

The Hangingwall fault strikes between 000° and 025° and dips between 53° and 65°to the east and is represented in drill-core by very wide zones (10-30 metres) of unconsolidated fault breccia and gouge, mineralization is sporadic and weak and occurs as trails of fragmented clasts that are interpreted to represent pre-fault material. The Hangingwall fault extends to surface where it was intersected by historic trenching northeast of the current resource area.

The Cross fault strikes between 120° and 130° and dips between 45° and 68° to the south. The fault displaces all veins 76 m down to the south along a vector 274° / -29°.The Cross fault includes two sub-parallel splays and their generation is considered a response to a strong flexure in the main fault shape.

The Super fault strikes 133° and dips 25° to the southwest with the hanging wall displaced approximately 42 m downward to the south along a vector 272° / -15°. The structure dislocates the historic workings and open pit from the current resource area that is wholly situated in the footwall. The fault structure is well represented by drill-core and is exposed in the north end of the historic main pit where it has also been referred to as the Mirror fault.

## 2.3 GENERAL ENVIRONMENTAL CONDITIONS

Table 2-1 summarizes existing environmental conditions in the Keno Hill project area. The Keno Hill Silver District lies within the Yukon Plateau – North Ecoregion, just south of the Wernecke Mountains. The terrain consists of concordant, rolling, upland areas separated by wide valleys. Alpine mountain peaks extend above the uplands locally. Many valleys include peatlands, palsas, fens and meadows of sedge tussocks. Upper slopes may be covered with scree material, with treeline occurring at 1,350 to 1,500 metres above sea level (masl). The area has been influenced by the latest glaciation but shows more subtle evidence of an earlier event as well.

**Table 2-1: Keno Hill District Environmental Setting Summary**

| | |
|---|---|
| **Drainage Region** | Stewart River drainage region |
| **Significant Watersheds** | McQuesten River, Lightning Creek and Stewart River Watershed, Mayo River |
| **Ecoregion** | Yukon Plateau (North) |
| **Study Area Elevation** | 900-1350 masl (metres above sea level) |
| **Vegetation Communities** | Northern boreal forests occupy lower slopes and valley bottom; spruce, pine and alder; grasses and sedges, mosses occupy forest floor; heavy moss and lichen growth resident as ground cover understory of shrub willow; open and forest fringe areas of willow and scrub birch, and various flowering plant species. |
| **Wildlife Species** | Moose, grizzly and black bear, caribou, beaver, wolf, lynx, marten, wolverine, western tanager, white-throated sparrow, bald eagle, furbearers and small animals.<br>Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed species include: Common Nighthawk (Threatened); Rusty Blackbird and Olive-Sided Flycatcher (Special Concern). |
| **Fish Species** | Bering and Beaufort Sea salmonids and freshwater species, including: Arctic grayling, Arctic char, lake trout, trout perch, lake whitefish, broad whitefish, burbot, inconnu, Arctic Cisco, Northern pike, slimy sculpin, chinook salmon |

## 2.4 HYDROLOGY

The Keno Hill Silver District contains two main watersheds: Lightning Creek water shed and the Christal Creek watershed which is a sub-watershed of the South McQuesten River.

Christal Creek flows northwest from Christal Lake for approximately 22 km before it flows into the South McQuesten River. Water chemistry and aquatic resources in the creek have been influenced by previous mine and milling operations including tailings deposition and adit discharge. Christal Creek receives input from treated water from Galkeno 900 adit, Galkeno 300 adit, and seepages (surface and groundwater) from workings on the west face of Keno Hill. Christal Lake has been a receptor for effluent from various mines including Galkeno 900 and the Mackeno Mill area and Mackeno tailings, contributing to metal loading in Christal Creek.

Lightning Creek is situated within a narrow valley with a steep gradient flowing from the north side of Sourdough Hill into Duncan Creek, which drains into the Mayo River. Hope and Thunder Gulches flow into Lightning Creek within the bounds of the KHSD. Lightning Creek has also been the site of extensive placer mining upstream of Keno City both historically and at present time. Treated mine adit discharge (QZ09-092-2) from Bellekeno 625 (north side of Sourdough Hill) eventually reports to the Lightning Creek drainage.

The Bermingham Portal and associated infrastructure is in the No Cash Creek Catchment. The No Cash Creek is situated on the northwest slope of Galena Hill and flows down the hillside towards the wetlands northeast of Flat Creek. There is no direct connection between No Cash Creek and either Flat Creek or the South McQuesten River as No Cash Creek ends in a bog. From the headwaters on Galena Hill to dispersion in the bog, the distance is roughly 2.3 km.

## 2.5 CLIMATE

### 2.5.1 Meteorological Monitoring

An automated meteorological station (Calumet Weather Station) was installed on Galena Hill above the Hector adit at 1,380 masl in June 2007. The station measures air temperature, relative humidity, barometric pressure, rainfall, wind speed and direction, solar radiation, and soil temperature. Average monthly temperatures range from a low of approximately -19°C in January to a high of approximately 12°C in July. Table 2-2 summarizes total rainfall and average temperatures recorded at the Galena Hill meteorological station from 2007 to date.

A Campbell Scientific meteorological station located above the District Mill near Keno City (at an elevation of 936 masl) was commissioned and installed in June 2011. The sensors on this station include air temperature, relative humidity, rainfall and wind speed and direction. Note that the wind sensor is at a height of 10 m, which is the standard height for use of the data in air dispersion models. Table 2-3 summarizes data collected to date at the Keno District Mill.

There are three regional snow survey sites that are monitored by the Yukon Government: Mayo Airport A, Mayo Airport B, and Calumet. Mayo Airport A and B are located in the Village of Mayo at an elevation of 540 masl and Calumet is on Galena Hill, near Keno City at an elevation of 1310 masl. The March and April monthly snow water equivalent (SWE) statistics for the three regional sites are shown in Table 2-4

## Table 2-2: Calumet Weather Station Temperature and Rainfall 2007-2018

| | Average Temperature (°C) | | | | | | | | | | | | Total Rainfall (mm) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | *0.0*[17] | 5.05 |
| January | - | -17.18 | -18.84 | -14.08 | -16.78[3] | -18.71[4] | -16.90 | [6] | -13.22 | *-8.34*[12] | *-13.06*[14] | -13.80 | - | - | - | - | - | - | - | [6] | 0.0 | 0.0[12] | [17] | 0.25 |
| February | - | -16.99 | -16.95 | -9.09 | -15.88[3] | -9.94[4] | -10.81 | -15.69 | -13.42 | -9.32 | [14] | -16.86 | - | - | - | - | 1.8[3] | [9] | - | - | 0.2 | 0.3 | *0.8*[17] | 1.25 |
| March | - | -11.04 | -16.39 | -9.21 | -12.92[3] | -12.92[4] | -14.45 | -11.95 | -10.69 | -5.84 | *-16.43*[14] | -11.99 | - | - | - | - | 0.5[3] | [9] | 0.6 | - | 2.8 | 2.8 | *4.3*[15] | 0.75 |
| April | - | -4.93 | -4.75 | -2.01 | -3.77[3] | -1.88[4] | -12.32 | -4.39 | -3.33 | -0.43 | *-3.62*[15] | -6.33 | - | 1 | - | 1.3[3] | 2.8[3] | [9] | 0.2 | 6.2 | 8.6 | 7.8 | [15] | 82.8 |
| May | - | 3.31 | 3.66 | 5.35 | 4.41[3] | 1.61[4] | n/a | 4.17 | 7.85 | 5.55 | [15] | 2.84 | - | 25.4 | 21.8 | 32.3[3] | 15.5[3] | [9] | n/a | 17.2 | 4.0 | 23.0 | [15] | 116.3 |
| June | *11.25*[1] | 8.70 | 9.58 | 8.68 | 8.82[3] | 7.76[4] | 11.59 | *7.31*[11] | 8.42 | 10.07 | [15] | 8.68 | *55.2*[1] | 44.6 | *11.8*[7] | 56.7[3] | 121.8[3] | [9] | 45.2 | *69.8* [11] | 45.2 | 43.0 | *71.3*[15] | 31.63 |
| July | 11.80 | 8.17 | 12.45 | 10.50 | 3.80[3] | 7.84[4] | 11.11 | [11] | 9.67 | 10.60 | *11.81*[15] | 11.93 | 108.8 | 108.4 | *22.8*[8] | 137.7[3] | 135.9[3] | *27.8*[10] | 39.2 | [11] | 135.5 | [13] | 44.5 | 164.3 |
| August | 9.63 | 5.54 | 7.47 | 9.61 | [2] | 8.33[5] | 10.58 | 7.95 | 6.71 | 9.25 | 10.03 | 7.14 | 54.8 | 110.2 | 89.4 | 140.0[3] | [9] | 45.0 | 35.6 | | 97.0 | [13] | 115.2 | 15.9 |
| September | 1.12 | 2.27 | 3.58 | 2.40 | [2] | 3.39 | 3.33 | 1.86 | *2.17*[12] | 2.95 | 4.74 | 1.55 | 57.6 | 61.4 | 50.4 | 78.0[3] | [9] | 17.4 | 64.6 | | *46.4*[12] | [13] | 16.0 | 9.4 |
| October | -6.53 | -7.20 | -4.73 | -4.86 | [2] | -8.16 | -2.52 | -5.02 | [12] | -6.23 | -4.94 | -2.64 | - | 12.6 | - | 16.0[3] | [9] | 1.6 | 14.6 | | [12] | 0.0[13] | 0.0 | 3.3 |
| November | -9.41 | -10.17 | -11.94 | -11.19 | -17.39[4] | -18.44 | -15.50 | -9.87 | [12] | -8.87 | -17.31 | -9.29 | - | - | - | - | - | 0.2 | 0.0 | | [12] | 0.0 | *0.0*[16] | *0.5*[18] |
| December | -16.19 | -18.34 | -11.16 | -17.72 | -11.78[4] | -18.83 | *-14.55*[6] | -10.43 | [12] | -15.27 | *-5.31*[16] | *-10.67*[18] | - | - | - | - | - | 0 | *0.0*[6] | | [12] | 0.0 | *0.0*[17] | 5.05 |

*Notes:*

*Values in grey italics indicate a partial month*

*[1] Station commissioned June 15, 2007*

*[2] Temperature probe malfunction – no proxy data available*

*[3] Calculated from MAYO A data*

*[4] Sensor occasionally offline but most data complete*

*[5] Sensor replaced August 7*

*[6] The station was down from December 12, 2013 to January 31, 2014.*

*[7] Rainfall gauge malfunction on June 11; total rainfall provided for June 1-11.*

*[8] Rainfall gauge back online; total rainfall provided for July 7-31.*

*[9] Tipping bucket malfunction – no proxy data available.*

*[10] Tipping bucket repaired July 4th; total rainfall provided for July 4-31.*

*[11] Station was down between June 26 and July 31, 2014.*

*[12] Data missing from September 17, 2015 to January 5, 2016.*

*[13] Rainfall data missing from June 23, 2016 to October 23, 2016.*

*[14] Temperature data missing between January 14, 2017 and March 4, 2017.*

*[15] Data missing between April 7, 2017 and July 17, 2017.*

*[16] Last data download on December 15, 2017.*

*[17] Rain data missing between January 26, 2017 and March 4, 2017.*

*[18] Data only available till December 26, 2018.*

## Table 2-3: Monthly statistic for meteorological parameters collected at Keno District Mill Station

| Month | Extreme Maximum Temperature (ºC) | Average Maximum Temperature (ºC) | Average Temperature (ºC) | Average Minimum Temperature (ºC) | Extreme Minimum Temperature (ºC) | Average Relative Humidity (%) | Total Precip (mm) | Average Wind Speed (m/s) [1] | Extreme Maximum Wind Speed (m/s) [1] | Average Barometric Pressure (kPa) | Average Solar Radiation (W/m²) | Total Evapo-transpiration (mm)[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jun -11[2] | 24.72 | 18.59 | 11.96 | 6.30 | -2.56 | n/a | n/a | 1.35 | 9.14 | n/a | n/a | n/a |
| Jul-11 | 25.67 | 18.50 | 12.91 | 8.00 | 5.09 | n/a | n/a | 1.15 | 8.02 | n/a | n/a | n/a |
| Aug-11 | 22.32 | 15.58 | 9.78 | 5.37 | 1.93 | n/a | n/a | 1.18 | 9.15 | n/a | n/a | n/a |
| Sep-11 | 17.97 | 11.29 | 6.07 | 1.85 | -2.47 | n/a | n/a | 1.43 | 11.36 | n/a | n/a | n/a |
| Oct-11 | 7.20 | 0.20 | -2.74 | -5.41 | -9.84 | n/a | *2.60*[3] | 0.94 | 13.12 | n/a | n/a | n/a |
| Nov-11 | -4.23 | -16.79 | -19.54 | -22.47 | -34.99 | n/a | 0.00 | 0.58 | 12.05 | n/a | n/a | n/a |
| Jan-12 | -0.96 | -19.10 | -23.13 | -26.79 | -37.32 | n/a | 0.00 | *0.59* | *9.51* | n/a | n/a | n/a |
| Feb-12 | 2.77 | -6.77 | -10.00 | -13.07 | -26.78 | n/a | 0.10 [4] | *1.38* | *15.62* | n/a | n/a | n/a |
| Mar-12 | 5.33 | -7.69 | -13.37 | -18.00 | -27.80 | n/a | 0.00 | *0.97* | *9.24* | n/a | n/a | n/a |
| Apr-12 | 9.69 | 6.13 | 0.96 | -3.87 | -15.92 | n/a | 0.60 [4] | 1.37 | 10.27 | n/a | n/a | n/a |
| May-12 | 17.78 | 10.73 | 6.31 | 1.91 | -3.47 | *51.81* [5] | 18.30 | 1.78 | 10.60 | n/a | n/a | n/a |
| Jun-12 | 27.62 | 18.41 | 13.46 | 8.29 | 4.42 | 56.35 | 21.70 | 1.44 | 10.26 | n/a | n/a | n/a |
| Jul-12 | 25.14 | 18.07 | 12.75 | 7.73 | 1.64 | 69.26 | 85.80 | 1.36 | 12.99 | n/a | n/a | n/a |
| Aug-12 | 21.72 | 16.31 | 11.25 | 6.56 | -0.89 | 67.79 | 47.00 | 1.62 | 9.41 | n/a | n/a | n/a |
| Sep-12 | 20.24 | 10.33 | 5.90 | 2.08 | -5.22 | 69.51 | 36.40 | 1.84 | 14.27 | n/a | n/a | n/a |
| Oct-12 | 7.60 | -3.95 | -7.35 | -10.32 | -20.62 | 79.54 | 7.60 | 1.13 | 10.37 | n/a | n/a | n/a |
| Nov-12 | -8.98 | -19.55 | -21.90 | -24.32 | -33.36 | 81.43 | 0.00 | 0.94 | 9.36 | n/a | n/a | n/a |
| Dec-12 | -3.36 | -21.30 | -23.44 | -25.58 | -36.32 | 81.34 | 0.00 | *0.26* | *5.93* | n/a | *1.01* [6] | *0.05* [7] |
| Jan-13 | -1.59 | -17.06 | -20.01 | -23.08 | -41.48 | 82.92 | 0.00 | *0.76* | *14.48* | n/a | 1.06 | 0.81 |
| Feb-13 | 1.54 | -9.10 | -12.52 | -15.46 | -23.74 | 88.36 | 0.30 [4] | *0.85* | *12.25* | n/a | 10.26 | 1.27 |
| Mar-13 | 3.26 | -7.52 | -13.16 | -17.99 | -29.96 | 64.08 | 3.90 | 1.59 | 12.47 | n/a | 95.82 | 6.33 |
| Apr-13 | 6.07 | -2.76 | -7.94 | -13.69 | -25.07 | 54.50 | 8.20 | 2.44 | 12.93 | n/a | 190.02 | 14.48 |
| May-13 | 23.31 | 10.20 | 5.27 | 0.23 | -9.46 | 61.83 | 39.60 | 1.77 | 11.76 | n/a | 215.44 | 21.70 |
| Jun-13 | 30.51 | 19.97 | 14.27 | 8.30 | 1.84 | 58.72 | 57.30 | 1.82 | 12.87 | n/a | 234.69 | 29.79 |
| Jul-13 | 24.93 | 19.40 | 14.01 | 8.60 | 2.25 | 62.67 | 46.90 | 1.75 | 16.14 | n/a | 211.00 | 27.10 |
| Aug-13 | 27.34 | 18.54 | 12.98 | 8.01 | -0.38 | 66.30 | 51.90 | 1.49 | 11.05 | n/a | 156.25 | 21.38 |
| Sep-13 | 16.11 | 9.69 | 5.81 | 2.26 | -3.74 | 77.52 | 59.70 | 1.54 | 10.99 | n/a | 79.69 | 10.88 |
| Oct-13 | 8.25 | 1.61 | -1.32 | -4.21 | -10.10 | 86.75 | 44.60 | 1.11 | 11.62 | n/a | 35.75 | 4.26 |
| Nov-13 | 0.18 | -13.41 | -16.68 | -20.08 | -37.96 | 84.26 | 10.60 | *1.02* | *10.96* | n/a | 4.93 | *1.08* |
| Dec-13 | -1.73 | -21.23 | -23.91 | -26.70 | -35.29 | 78.77 | 4.90 | *0.75* | *9.47* | n/a | 0.57 | *0.62* |
| Jan-14 | 3.74 | -9.33 | -12.16 | -15.10 | -32.22 | 89.44 | 24.9 | *0.72* | *10.03* | n/a | 2.42 | *0.641* |
| Feb-14 | -1.93 | -15.25 | -19.40 | -23.02 | -33.55 | 75.20 | 2.9 | 0.87 | 10.85 | n/a | 31.34 | 1.988 |
| Mar-14 | 4.57 | -5.31 | -11.29 | -16.16 | -26.79 | 54.77 | 0.7 | 1.57 | 11.98 | n/a | 115.54 | 9.174 |

| Month | Extreme Maximum Temperature (ºC) | Average Maximum Temperature (ºC) | Average Temperature (ºC) | Average Minimum Temperature (ºC) | Extreme Minimum Temperature (ºC) | Average Relative Humidity (%) | Total Precip (mm) | Average Wind Speed (m/s) [1] | Extreme Maximum Wind Speed (m/s) [1] | Average Barometric Pressure (kPa) | Average Solar Radiation (W/m$^2$) | Total Evapo-transpiration (mm)[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr-14 | 10.93 | 4.09 | -0.96 | -5.78 | -17.33 | 57.54 | 5.1 | 1.64 | 12.05 | n/a | 171.28 | 15.77 |
| May-14 | 21.30 | 12.70 | 7.64 | 2.03 | -3.03 | 52.18 | 12.8 | 2.09 | 19.21 | n/a | 217.91 | 29.81 |
| Jun-14 | 24.93 | 16.21 | 11.39 | 5.95 | -0.13 | 56.14 | 40.4 | 1.78 | 10.43 | n/a | 217.90 | 28.58 |
| Jul-14 | 23.44 | 18.49 | 13.68 | 8.73 | -0.04 | 65.01 | 31.0 | 1.63 | 13.38 | n/a | 187.31 | 23.84 |
| Aug-14 | 22.09 | 15.57 | 10.87 | 6.93 | 0.06 | 74.59 | 67.7 | 1.44 | 11.85 | n/a | 139.84 | 15.72 |
| Sep-14 | 17.70 | 8.76 | 4.28 | 0.49 | -6.74 | 70.54 | 36.4 | 1.37 | 11.32 | n/a | 93.38 | 11.56 |
| Oct-14 | 7.47 | -0.91 | -3.79 | -6.33 | -15.42 | 88.21 | 15.7 | 1.24 | 12.80 | n/a | 24.83 | 3.39 |
| Nov-14 | -2.21 | -12.15 | -14.34 | -16.59 | -30.16 | 88.64 | 1.40 | *0.59* | *6.27* | n/a | 3.12 | *0.60* |
| Dec-14 | -0.09 | -11.05 | -13.67 | -16.31 | -26.66 | 89.06 | 1.40 [9] | *0.51* | *8.87* | n/a | 0.33 | *0.40* |
| Jan-15 | -0.34 | -13.74 | -16.50 | -19.13 | -34.86 | 85.85 | 1.9 | *0.49* | *5.488* | n/a | 1.30 | *0.431* |
| Feb-15 | 2.87 | -12.95 | -15.93 | -18.78 | -39.39 | 84.95 | 12.7 | 0.75 | 10.36 | n/a | 9.06 | 0.859 |
| Mar-15 | 5.54 | -4.76 | -9.83 | -14.37 | -28.70 | 70.52 | 4.1 | 1.45 | 12.6 | n/a | 86.48 | 6.292 |
| Apr-15 | 10.90 | 5.36 | 0.56 | -3.89 | -10.48 | 61.71 | 4.2 | 1.75 | 12.37 | n/a | 163.45 | 16.03 |
| May-15 | 26.51 | 16.95 | 10.96 | 4.60 | -7.00 | 45.35 | 1.4 | 1.89 | 10.64 | n/a | 246.80 | 34.67 |
| Jun-15 | 23.18 | 16.65 | 11.37 | 5.81 | 0.52 | 61.05 | 26.3 | 1.85 | 12.62 | n/a | 219.18 | 26.46 |
| Jul-15 | 25.43 | 17.54 | 12.54 | 7.72 | 4.73 | 68.63 | 72.4 | 1.48 | 12.62 | n/a | 190.74 | 19.98 |
| Aug-15 | 24.63 | 14.03 | 9.35 | 5.08 | -3.09 | 75.14 | 54.9 | *1.47* | *9.86* | n/a | 146.76 | *13.87* |
| Sep-15 | 13.57 | 7.07 | 2.77 | -0.72 | -7.72 | 79.33 | 32.6 | 1.71 | 15.64 | n/a | 83.01 | 10.12 |
| Oct-15 | 7.32 | 0.88 | -1.78 | -4.16 | -13.22 | 89.14 | 19.4 | *1.08* | *10.07* | n/a | 32.52 | *2.92* |
| Nov-15 | 0.83 | -11.17 | -13.75 | -17.16 | -31.38 | 89.09 | 22.8 | *0.71* | *12.15* | n/a | 4.03 | *0.60* |
| Dec-15 | 0.18 | -12.38 | -14.60 | -16.93 | -31.06 | 89.01 | 4.0 | *4.59* | *14.24* | n/a | 0.63 | *0.13* |
| Jan-16 | 1.17 | -8.96 | -11.14 | -13.58 | -21.91 | 88.06 | 24.9 | *0.83* | *15.35* | n/a | 1.67 | *1.45* |
| Feb-16 | 2.04 | -7.63 | -10.94 | -14.27 | -26.68 | 82.96 | 2.3 | 0.86 | 9.55 | n/a | 22.80 | 2.32 |
| Mar-16 | 12.35 | -0.55 | -4.96 | -8.72 | -16.96 | 73.13 | 7.1 | 1.26 | 8.11 | n/a | 82.81 | 7.12 |
| Apr-16 | 13.50 | 7.12 | 2.28 | -2.23 | -12.45 | 63.20 | 3.8 | 1.64 | 10.66 | n/a | 159.95 | 15.86 |
| May-16 | 22.80 | 13.61 | 8.44 | 3.04 | -1.59 | 54.73 | 14.7 | 1.89 | 11.89 | n/a | 210.96 | 25.97 |
| Jun-16 | 25.98 | 18.36 | 12.88 | 7.17 | 2.27 | 56.52 | 40.0 | 1.76 | 13.37 | n/a | 234.99 | 29.78 |
| Jul-16 | 23.73 | 17.71 | 13.37 | 9.07 | 1.71 | 73.05 | 63.4 | 1.46 | 12.54 | n/a | 173.59 | 17.36 |
| Aug-16 | 24.42 | 16.67 | 11.92 | 7.82 | 1.22 | 70.86 | 42.2 | 1.50 | 10.69 | n/a | 152.32 | 17.72 |
| Sep-16 | 17.42 | 10.00 | 5.01 | 0.90 | -6.18 | 71.05 | 28.9 | 1.50 | 10.81 | n/a | 100.94 | 14.02 |
| Oct-16 | 2.43 | -3.20 | -7.07 | -9.99 | -17.15 | 79.60 | 11.4 | 1.12 | 8.29 | n/a | 50.66 | 4.15 |
| Nov-16 | 4.05 | -8.20 | -10.89 | -13.45 | -25.46 | 86.45 | 7.6 | *0.80* | *9.57* | n/a | 5.70 | *1.99* |
| Dec-16 | -4.20 | -17.39 | -19.62 | -21.89 | -32.16 | 83.76 | 1.3 | *0.62* | *8.45* | n/a | 0.56 | *0.51* |
| Jan-17 | -0.10 | -13.10 | -16.04 | -18.97 | -33.59 | 82.95 | 0.8 | *1.06* | *11.03* | n/a | 1.64 | *1.76* |
| Feb-17 | 5.04 | -11.47 | -15.17 | -18.42 | -28.26 | 78.03 | 21.6 | 1.12 | 11.61 | n/a | 26.93 | 3.17 |
| Mar-17 | 9.56 | -9.61 | -15.23 | -19.49 | -32.14 | 64.03 | 8.4 | 1.72 | 8.83 | n/a | 100.75 | 6.51 |

| Month | Extreme Maximum Temperature (ºC) | Average Maximum Temperature (ºC) | Average Temperature (ºC) | Average Minimum Temperature (ºC) | Extreme Minimum Temperature (ºC) | Average Relative Humidity (%) | Total Precip (mm) | Average Wind Speed (m/s) [1] | Extreme Maximum Wind Speed (m/s) [1] | Average Barometric Pressure (kPa) | Average Solar Radiation ($W/m^2$) | Total Evapo-transpiration (mm)[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr-17 | 12.09 | 4.09 | -1.17 | -6.23 | -16.26 | 57.70 | 7.1 | 1.81 | 10.50 | n/a | 173.66 | 15.44 |
| May-17 | 19.93 | 12.98 | 8.06 | 2.94 | -2.30 | 54.38 | 16.8 | 1.92 | 11.54 | n/a | 211.85 | 27.95 |
| Jun-17 | 25.34 | 17.47 | 12.39 | 6.78 | -0.90 | 54.93 | 20.2 | 1.73 | 13.32 | n/a | 225.93 | 28.61 |
| Jul-17 | 28.09 | 20.67 | 14.99 | 9.44 | 4.21 | 64.01 | 39.4 | 1.57 | 13.65 | n/a | 212.94 | 25.50 |
| Aug-17 | 28.31 | 18.20 | 12.83 | 8.12 | 1.95 | 64.85 | 16.7 | 1.46 | 11.01 | n/a | 156.87 | 21.67 |
| Sep-17 | 19.06 | 11.19 | 6.94 | 3.36 | -2.32 | 77.06 | 48.7 | 1.34 | 11.06 | n/a | 78.21 | 10.37 |
| Oct-17 | 10.14 | -0.31 | -3.41 | -6.38 | -12.54 | 87.16 | 28.0 | *1.05* | *8.65* | n/a | 31.26 | *3.40* |
| Nov-17 | -5.89 | -17.87 | -20.14 | -22.26 | -33.90 | 83.46 | 0.0 | *0.45* | *5.47* | n/a | 5.37 | *0.45* |
| Dec-17 | 4.27 | -9.99 | -12.29 | -14.69 | -31.16 | 86.62 | 19.8 | *1.78* | *12.28* | n/a | 0.74 | *2.00* |
| Jan-18 | 6.71 | -13.82 | -17.19 | -20.47 | -34.3 | 82.19 | 9.6 | 0.34 | 12.84 | n/a | 2.84 | *1.68* |
| Feb-18 | -5.60 | -16.65 | -20.57 | -23.82 | -33.78 | 79.90 | 0.1 | 0.76 | 7.80 | n/a | 11.40 | *1.01* |
| Mar-18 | 11.19 | -4.43 | -10.72 | -15.56 | -28.12 | 63.15 | 17.2 | 1.55 | 14.32 | n/a | 84.89 | *7.56* |
| Apr-18 | 12.56 | 3.03 | -3.89 | -10.17 | -21.68 | 50.97 | 0 | 1.77 | 9.28 | n/a | 180.88 | *15.92* |
| May-18 | 21.13 | 12.34 | 6.27 | 0.75 | -10.64 | 61.61 | 67.6 | 1.75 | 11.42 | n/a | 186.76 | *21.96* |
| Jun-18 | 28.51 | 17.51 | 11.52 | 6.11 | 2.00 | 65.23 | 75.8 | 1.59 | 12.21 | n/a | 200.62 | *21.82* |
| Jul-18 | 29.01 | 21.05 | 14.15 | 7.91 | 3.56 | 59.75 | 19.7 | 1.66 | 10.06 | n/a | 212.37 | *28.97* |
| Aug-18 | 26.92 | 16.04 | 10.30 | 6.14 | 0.26 | 79.09 | 110.6 | 1.47 | 17.1 | n/a | 132.47 | *12.32* |
| Sep-18 | 13.8 | 10.05 | 3.27 | -1.94 | -6.46 | 63.01 | 14 | 1.55 | 10.73 | n/a | 118.01 | *6.56* |
| Oct-18 | 10.85 | 3.71 | -0.94 | -4.88 | -12.41 | 72.22 | 4.23 | 1.32 | 10.79 | 89.71 | 31.70 | *4.56* |
| Nov-18 | 2.83 | -8.71 | -11.52 | -14.61 | -25.79 | 89.76 | 0 | 0.56 | 10.49 | 90.09 | 3.34 | *0.78* |
| Dec-18 | *2.22* | *-10.21* | *-13.42* | *-16.58* | *-27.92* | *83.56* | *0* | *0.95* | *13.48* | 89.38 | 1.21 | *2.63* |

*Notes:* *Values in grey italics indicate a partial month*

*[1]January 2012 has 25 days of complete wind data*
*February 2012 has 28 days of complete wind data*
*March 2012 has 30 days of complete wind data*
*December 2012 has 15 days of complete wind data*
*January 2013 has 21 days of complete wind data*
*February 2013 has 26 days of complete wind data*
*November 2013 has 24 days of complete wind data*
*December 2013 has 20 days of complete wind data*
*January 2014 has 9 days of complete wind data*
*November 2014 has 23 days of complete wind data*
*December 2014 has 6 days of complete wind data*
*January 2015 has 24 days of complete wind data*
*August 2015 has 28 days of complete wind data*
*October 2015 has 29 days of complete wind data*
*November 2015 has 9 days of complete wind data*
*December 2015 has 0 days of complete wind data*
*January 2016 has 16 days of complete wind data*
*November 2016 has 23 days of complete wind data*
*December 2016 has 22 days of complete wind data*
*January 2017 has 25 days of complete wind data*
*October 2017 has 28 days of complete wind data*
*November 2017 has 19 days of complete wind data*

*[2] June 2011 has 29 days of complete data (station commissioned on June 2)*

*[3] 16 days of complete rain data*

*[4] Rainfall recorded at temperatures below zero may be due to snowmelt*

*[5] 25 days of complete RH data*

*[6] 18 days of complete solar radiation data*

*[7] 7 days of complete evapotranspiration data*

*[8] Evapotranspiration is invalid where wind is invalid*

*[9]Total precipitation likely underestimated due to partial freezing in snowfall conversion adaptor*

**Table 2-4: Regional Snow Survey Stations – SWE (mm) Statistics**

| Station | Elevation (masl) | Period | Month | Min | Max | Average |
|---|---|---|---|---|---|---|
| **Mayo A** | **540** | **1968-2018**<br>**n = 49** | **March** | 30 | 160 | 87 |
| | | | **April** | 10 | 176 | 96 |
| **Mayo B** | **540** | **1987-2018**<br>**n = 62** | **March** | 42 | 166 | 92 |
| | | | **April** | 48 | 192 | 103 |
| **Calumet** | **1310** | **1975-2018**<br>**n = 41** | **March** | 94 | 298 | 173 |
| | | | **April** | 101 | 300 | 195 |

## 2.6 ORE RESERVES AND RESOURCES

### 2.6.1 Bermingham

Alexco issued the results of a Pre-Feasibility Study (PFS) for the Keno Hill Silver project in April 2019. The PFS includes an updated mine plan for the Bermingham deposit which represents the current mine plan in the Bermingham Mine Development and Operations Plan. The ore tonnes and grade contained within the PFS represent Mineral Reserves. The following Table 2-5 summarizes the Mineral Reserves and Mineral Resources for the Bermingham deposit.

The underground and surface drill holes used to compile the Bermingham resource are shown in Figure 2-3.

**Table 2-5: Mineral Reserve and Resource Statement April 2019**

| | Classification | Tonnes | Ag (g/t) | Pb (%) | Zn (%) | Au (g/t) |
|---|---|---|---|---|---|---|
| Bermingham | Proven | | | | | |
| | Probable | 362,343 | 972 | 2.59 | 1.32 | 0.13 |
| | | | | | | |
| Bermingham[1] | Indicated | 1,102,300 | 930 | 2.4 | 1.7 | 0.14 |
| | Inferred | 509,400 | 717 | 1.7 | 1.5 | 0.15 |

---

*Note 1 - The effective date of this mineral resource table is September 26, 2018, and is based on a revised narrow-vein interpretation prepared by Alexco on September 13, 2018. An initial vein model was prepared by Alexco on August 28, 2018, which was predicated on a wider vein interpretation that incorporated a significant volume of low-grade material (i.e. <100 g/t silver). Although an initial mineral resource estimate was completed using the wider vein model, a subsequent update has been completed using the narrow-vein model to remove this low-grade tonnage for use in the 2018 PFS study. The narrow-vein geological model was interpreted using a 100 g/t silver cut-off grade to define the mineralized veins but otherwise estimated using the same parameters. Mineral resources are not mineral reserves and have not demonstrated economic viability. All figures have been rounded to reflect the relative accuracy of the estimates. Mineral Resources are inclusive of Mineral Reserves.*

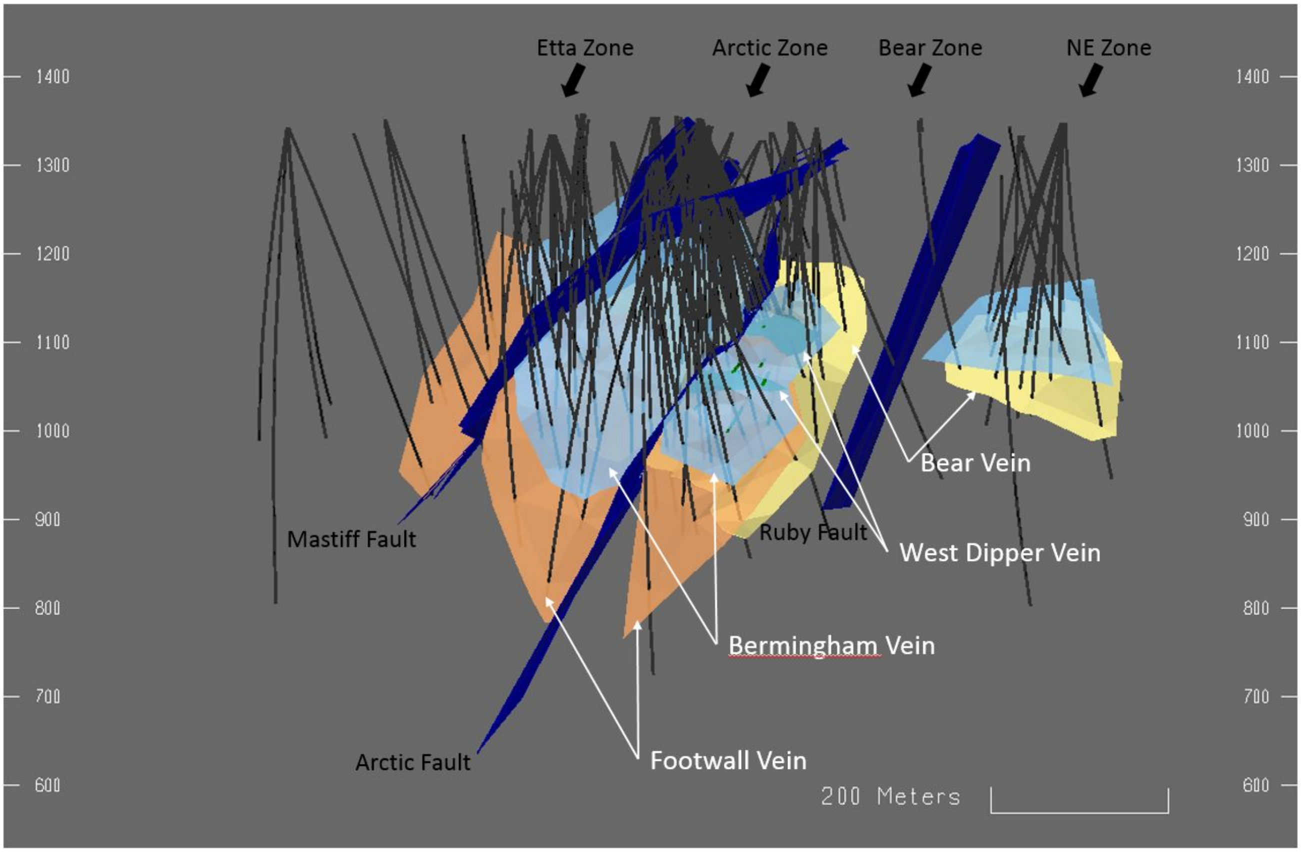


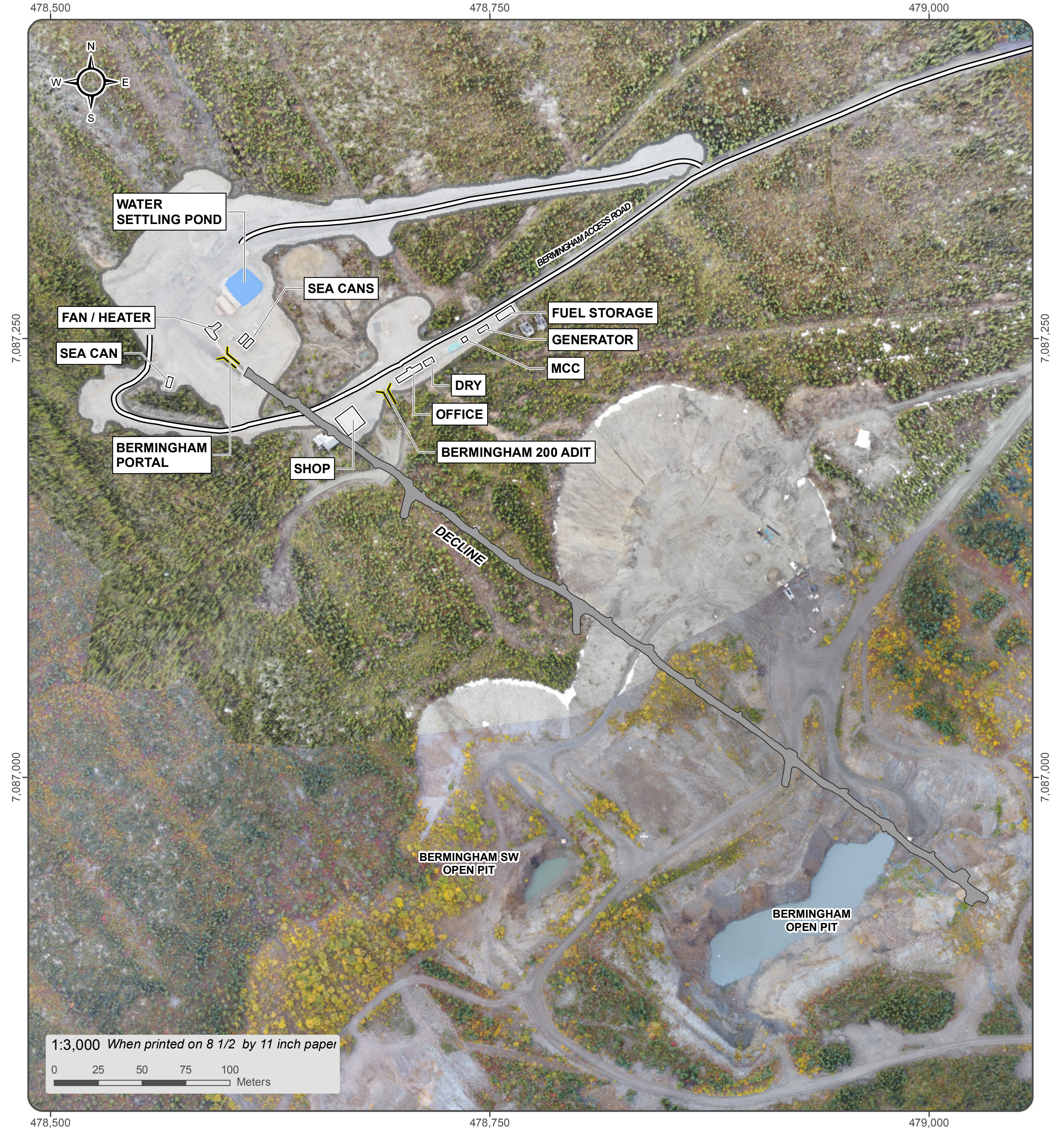
Figure 2-3: Bermingham Deposit Summary of Drill Holes

# 3 UNDERGROUND MINE DESIGN AND METHODS

## 3.1 LAYOUT AND PORTAL LOCATION

Various surface facilities and infrastructure were constructed in 2017 and 2018 to support the construction of the underground exploration decline including a dedicated mine office, dry/lunch room, maintenance shop, diesel power generation, fuel storage tanks and laydown yard. The surface infrastructure that was constructed for the advanced exploration decline will remain in place and be expanded to facilitate development and production at Bermingham. A lined water management pond constructed ion 2017 will be used as part of the water treatment plant and system required during active mine operations. The current as built layout of the surface facilities for Bermingham is presented in Figure 3-1 including the current portal location. The as-built for the decline is shown in Figure 3-2. The pillar thickness between the historic Bermingham open pit and the Bermingham decline is 114 m.

Prior to resuming development and operations at Bermingham, additional surface facilities will be constructed or current ones modified to facilitate long-term operations. The current maintenance shop will be modified to house the future water treatment plant required for operations. An additional office/dry trailer will be installed. A temporary P-AML facility will be constructed near the portal to provide temporary (< 30 days) storage of P-AML rock prior to rehandling underground as backfill. Figure 3-3 shows the layout of the planned remaining surface facilities along with the surface expression of the underground development.



Adit/Portal

▬ Decline

▭ As Built Mine Footprint

🟦 Ponds

═ Road

ALEXCO KENO HILL MINING CORP.
BERMINGHAM

## FIGURE 3-1
## BERMINGHAM AS-BUILT PROJECT LAYOUT

DECEMBER 2018

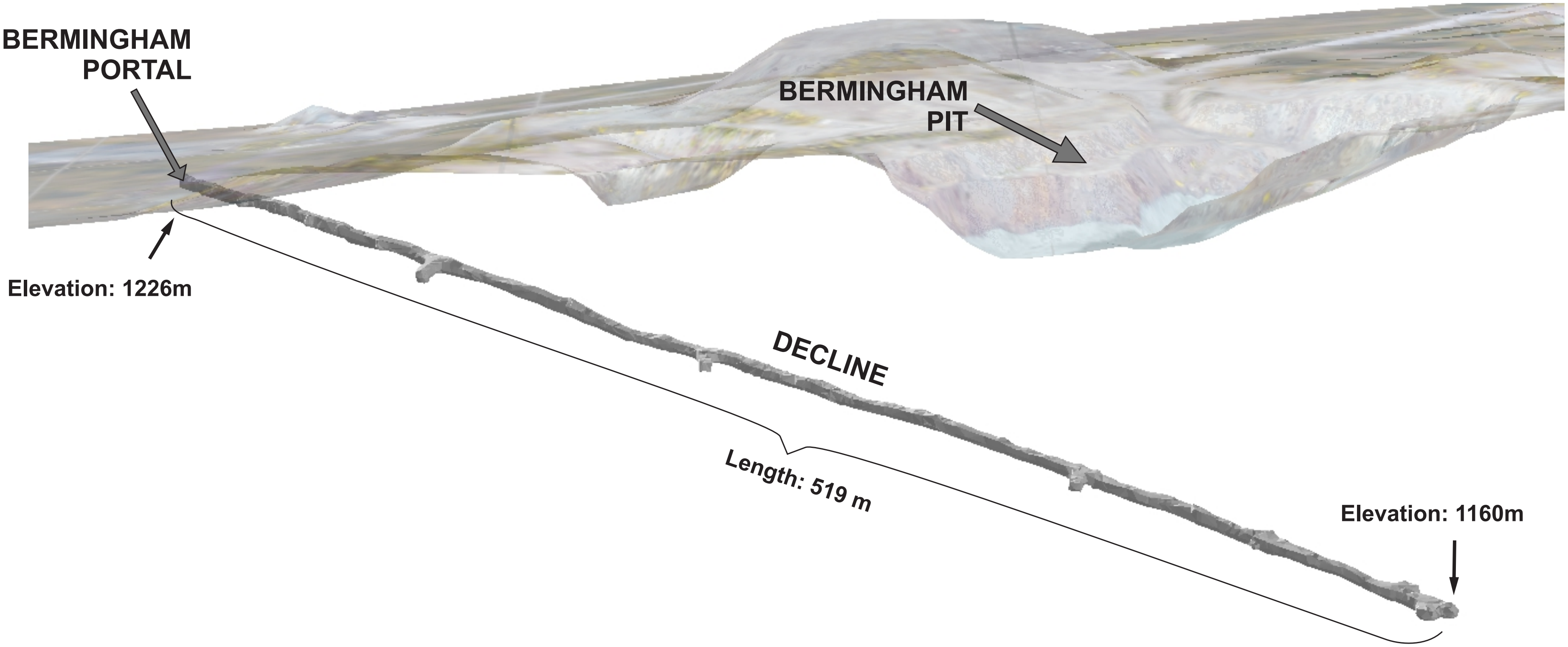
National topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Reproduced under license from Her Majesty the Queen, as represented by the Minister of Natural Resources Canada. All rights reserved.
Datum: NAD 83; Projection: UTM Zone 8N

AEG

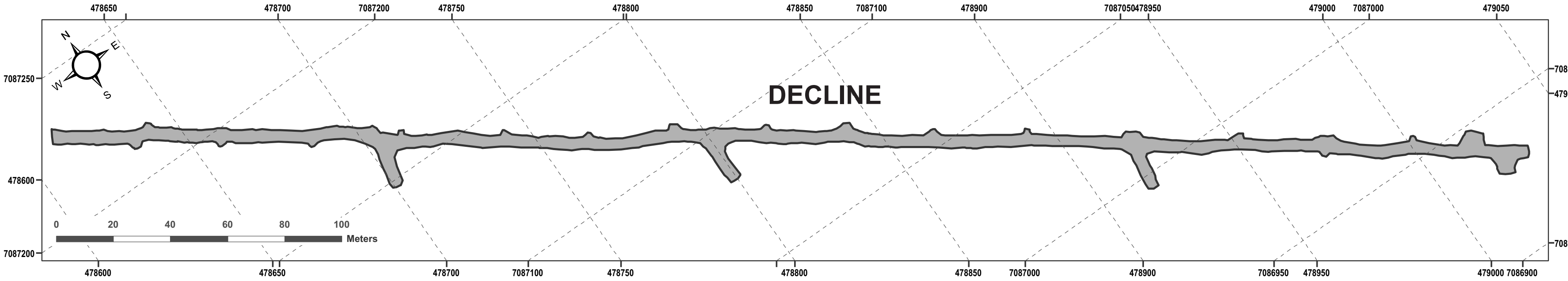
AKHM

D:\Project\AllProjects\Keno_Area_Mines\BERM\Maps\01-Overview\03-Overview\CloseUp\As_Built_Site_Layout_20181218.mxd
(*Last edited by: amatlashevska; 18/12/2018/14:29 PM*)

# VERTICAL SECTION VIEW



# PLANAR VIEW



*CONCEPTUAL DRAWING; FEATURES ARE NOT TO SCALE*

AKHM

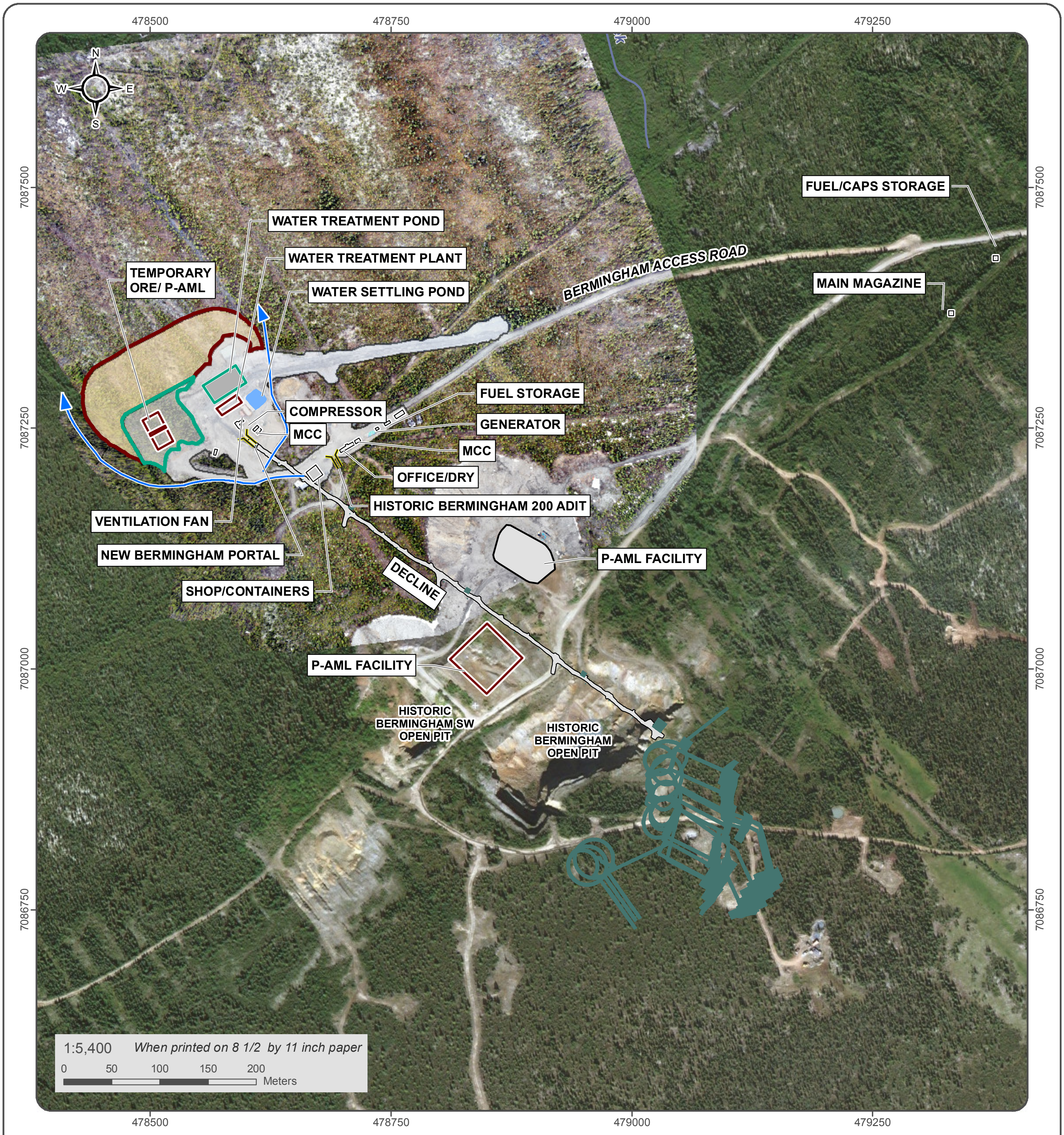
**BERMINGHAM ADVANCED EXPLORATION**

FIGURE 3-2

BERMINGHAM DECLINE AS BUILT

DECEMBER 2018

D:\Project\AllProjects\Keno_Area_Mines\BERM\Presentations\Decline



- Adit/Portal
- Diversion Ditch
- Proposed Underground Workings
- As Built Pond
- Permitted To Be Construced Mine Features
- Proposed Mine Feature
- As Built Mine Feature

ALEXCO KENO HILL MINING CORP.

## FIGURE 3-23
## BERMINGHAM MINE PROJECT LAYOUT

APRIL 2019

National topographic Data Base (NTDB) compiled by Natural Resources Canada at a scale of 1:50,000. Reproduced under license from Her Majesty the Queen, as represented by the Minister of Natural Resources Canada. All rights reserved.
Aeral Imagery was obtained on September 2017 and June 2018
Datum: NAD 83; Projection: UTM Zone 8N

AEG

AKHM

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## 3.2 MINE PLAN

In order to reach the mineralization of the Bermingham deposit, the underground exploration decline will be extended a further 310metres and will serve as the primary ingress/egress and development/production haulage and transportation route. The primary decline is 3.7 m wide by 3.7 m high (for mechanized development and production mining) driven at a grade of approximately -15%. The current Bermingham portal is shown in Figure 3-4. The decline will include safety bays and remucks as required for decline development work. The preliminary portal is located at UTM 7,087,231N and 478,612E (zone 8).

The decline will be driven using Alexco's owned mechanized equipment; specifically, rubber tire load-haul-dump scoops, 15 ton trucks, a jumbo and mechanized roof bolter. This fleet will be supported by a fleet of mechanized utility equipment.

**Figure 3-4: Bermingham Portal**

A development and production schedule has been prepared for the Bermingham deposit (Table 3-1). The schedule tracks and reports development metres and vein production material. The schedule shown is based on various assumptions; including commodity prices, economic parameters, development costs and productivity constraints. This schedule is a snapshot of Bermingham based on these parameters. As these parameters change in the future, the various production rates and timing will vary as well. The schedule shown in Table 3-1 assumes a start date of Q3 2019 for resuming development at Bermingham. Changes to this start date will affect the annual timeline shown in the mine plan. The schedule assumes a development rate of 4 metres per day for the main ramp.

The production schedule includes some time allowances for vein water drainage after the vein has been intersected by access crosscuts. One month or more has been allowed for drainage before mining in the vein begins. Another constraint is that production stoping is not scheduled to begin until a second route out of the mine has been established to that location.

The sequence of underground development will entail shooting line and grade, marking up the face for jumbo drilling, drilling, loading holes for blasting, excavation and transportation of broken rock to pre-determined destinations, roof and rib bolting after the mucking sequence, assessment and sampling of the new face by a geologist and then repetition of the drill, blast, muck, bolt and assessment cycle. Utility piping, power cable and ventilation will be installed as the decline progresses.

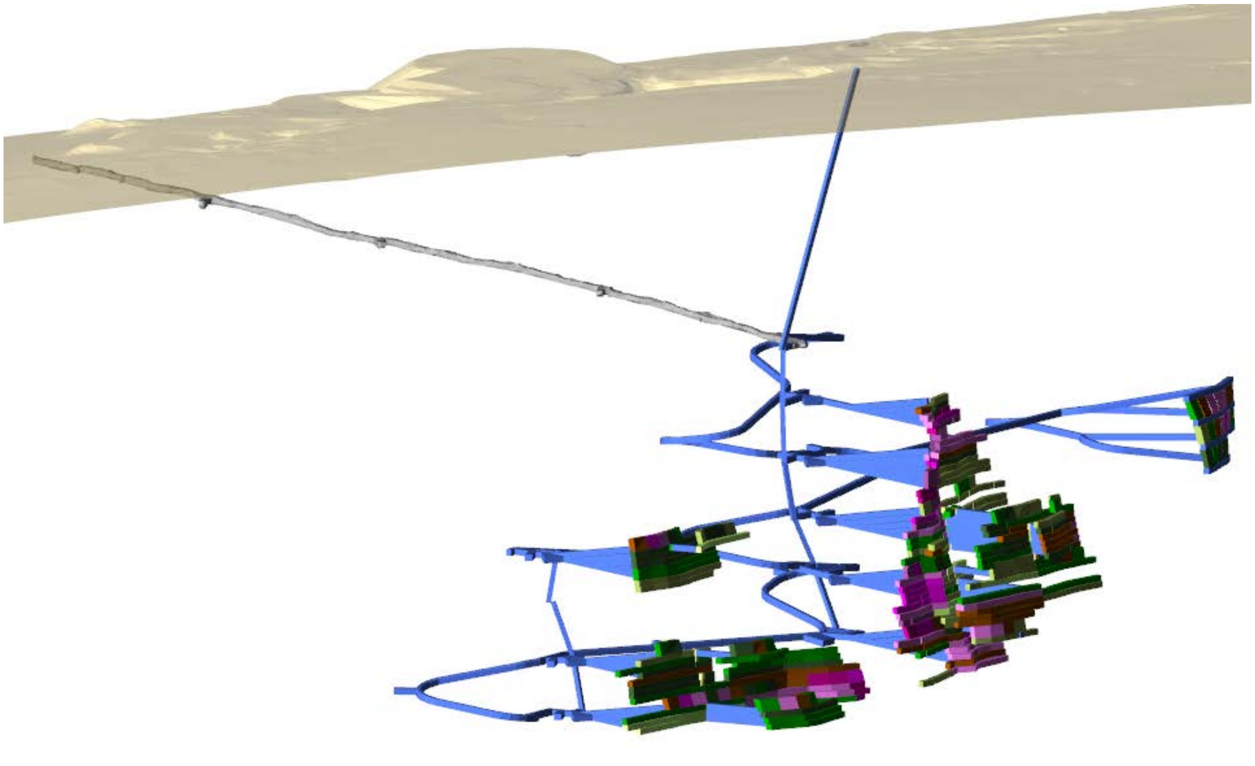


**Figure 3-5: Bermingham Mine Design**

**Table 3-1: Bermingham Mine Plan**

| Description | Row Total | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| Ore Tonnes | 362,343 | 8,874 | 76,411 | 90,000 | 90,000 | 89,000 | 8,057 |
| Waste Tonnes | 302,489 | 46,936 | 149,900 | 52,536 | 31,099 | 22,018 | - |
| Total Tonnes | 664,832 | 55,811 | 226,311 | 142,536 | 121,099 | 111,018 | 8,057 |
| C&F Stope Tonnes | 265,542 | 8,874 | 58,115 | 85,190 | 66,445 | 44,453 | 2,464 |
| LH Stope Tonnes | 96,801 | - | 18,296 | 4,810 | 23,555 | 44,547 | 5,593 |
| MCF Backfill Tonnes | 190,500 | 5,355 | 40,315 | 55,987 | 47,085 | 37,655 | 4,104 |
| LH Backfill Tonnes | 61,032 | - | 5,187 | 3,199 | 16,114 | 32,596 | 3,938 |
| Total Backfill Tonnes | 251,532 | 5,355 | 45,502 | 59,185 | 63,198 | 70,250 | 8,042 |
| Ag (g/t) | 972 | 1,598 | 970 | 999 | 1,048 | 830 | 737 |
| Au (g/t) | 0.13 | 0.12 | 0.13 | 0.13 | 0.15 | 0.12 | 0.13 |
| Pb (%) | 2.59 | 4.10 | 2.14 | 2.93 | 2.75 | 2.37 | 1.92 |
| Zn (%) | 1.32 | 1.11 | 1.45 | 1.17 | 1.43 | 1.30 | 1.11 |
| Ramp (m) | 1,394 | 540 | 787 | 67 | - | - | - |
| Main XCut (m) | 1,001 | 203 | 642 | 156 | - | - | - |
| XCut (m) | 2,769 | 37 | 504 | 977 | 753 | 499 | - |
| Level Access (m) | 992 | - | 992 | - | - | - | - |
| Ore Drive (m) | 269 | - | 269 | - | - | - | - |
| Vent Raise (m) | 446 | 240 | 174 | 32 | - | - | - |
| Vent Drive (m) | 127 | 49 | 69 | 9 | - | - | - |
| Remuck (m) | 240 | 60 | 165 | 15 | - | - | - |
| Sump/Pump station (m) | 82 | 8 | 37 | 15 | 8 | 15 | - |
| Development (m) | 7,051 | 1,136 | 3,369 | 1,271 | 761 | 514 | - |
| Ramp (Tonne) | 64,859 | 25,109 | 36,631 | 3,119 | - | - | - |
| Main Xcut (Tonne) | 39,916 | 8,052 | 25,643 | 6,221 | - | - | - |
| Xcut (Tonne) | 110,873 | 1,450 | 20,265 | 39,149 | 30,063 | 19,946 | - |
| Level Access (Tonne) | 46,242 | - | 46,242 | - | - | - | - |
| Ore Drive (Tonne) | 12,076 | - | 12,076 | - | - | - | - |
| Vent Raise (Tonne) | 11,342 | 6,097 | 4,430 | 815 | - | - | - |
| Vent Drive (Tonne) | 5,055 | 1,955 | 2,747 | 352 | - | - | - |
| Remuck (Tonne) | 12,947 | 3,237 | 8,901 | 809 | - | - | - |
| Sump/PumpStation (Tonne) | 11,256 | 1,036 | 5,041 | 2,071 | 1,036 | 2,071 | - |
| Development mined (Tonne) | 302,489 | 46,936 | 149,900 | 52,536 | 31,099 | 22,018 | - |

## 3.3 MINING METHODS

The relevant characteristics of the Bermingham deposit from a mining method selection perspective are:

- The deposit is offset by approximately 65 m of apparent right lateral movement along the west-northwest trending post-mineral Cross Fault. The Cross Fault dips approximately 60° to the southwest. Bear and West-Dip Vein mineralization is mainly situated within the hanging-wall block and Footwall Vein mineralization is located on both sides;
- The deposit area is covered by thin soil and regolith that ranges in depth from 1 to 20 m;
- It is a vein-type deposit consisting of several anastomosing vein-fault surfaces that split and rejoin, primarily the Aho, Bear, Bermingham, Footwall and West Dip Veins, current planned mine areas predominantly target the veins where they dip approximately 70°;
- Vein widths vary from less than 1 to 10 m. The selected mineable portions of the veins are mainly in the range of 1 to 5 m wide. LOM ore dilution is estimated at 37%.
- It is a high grade, high value deposit requiring good mining recovery;
- Mining depths ranging from 170 m below bedrock surface to a current maximum depth of 350 m;

- Vein continuity is expected to be reasonably good with contacts that can be visually identified; and
- Wall rock strength is good with the vein material being of fair to weak. Vein material strength is expected to be much improved when dewatered.

Planned mining methods are predominantly cut and fill, similar to the mining methods currently used at Bellekeno (Table 3-2). There are limited areas that may be amenable to longhole mining methods that were also used at Bellekeno.

**Table 3-2: Mining Method Selection**

| Selected Mining Methods | Justification |
|---|---|
| Overhand Cut and Fill | Selected for less competent rock, less dilution, better ground control and optimized ore recovery |
| Long Hole | Selected for more competent rock and to extract the remaining pillars towards the end of the mine life |

A brief description of each main mining method is given in the following pages.

Cut and Fill (CF) mining is a method of short hole mining used in a wide range of deposit geometries. There are two main methods of cut and fill (CF) mining; overhand cut and fill (OCF) and underhand cut and fill. In the case of Bermingham, the LOM plan estimates 76% cut and fill and 24% long hole extraction.

OCF typically uses uncemented fill and mining begins at the bottom of a mining block and advances in “slices” of “lifts” upwards. Stoping begins from an access ramp driven off the main level to the bottom of the mineralized zone to be accessed. Using development mining techniques, a drift is driven through the mineralized zone to the defined limit of mining. Upon completion, the drift (or "cut") is filled with cemented back-fill, which would consist of tailings or waste rock. Once the stope is filled the ore access off the main haulage ramp is driven down to access the next lift on top of filled cut. This process continues until the top of the stope is reached. See Figure 3-6 for a typical CF schematic. The majority of ore mined from the Bellekeno mine to date has been through OCF and cemented rock fill mining methods and is well demonstrated.

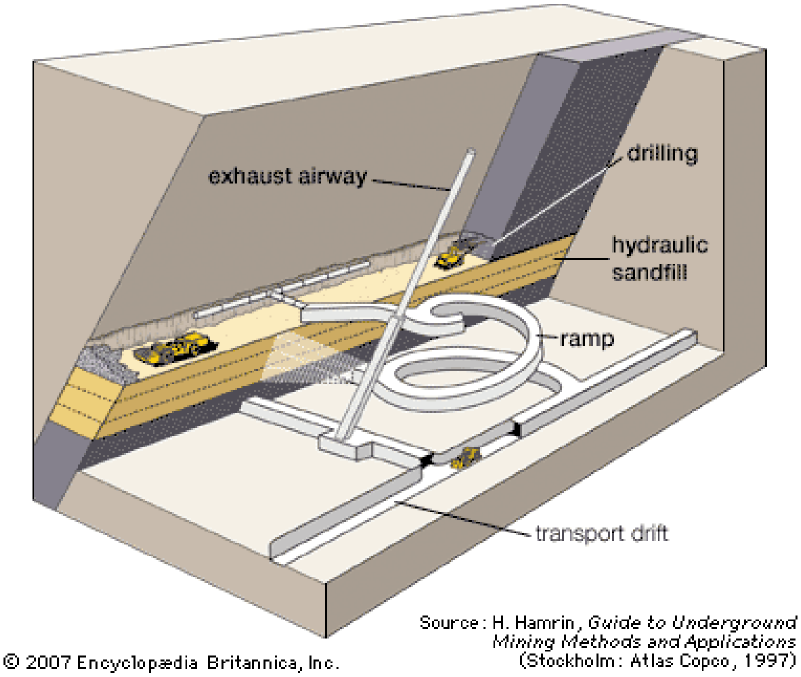


**Figure 3-6: Overhand, Mechanized Cut & Fill Mining Methods (Source: Atlas Copco)**

**Long hole stoping** ("LH") is normally used where large blocks of continuous mineralization can be identified and the surrounding rock is reasonably strong (Figure 3-7). Access to the top and bottom of the mineralized block is provided with drifts. A vertical opening (slot raise) is created within the stope block from the top of the block to the bottom. Long holes are drilled to blast vertical slabs off the mineralized block which is then scooped from a lower drawpoint by a Load Haul Dump (LHD) loader.

The depth on blast holes in the production sequence will be approximately 10-15 metres long. Blind raises or slot raises will be drilled with the LH drill unit, blasted and the stope block will be retreated out by drilling and blasting successive rings. Typically, LH blocks will be pulled last unless they are in an area that would not conflict with ongoing operations. They could also be filled if they are located too close to mine infrastructure.

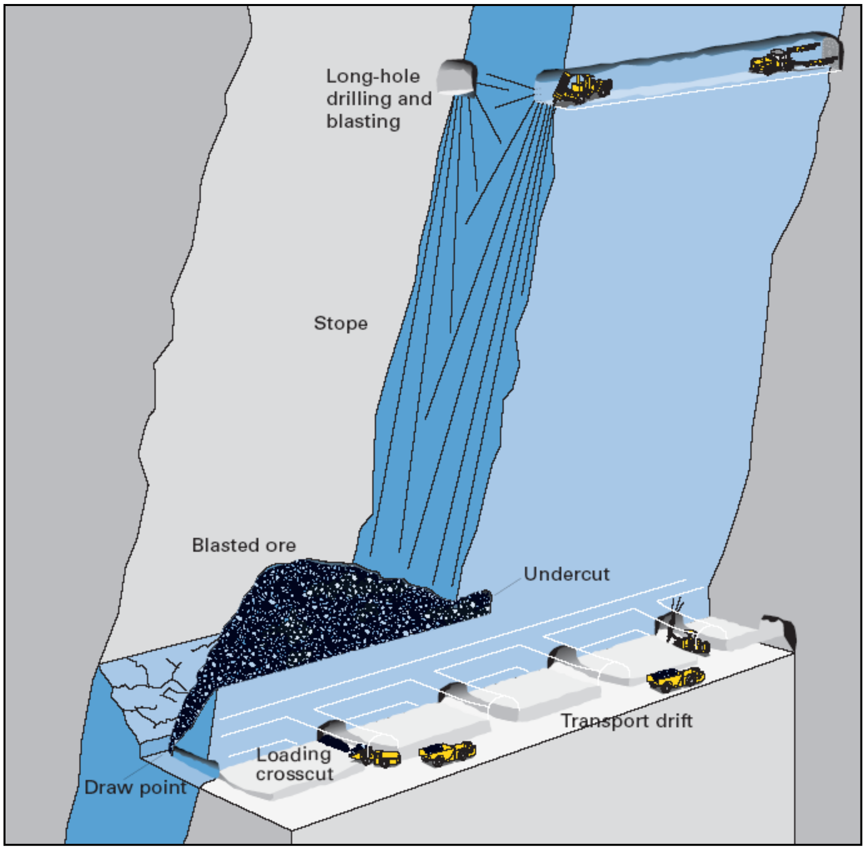


**Figure 3-7: Long Hole Mining Method (Source: Atlas Copco)**

The Bermingham deposit is smaller than Bellekeno in terms of average vein width and anticipated production rates although the ore grade is significantly higher in value. The primary decline will be smaller than Bellekeno and ROM ore will be stored on surface in a covered enclosure rather than underground as was done at Bellekeno. The smaller underground haulage trucks (15 t) will come directly to surface and place the ROM ore temporarily until it is hauled to the Keno District Mill using larger 35 tonne haul trucks.

## 3.4 MINE DEWATERING

A comprehensive hydrogeological investigation was completed at the Bermingham deposit to assess the hydrological conditions associated with development of the deposit. The details of the program are included as Appendix H. The hydrogeological investigation estimates that up to 11.5 lps (13.9 L/S with 20% contingency) of groundwater inflow could be expected and encountered during the operation of the Bermingham mine. Management of mine inflows at Bermingham is planned to be via underground sumps and pumps, similar to the water management program at the Bellekeno Mine. Figure 3-8 shows the relationship between mine inflow and depth from surface.

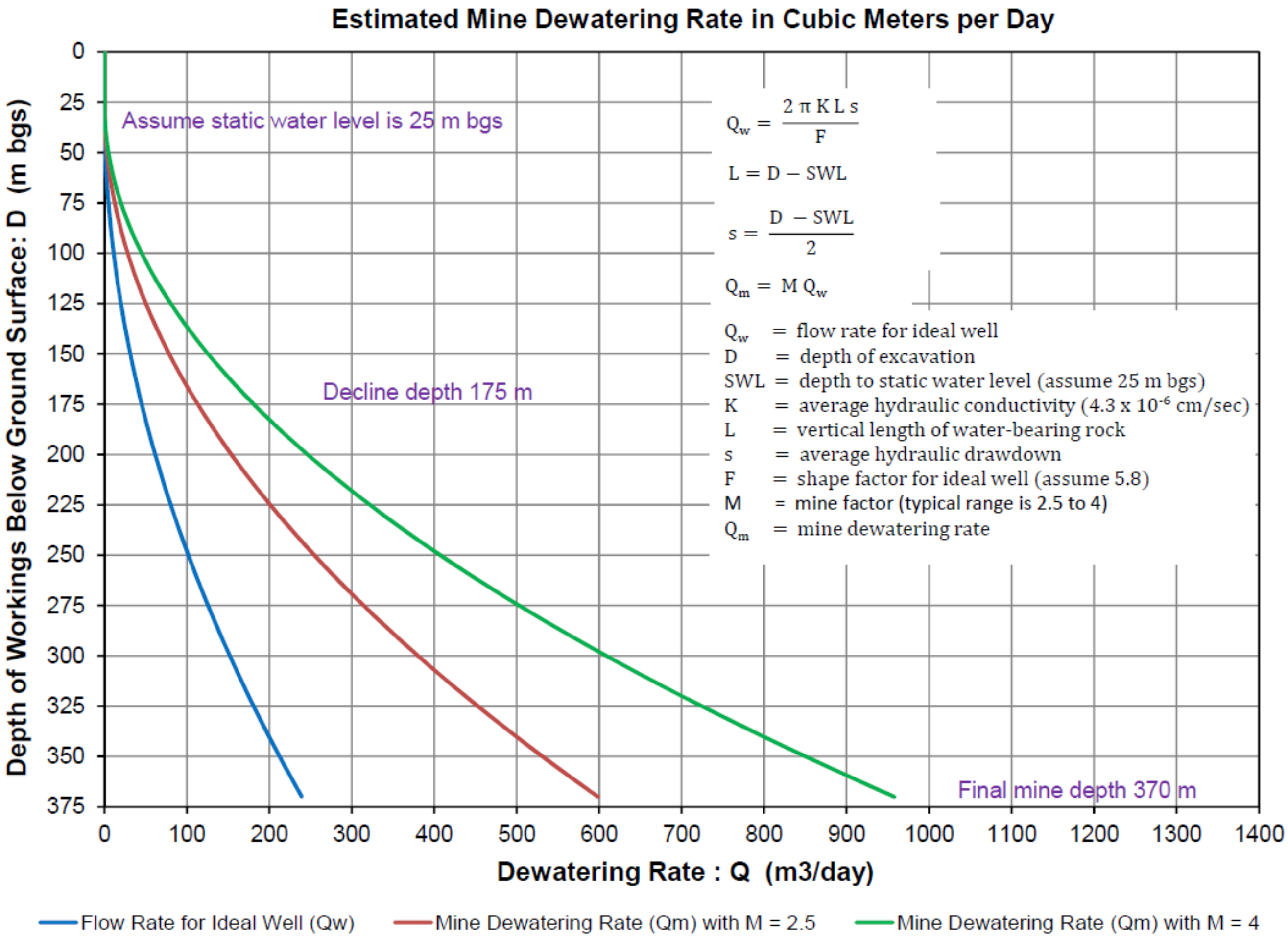


**Figure 3-8: Mine Water Inflow Versus Mine Depth**

## 3.5 MINE DEVELOPMENT

### 3.5.1 Clearing

Minimal area is required to be cleared at Bermingham as the majority of the surface area has been prepared and developed as part of the advanced underground exploration program. The areas that have been cleared are the portal location, waste rock storage area, access road into the laydown and portal area. The total area remaining to be cleared for the Bermingham N-AML WRDA is up to 15,000 $m^2$ and 3,000 $m^2$ for the P-AML WRSF. Clearing will be conducted under the environmental protection provisions of the QML.

### 3.5.2 Decline

The Bermingham ramp development consists of approximately 1,940 metres of primary ramp (3.7m x 4.0m @ -15%) including the ~ 550 m of ramp development completed in 2018. A typical ramp profile with services is shown in Figure 3-9 Sublevel accesses will be constructed on 30 m sublevel spacings and each sublevel will have a sump and remuck off of the main ramp. The vein will be intersected perpendicular to the ore access drift. Access drifts will first be driven 3.5 x 3.5 meters at -15%, this will allow for 7 cuts of the vein from each access drift. Once the 7 cuts have been completed an 8m high backslash will extract the remaining ore from the sill pillar from the level above.

An Alimack ventilation and secondary escape raise will be constructed.

A central blasting system, using conventional cabtire wire, junction boxes and blasting boxes will be used throughout the development and production stages of the mine. The main central blast station will be placed outside the portal entrance.

A typical level access is shown in Figure 3-10.

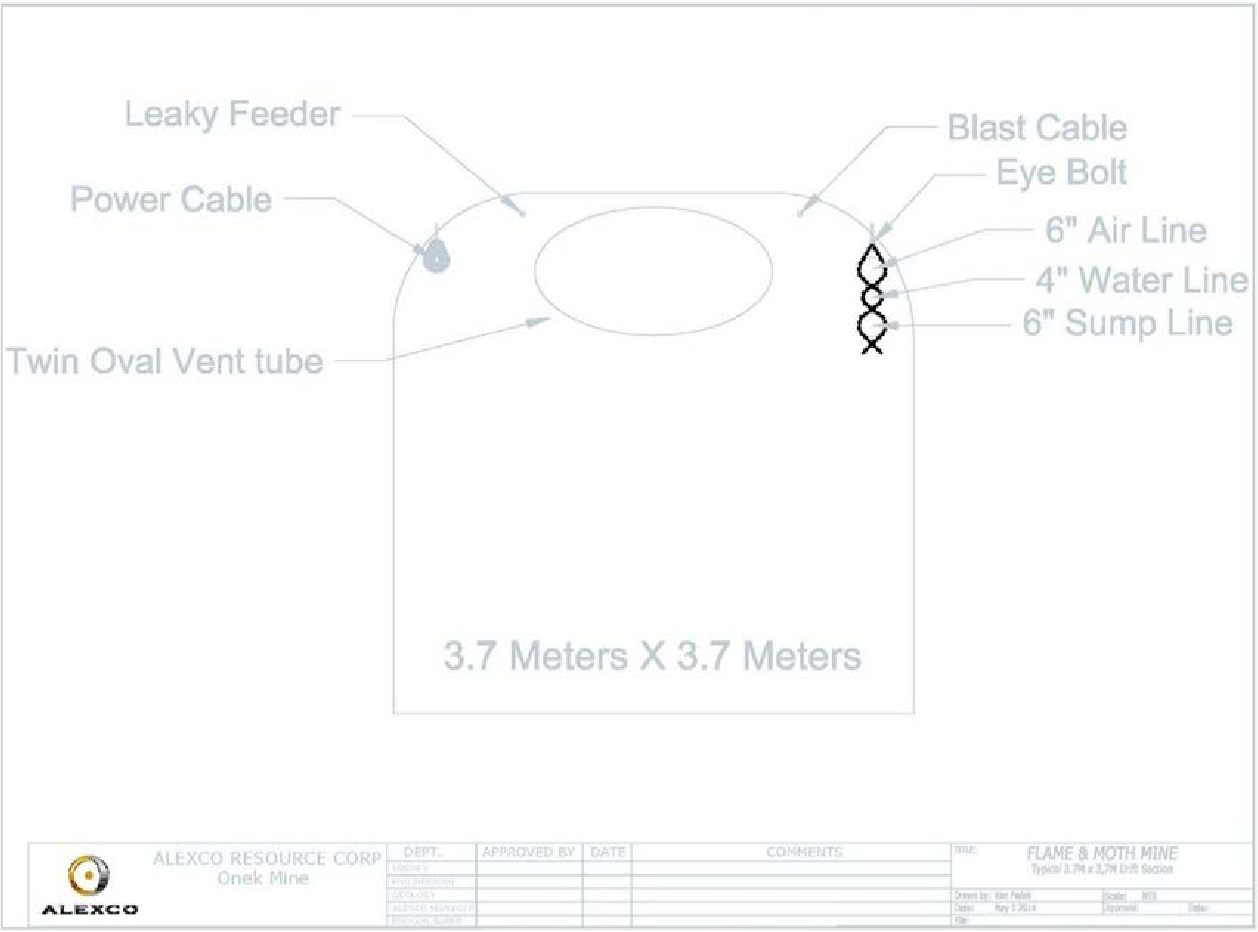


Figure 3-9  Typical Ramp Profile

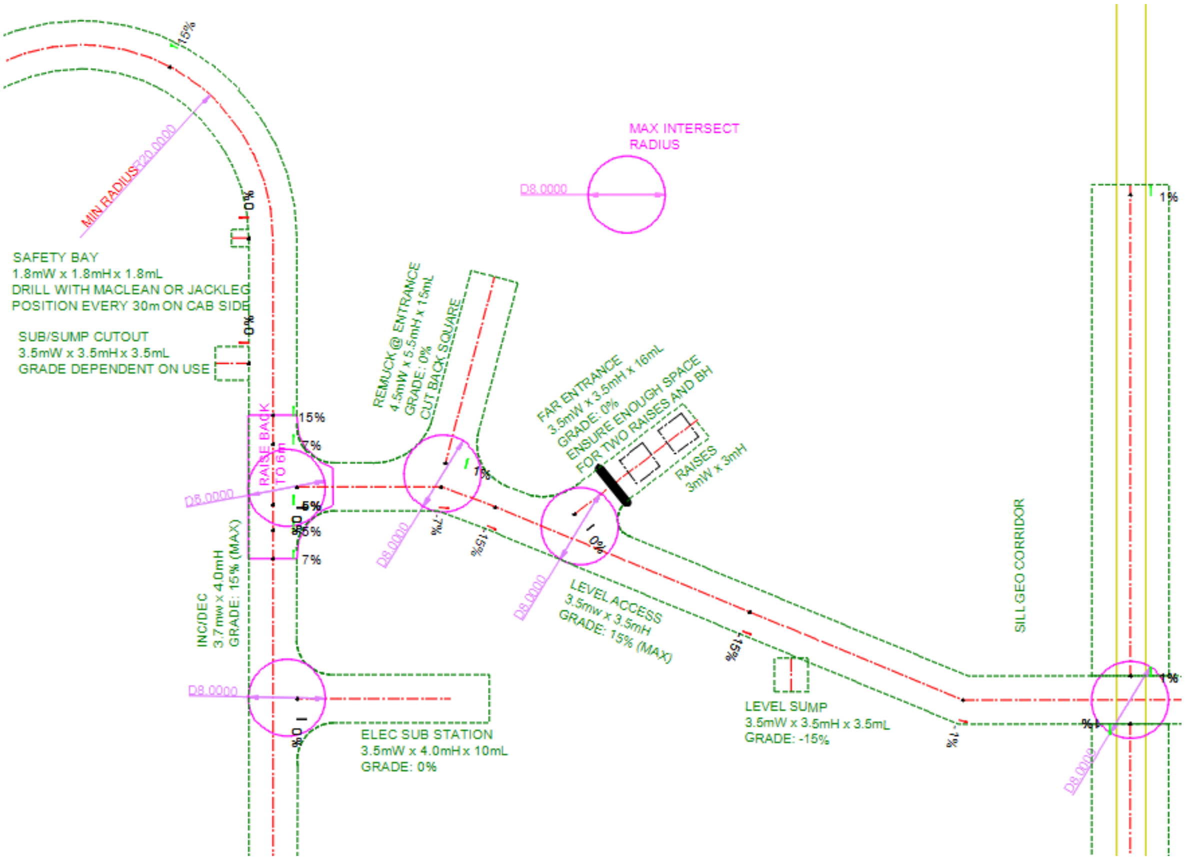


Figure 3-10 Typical Level Access Design

### 3.5.3 Drilling and Blasting

A minimum of two jumbo drills are required to meet production targets for the deposit. A twin boom jumbo will be dedicated to the development of ramps, level accesses and sill development in the cut and fill stopes. A second single boom jumbo will be used in the smaller cut and fill headings and as a back-up for when the main jumbos are down for maintenance and servicing. In addition, jacklegs may be required if the vein geometry dictates.

Standard operating procedures are in place for drilling, loading, and blasting to ensure a safe work environment for all Alexco personnel, contractors, and visitors. These procedures follow all legislative requirements as set out in the Yukon OH&S Regulations and include but are not limited to the following:

#### *3.5.3.1 Face Preparation and Drilling*

1. Before drilling on any face, the back and walls must be made safe by scaling, bolting or by other means of support as required.
2. The face must be properly washed with water.

3. The driller must thoroughly examine the face for misfires, cutoff holes, and remnants of blast holes (bootlegs). All remnants of blasted holes must be washed out and marked with paint.
4. Any hole, regardless of length is to be treated as a misfire where:
    - The hole cannot be inspected
    - The toe of the hole is not visible
    - Any explosive products and components remain in the hole
5. Lifters must be dug out, washed, marked and flagged with lifter tubes.
6. All faces in abandoned headings must be examined, washed, marked up, dated and signed.
7. Drilling must not be carried out within 160mm (6 in.) of a hole that has been previously blasted, or an intact portion of a blasted hole.
8. Drilling must not be done within one meter (3.3 ft.) of any hole containing explosives.
9. Ensure that the face is marked up according to engineering or geology standards. This includes line, grade, drill pattern, and any special geological mark-ups.
10. Check scale the face as required as drilling proceeds.
11. The new cut must be rotated a minimum of one foot from the old cut.
12. Drilling and loading shall not be carried out concurrently on the same face.
13. All holes must be collared and drilled wet.

#### *3.5.3.2 Loading and Blasting a Development Round*

1. The face and work area must be checked for hazards before loading begins. Drilling operations may have loosened rock at the face. Check scale for loose before beginning loading operations. This is to ensure workers and explosives are not struck with loose rock. Falling rock could injure worker, cut nonel shock tube causing misfire, or in rare instances trigger a premature detonation wile loading.
2. All equipment not required for loading is to be removed from the working area.
3. “LOADED FACE” and “DO NOT ENTER” sign shall be hung across access to the drift before any holes are loaded.
4. Blow all holes clean to remove water and rock fragments, standing clear of the holes when blowing out to ensure nobody is hit by rock fragments.
5. Bring only the required number of detonators to the face.
6. Leave proper amount of collar in each hole.
7. Follow mine specifications for loading perimeter holes for perimeter control.
8. Stick powder shall be loaded into blast holes using a loading stick of non-sparking material.
9. When ground conditions allow for the use of ANFO, the following steps are to be carried out:
    - Inspect ANFO loader to ensure that no rock fragments are blocking the ejector.
    - Connect air hoses to the loader and use whip checks on connections. Before turning on the air make sure all valves are in the off position.
    - Only properly maintained anti-static hose shall be used when loading pneumatically.
    - The loader must be grounded to remove static electricity.
    - Ensure you have control of the loading hose at all times.
10. When priming explosives, only a non-sparking tool can be used to punch a hole in a cartridge, such as a powder punch.
11. Load holes from the top of the face and work your way down.
12. All holes must be loaded before hooking up the nonels to the B-Line.
13. Connect the nonels to the B-Line.

14. The blaster in charge will string the electric cap to the lead wire after running out the shunted lead wire from the central blast line or blasting box to the face. Test the lead wire to ensure there is no voltage in the line.
15. Attach the electric detonator to the detonating cord. Lastly, tie in the lead wire to the blast line or blasting box and check the continuity of the circuit.
16. Place proper signage at entrance to drift, warning personnel of a loaded round.
17. When loading is complete, return all unused explosives to the proper storage magazines and make required entries into the log books.
18. Remove material from the area prior to blasting. Ensure equipment is parked in an area where it will not be damaged by fly-rock or the concussion of the blast.

### 3.5.4 Mucking

Mucking will be accomplished using 3.5 yd$^3$ and 2 yd$^3$ Load Haul Dump Loaders (LHD) to meet production targets. One 3.5 yd$^3$ LHD will be dedicated to waste production from the ramp and level accesses. Waste rock will be hauled from the face to a remuck bay (constructed every 150 m along the primary ramp) and then reloaded into 15 tonne trucks at the remuck bay. Depending on the backfill cycle, waste rock may be directly hauled from the development face to a backfilled stope. A 2 yd$^3$ LHD will be used for mineralized ore mucking from the face to an ore remuck located at the intersection of each level access.

## 3.6 BACKFILLING

Backfill materials consisting of development waste rock (N-AML and P-AML) and dry filtered tailings will be placed into empty stopes by LHD or 15-tonne trucks. The mix of these materials is flexible and will be varied to minimize the surface environmental impact while optimizing the most efficient and cost-effective back filling sequence. For cut and fill stopes, the backfill will be pushed up tight to the back using an LHD equipped with a rammer jammer.

Cement addition rates for cut and fill backfill includes 8% for the sill and 2% for the remaining lifts. Cemented backfill at approximately 2% cement by weight will be used in longhole stopes. The cement, rock and water will be mixed by LHD bucket in a small sump-like cut out near the empty stope. Cement will be transported underground in 1,000 kg. bulk bags.

A waste rock and tailings materials balance for Bermingham is shown in Table 3-1. Waste rock will be brought to surface when immediate backfill locations are not available. Depending on backfill cycles, stockpiled waste on surface will be re-handled and brought back underground for use as backfill. The initial N-AML waste rock produced during the early development phase will be used for various construction projects including; the portal pad, laydown areas, haul road and coarse ore stockpile. The amount of rehandle will be minimized as much as possible to reduce the surface stockpile as well as reducing operating costs from rehandling. Vein material and waste will be handled by 15 and 20-tonne capacity haulage trucks underground and on surface. A temporary surface stockpile will be required for storage of P-AML waste. The first priority for backfill material will be the P-AML waste stored in the temporary P-AML facility near the portal. It is expected that 100% of all P-AML waste will be used as backfill underground.

Under the current mine plan, waste rock broken underground is estimated at 302,500 tonnes. The total amount of backfill required over the current Bermingham LOM plan is estimated at 190,500 tonnes. Assuming no tailings are used as backfill at Bermingham, the amount of waste rock used for surface construction and final deposition in the Waste Rock Storage Area (WRSA) is estimated to be up to 112,000 tonnes. All waste rock will be inspected and tested as per the updated Waste Rock Management Plan, which segregates all waste rock as either potentially acidic/metal leaching (P-AML) or not (N-AML).

**Table 3-3: Waste Rock and Tailings Summary**

| Description | Row Total | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|
| Total Meters Development | 7,051 | 1,136 | 3,369 | 1,271 | 761 | 514 | - |
| Tonnes Ore Mined/Milled | 362,343 | 8,874 | 76,411 | 90,000 | 90,000 | 89,000 | 8,057 |
| Tonnes Waste Rock Broken | 302,489 | 46,936 | 149,900 | 52,536 | 31,099 | 22,018 | - |
| Tonnes Concentrate Produced | 28,987 | 710 | 6,113 | 7,200 | 7,200 | 7,120 | 645 |
| Tonnes Tailings Generated | 333,355 | 8,164 | 70,298 | 82,800 | 82,800 | 81,880 | 7,413 |

## 3.6.1 Cemented Tailings/Waste Rock Backfill

Cemented tails and waste rock back fill are the preferred backfill methods. Where sill pillars are required, a cemented fill will be used to provide a stable back to mine up to from beneath. For cut and fill backfill this cement addition rate is designed at 8%. The remaining levels will be backfilled with a cement content of 2%. Extraction of the vein from the final lift requires that the pillar is self-supporting and maintains integrity while the heading is active.

Careful preparation of the excavation where cemented fill is to be placed will be required, including blasting beyond the vein contacts to provide a clean, rough surface for the fill to hang on. The floor should be cleaned prior to placement to prevent material falling from the back following mining. An appropriate lead time should be provided to allow set-up and cure for the cemented fill. Standard quality control procedures (e.g. unconfined compressive strength and slump tests) should be completed during batching and following placement of cemented tailing fill materials.

### *3.6.1.1 Backfill QA/QC*

Quality assurance and quality control (QA/QC) procedures are in place to ensure backfill procedures are appropriate for short and long-term stability requirements. The following QA/QC procedures will be part of the Bermingham backfill operations:

- All stopes requiring backfill will be filled as soon as practicable after the extraction of ore is complete. A backfill log is to be maintained to track fill schedules and determine schedule bottlenecks.

- An engineering design by a competent P. Eng. will be maintained to ensure that the backfill properties are met.

- A monthly and cumulative fill placement record will be maintained to track the filled and void space throughout the mine. This will provide the mine planning engineers the required information to ensure that the rate of backfilling is consistent with overall targets and ore production requirements.

- Specifications for fill material size, % solids, % cement, etc. are to be tracked and regularly reviewed to ensure consistency with the fill design.

- Tight filling will be used for minimizing stope failures and to prevent hangingwall and crown failures from propagating and to maximize the confinement of the fill in the stope.

- Appropriate safety measures will be established and maintained through standard operating procedures and JHA's to ensure employee safety where waste is actively dumped into the edge of an open stope. Examples of these safety measures include site specific standard operating procedures, site evidence of engineered backstops, additional lighting, training and employee competency assessment.

- A quality control program will be implemented to conduct ongoing testing of cemented backfill material to ensure design strengths are achieved. This will be done through collecting samples and conducting 7 and 28 day UCS tests on the samples.

## 3.7 WASTE ROCK AND ORE STORAGE

A summary of waste rock management for Bermingham over the current life of mine is shown in Table 3-8. The waste rock materials balance for the project indicates that the major permanent excavation to surface will be split approximately evenly during the initial three years of the development for a total permanent excavation tonnage of up to 302,500 tonnes. A lined temporary P-AML storage facility will be located near the portal entrance (shown on Figure 3-3) which will be used during the initial development after which the development schedule will enable all P-AML development rock to remain underground, and the P-AML rock stored within the temporary facility to be moved back underground as backfill. All P-AML waste rock will be rehandled back underground prior to closure

A total of 302,500 t of waste rock are anticipated to be brought to surface at Bermingham over its currently known mine life. Waste rock volumes and tonnages for the Bermingham deposit, including a breakdown by the major lithologic units and the relative proportion of N-AML and P-AML waste are shown in Table 3-4..

**Table 3-4: Bermingham Waste Rock Excavation Estimate**

| Bermingham | Greenstone (GNST) | Quartzite (QZT), Calcareous Quartzite (CQZT), Thin Bedded Quartzite (TQZT) | Graphitic Schist/Interbedded Carbonaceous Quartzite and Schist (GSCH/ICQS) | Total |
|---|---|---|---|---|
| Tonnes | 30,250 | 211,750 | 60,500 | 302,500 |
| % of Total Excavation | 10% | 70% | 20% | 100% |
| % N-AML | 100% | 87% | 93% | |
| % P-AML | 0% | 13% | 7% | |

### 3.7.1 Waste Rock Management

A summary of waste rock management for Bermingham over the life of mine for each deposit is shown in Table 3-5. The waste rock materials balance for the project (Table 3-1) indicates that the majority of the permanent excavation to surface will be placed on surface in the first 2 years. A temporary P-AML storage facility will be located on the historic Bermingham waste rock dump (shown on Figure 3-3) as well as a facility located on the historic Bermingham waste rock facility. The P-AML facility may be expanded if more than the currently approved temporary facility capacity is exceeded. The P-AML rock will be used preferentially as backfill, and the P-AML rock may come to surface temporarily to be stored within the temporary facility prior to being used underground as backfill.

**Table 3-5: Bermingham Waste Rock Management**

| Lithology | Total Estimated Tonnage | Tonnage P-AML | Tonnage N-AML | P-AML Rock Management | N-AML Rock Management |
|---|---|---|---|---|---|
| Quartzite | 211,750 | 27,530 | 184,220 | Underground backfill utilizing temporary storage on surface or permanent storage on surface in approved EBA generic design | construction/ upgrade material; road upgrade and maintenance and general construction, underground backfill, N-AML WRDA |
| Graphitic Schist | 60,500 | 4,240 | 56,265 | | |
| Greenstone | 30,250 | 0 | 30,250 | | |
| Project Proposal Total | 302,500 | 31,770 | 270,730 | | |

*Totals have been rounded*

Upon P-AML or N-AML determination as per the WRMP, directions will be given to the surface crew for hauling and disposal of the waste rock as described in the previous sections. These management protocols will mitigate potential effects associated with improper waste rock disposal, such as soil and surface/groundwater contamination. During operations, all waste rock will be immediately classified and moved to the appropriate disposal area or storage facility depending on type, thereby negating the need for a temporary waste rock classification area. Waste rock management facilities will be inspected by a third party geotechnical inspection on annual basis and will be inspected weekly by designated mine staff (i.e mine superintendent) per the Physical Inspections and Reporting Plan submitted as part of the Monitoring and Surveillance Plan.

### 3.7.2 N-AML Waste Rock Disposal Areas

A N-AML waste rock disposal area has been initially constructed for the Bermingham advanced exploration program. Additional N-AML waste will be deposited into the WRDA to provide additional space for construction of surface facilities including construction of portal laydown area, expanded coarse ore stockpile and the temporary P-AML facility.

#### *P-AML Waste Rock Disposal Areas*

The temporary P-AML WRSF facility will not be located within 30 m of a waterbody/watercourse. The facility will be bermed to ensure runoff does not enter the facility and leachate are appropriately managed. Temporary storage of P-AML will be constructed using a cemented waste rock floor to catch any precipitation that falls on the facility. This precipitation will be directed to the adjacent water storage pond. This water is then pumped to the water treatment plant for treatment and discharge.

A permanent P-AML storage facility will be constructed to store P-AML waste rock longer term than 30 days. EBA's Construction Specifications require that an engineer approve the site. Design criteria/specifications for this P-AML Waste Rock Storage Facilities are provided in the approved Typical Waste Containment Facility Design – Construction Specifications (EBA, 2008[1]).

EBA's Construction Specifications account for physical stability of the temporary P-AML WRSF facility. The facility will be lined and seepage collected, would be pumped and treated as required during operations. At closure, all P-AML material in the temporary facility will be relocated underground and the P-AML facility will be decommissioned.

*Temporary Ore Storage*

All the Bermingham ore will first be stored at the proposed coarse ore stock pad shown on Figure 3-3. Underground ore will be brought to surface and deposited onto the coarse ore storage facility and then rehandled into larger 35 tonne surface trucks that will transport ore to the Keno District Mill crushing facility. The coarse ore storage facility will be covered to prevent precipitation and runoff. The base of the facility will constructed of a cement/waste rock foundation. The facility will have a capacity of 1,000 tonnes which will provide approximately 3 days of storage volume.

## 3.8 GROUND SUPPORT METHODS

Ground support requirements at Bermingham are based on experience from the development of the Bermingham decline and the Bellekeno mine. Expected ground conditions at Bermingham are also based from geotechnical assessments from the underground exploration decline and geotechnical logging of surface and underground core samples. Geotechnical conditions may change during excavation based on physical observation by Alexco technical representatives.

### 3.8.1 Ground Classes

Third party review on the geotechnical aspects regarding Bermingham has been used to develop site specific ground support standards for both development and production stoping. The geotechnical domains are divided into 4 zones of rock quality for waste development and ore headings. Based on this review the following ground classes have been defined and presented in Table 3-6. These are based on the lithology determined from the face of the advancing heading. These ground control classes will form the basis of the ground control management for Bermingham, and additional classes added or modified as required.

Development and production support requirements are based on the ground classes that are determined to be representative of the likely rock mass conditions. Mining practices in and around the deposit will need to be cautious and excavation size and overbreak limited as much as possible to maintain the stability of the excavations. Mining rates within the vein are expected to be low due to the requirement of short face rounds. Support classes have been determined for the ground classes. Options have been provided in some classes to allow for flexibility in the selection of mining equipment.

**Table 3-6: Ground Classes**

| Area | Ground Class | Typical Conditions |
|---|---|---|
| Development Headings | ZONE 1 | Quartzite with less than 20% interbeds of schist (graphitic, chloritic). RQD* 70 – 90%, and intact rock strength ("IRS") 100 – 150MPa. |
| | ZONE 2 | Quartzite with 20 – 80% interbeds of schist (graphitic, chloritic). RQD 60 – 80%, and IRS 40 – 90MPa. |
| | ZONE 3 | Fault/shear zones comprising predominantly graphitic schist. RQD <50% and IRS 15 – 40MPa. |
| Production Headings | ZONE 3 | Predominantly soil strength materials in vein. HW and FW units are broken or sheared. RQD 0 – 30%, and IRS <15MPa. Excavation potentially does not require the use of explosives |
| | ZONE 4 | Predominantly intact vein materials with RQD 50 – 60% and IRS 20 –40MPa. Weaker materials comprise <10% of vein; HW and FW units are competent and intact. |

** "RQD" Rock Quality Designation*

## 3.8.2 Development Support Requirements

In general, the infrastructure in development headings is considered to be open for the long-term situation, and support has been designed accordingly. The infrastructure has been designed to avoid areas with potential poor ground conditions; in some situations, this is unavoidable, and support will be increased to provide long term stability.

## 3.8.3 Production Support Requirements

Support design for production headings has been based on observed ground conditions, historic support performance, and anticipated ground conditions. It should be assumed that an increase in ground support will delay advance rates. Table 3-7 and Table 3-8 outlines support for both development and production headings.

**Table 3-7: Support Classes for Development and Production Headings**

| Location | Dimensions | Zone 1 | Zone 2 | Zone 3 | Zone 4 |
|---|---|---|---|---|---|
| Development - LOM | 3.7mW x 4.0mH | 1A | 2A | 3A | NA |
| Development (<2 yrs) | 3.5mW x 3.5mH | 1B | 2B | 3B | NA |
| Production – Cut & Fill | 3.5mW x 3.5mH | NA | NA | 3C | 4A |
| Production – Longhole | 2.0mW x 4.0mH | NA | NA | NA | 4B |

## Table 3-8: Support Requirements by Design Class

| | **Support Requirements** | | | | | |
|---|---|---|---|---|---|---|
| Design | Shotcrete | Bolt No. Type | Bolt Length | Bolt Spacing | Bolt Ring Spacing | Weld Mesh |
| 1A | None | 8 x Rebar | 1.8 m | 1.5 m | 1.4 m | 10 cm square, 1 m from floor |
| 1B | None | 8 x Swellex | 1.8 m | 1.5 m | 1.4 m | 10 cm square, 1 m from floor |
| 2A | 50 mm, to floor | 8 x Rebar | 1.8 m | 1.5 m | 1.4 m | 10 cm square, to floor |
| 2B | 50 mm, to floor | 8 x Swellex | 1.8 m | 1.5 m | 1.4 m | 10 cm square, to floor |
| 3A | 60 mm, tp floor | 8 x Rebar | 1.8 m | 1.5 m | 1.4 m | 10 cm square, to floor |
| 3B | 60 mm, tp floor | 8 x Swellex | 1.8 m | 1.5 m | 1.4 m | 10 cm square, to floor |
| 3C | 60 mm, to floor | 7 x Swellex | 1.5 m | 1.4 m | 1.4 m | 10 cm square to floor |
| 4B | None | 7 x Rebar | 1.5 m | 1.4 m | 1.4 m | 10 cm square, 1 m from floor |
| 4C | None | 9 x Rebar | 1 m | 1.1 m | 1.2 m | 10 cm square, 1 m from floor |

### 3.8.4 Shotcrete Requirements

Where required, shotcrete will be used to provide short and long term stability to access and production headings. In production headings, the main purpose of the shotcrete will be to prevent progressive ravelling of the rock mass. Where required, a 25 millimetre (“mm”) flashcoat of shotcrete can be applied immediately after mucking to tie the rock mass together prior to the installation of conventional bolts and mesh support. Additional shotcrete can be applied if ground conditions dictate. In areas where shotcrete is required, it is important that shotcrete is applied as soon as possible following blasting and mucking to control the behaviour of the rock mass and prevent unravelling of the rock mass before final support is installed. In excavations expected to be open for the long-term, shotcrete can be used to prevent rock mass dilation and ravelling (e.g. where schist packages are intersected). In this situation, shotcrete can be applied as a flash-coat, with additional shotcrete thickness (50-60 mm total) added following the installation of conventional support. Dry-mix shotcrete is the recommended product for use at Bermingham due to the requirement for compact equipment that can be rapidly moved around the mine. It is recommended that multiple dry-mix shotcrete machines are available for back up, and to support the need for multiple headings to be operating at one time. For most applications, additives will be used to provide the fast set-up times required to prevent ravelling of vein materials prior to conventional support installation.

### 3.8.5 Ground Support Monitoring Instrumentation

Quality control / quality assurance of the ground support methods for Bermingham and Moth will be monitored by the following programs;

- On-going field observations of ground support installations;
- Pull-tests to determine anchor strengths of various ground support anchors / rockbolts. These tests will be performed on ground support installations that have been installed specifically for the purpose of doing the test. These installations will not be part of the active ground support;
- Pull-tests will be performed on each type of anchor / rockbolts and in each type of ground condition; and
- Test panels for shotcrete to determine compressive strengths.

As development and production advances, routine ground control and stability inspections will be done. This will be performed by Alexco personnel in conjunction with external rock mechanics / ground control experts. An annual audit and report will also be done in order to continuously review ground conditions and support methods.

In addition, any suspected ground concerns will be monitored by the appropriate instrumentation including field observations, ground movement monitors (GMMs), extensometers and/or other methods deemed appropriate. A dedicated ground control log book will be located at Bermingham and ground control concerns tracked and documented on an on-going basis. In addition, safety discussions are held with all personnel on a daily basis and this forum will be used to raise awareness of any ground control concerns and to discuss solutions.

# 4 ASSOCIATED MINE SERVICES AND INFRASTRUCTURE

## 4.1 POWER

Electrical power at Bermingham is currently provided by a 400 kW diesel generator. Initial development may resume under generator power but will transition to YEC grid power as the demand increases. Total power demand during the decline development is approximately 300 kW. Electrical power at 4,160 V will provided through the installation of a substation and connection to the YEC 69 kV overhead line located approximately 1 km from the Bermingham portal. A new electrical cable will be extended from the new substation to the Bermingham MCC located adjacent to the portal. During peak production levels, Bermingham will require approximately 1,200 kW of power, primarily for ventilation requirements. Single line drawings are provided as Figure 4-1, 4-2 and 4-3.

## 4.2 CAMP EXPANSION

The existing Flat Creek Camp, which presently accommodates up to 150 people, will be expanded for up to 200 people required for Bermingham and district mining operations. Additional trailers will be added within the footprint of existing disturbance. The sewage disposal system will be expanded in accordance with the Public Health and Safety Act Sewage Disposal Systems Regulations and in conjunction with Environmental Health Services.

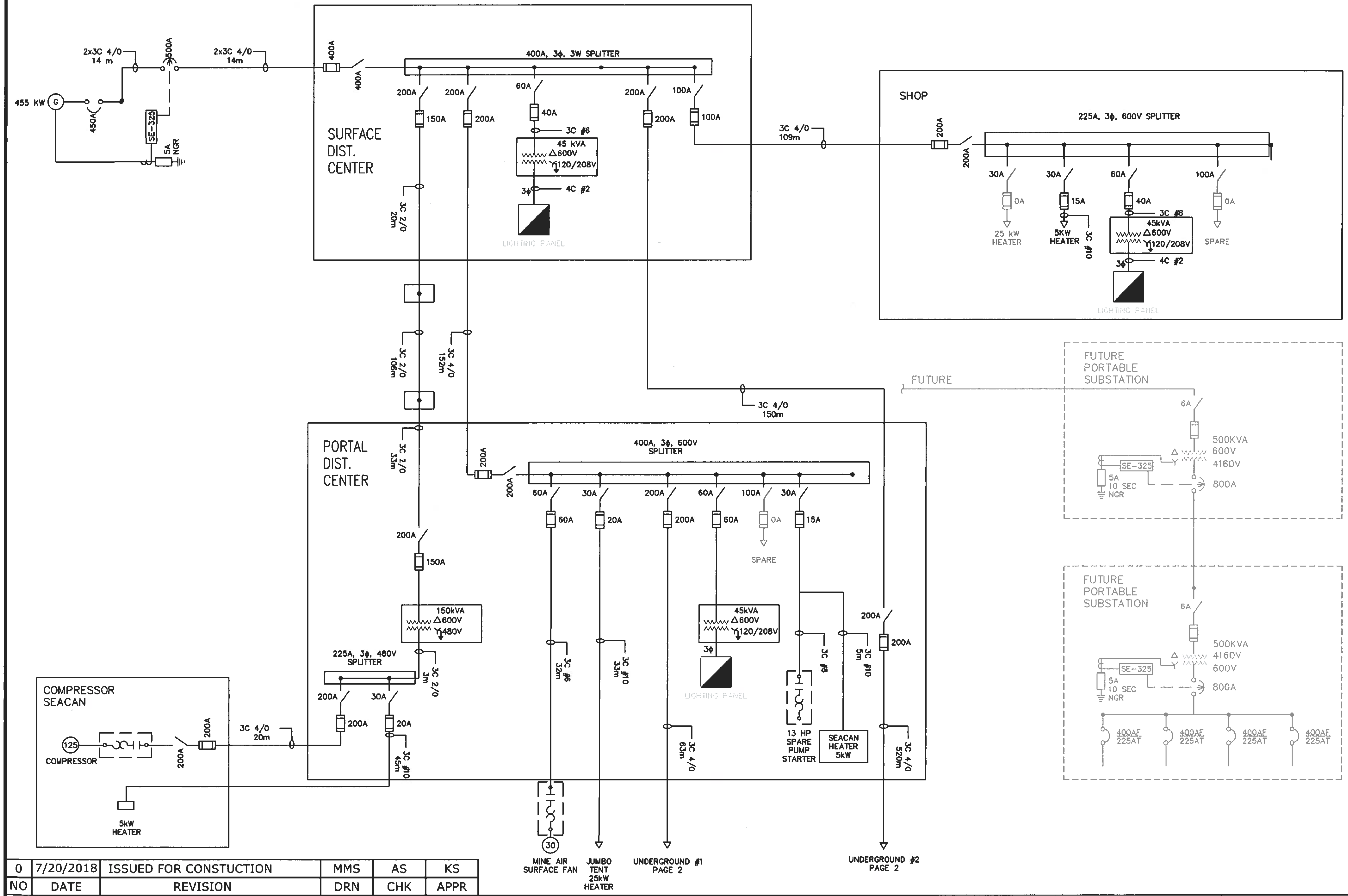
## 4.3 FUEL STORAGE

Fuel and petroleum products required for Bermingham development and production will be managed appropriately. A 56,000 L Envirotank will be used for fuel containment at Bermingham. This tank is currently in place at Bermingham. Alexco's existing and approved Spill Contingency and Hazardous Materials Management Plans have been updated for the Bermingham and will be adhered to for the development project.

## 4.4 EXPLOSIVES

Explosives will be used in mining operations at the Bermingham mine. Onsite manufacturing will not be required. At Bermingham, explosives will be trucked to the site and stored in an approved magazine as shown in Figure 3-3. Explosives use, transport, handling, storage and disposal is governed by the Yukon *Occupational Health and Safety Act* Blasting Regulations and Occupational Health & Safety Regulations, and the *Transport of Dangerous Goods Act* and Regulations.

The blasting product will be ammonium nitrate / fuel oil (ANFO) and augmented with stick powder where needed. Detonators will be non-electric and tied in with detonator cord. The explosive magazines will be located at appropriate distances away from the portal and other buildings as dictated by regulations. Explosives and detonators will be conveyed to the working headings on as need basis transported via approved day boxes. Excess explosives will be returned to the magazine at the end of the shift. A log book will be maintained in the magazine as required by regulations.



NOTES:

1. A FUSE LISTED AS 0A INDICATES NO FUSE IS INSTALLED.
2. MOTOR SIZES ARE IN HORSE POWER.

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July 23, 2018
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## ALEXCO RESOURCE CORP
## Bermingham Mine

Figure 4-1

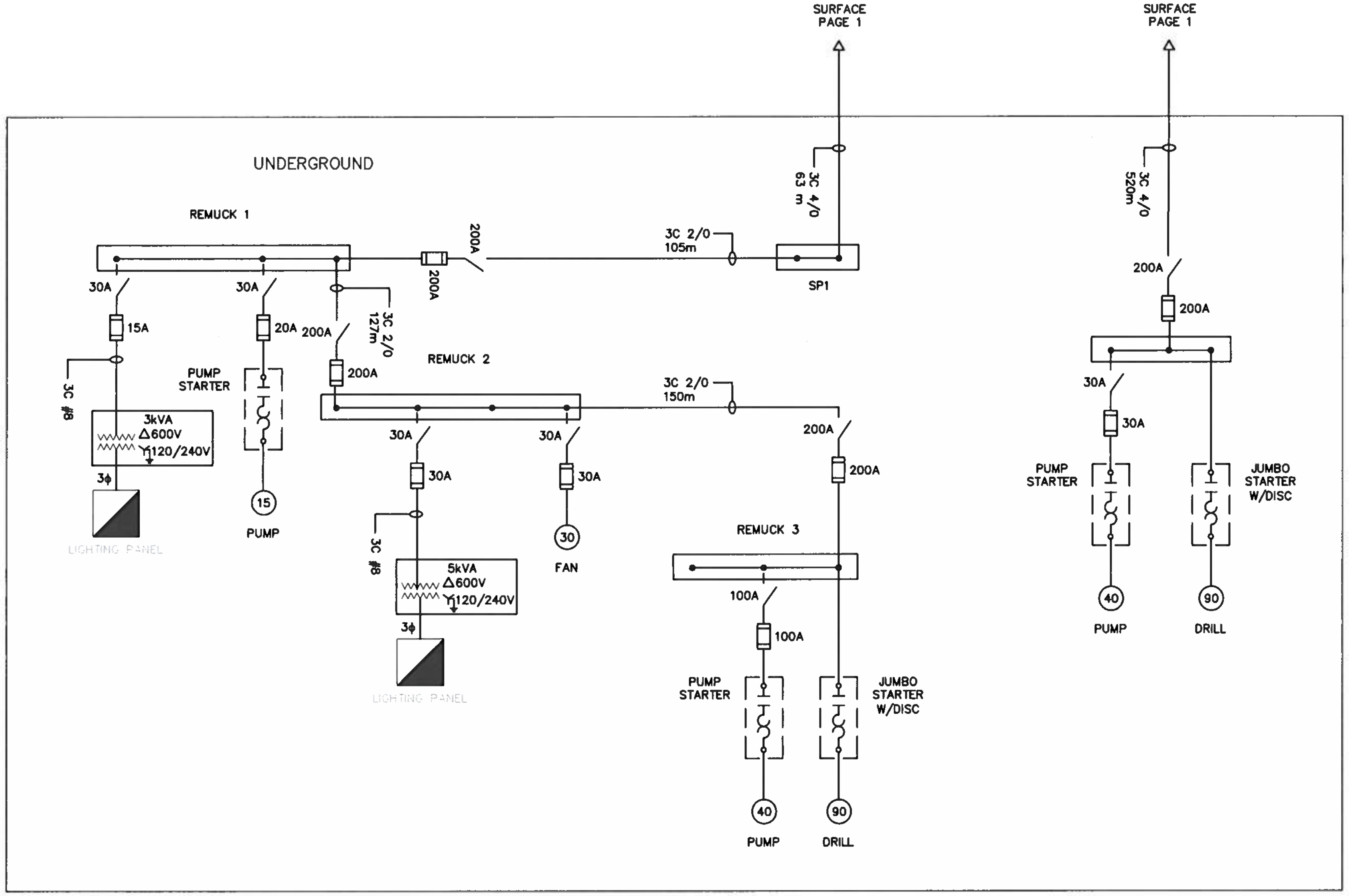
| DEPT. | APPROVED BY | DATE | COMMENTS |
|---|---|---|---|
| SURVEY | | | |
| ENGINEERING | | | |
| GEOLOGY | | | |
| ALEXCO MANAGER | | | |
| PROCON SUPER | | | |

TITLE: ELECTRICAL PLAN
BERMINGHAM
PAGE 1

Drawn by: D. SILANDER/ P. JOHNSON
Scale: N.T.S
Date: JULY 20, 2018
Approval:
Date:
File: 217301-EL-01
Revision: 0

NOTES:

1. A FUSE LISTED AS 0A INDICATES NO FUSE IS INSTALLED.
2. MOTOR SIZES ARE IN HORSE POWER.



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ALEXCO RESOURCE CORP
Bermingham Mine

Figure 4-2

| DEPT. | APPROVED BY | DATE | COMMENTS |
|---|---|---|---|
| SURVEY | | | |
| ENGINEERING | | | |
| GEOLOGY | | | |
| ALEXCO MANAGER | | | |
| PROCON SUPER | | | |

TITLE: ELECTRICAL PLAN
BERMINGHAM
PAGE 1

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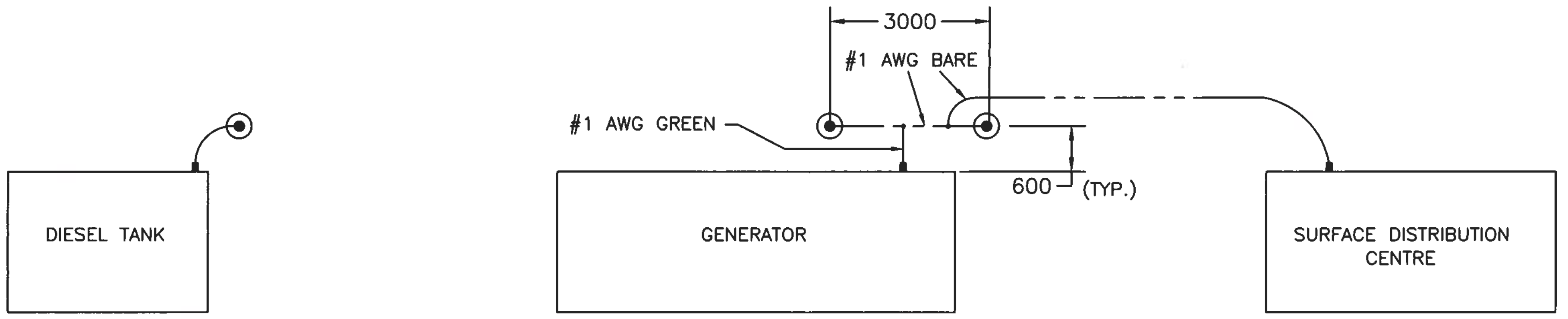
| File: 217301-EL-02 | Revision: 0 |



## GROUNDING LAYOUT

NTS

## LEGEND

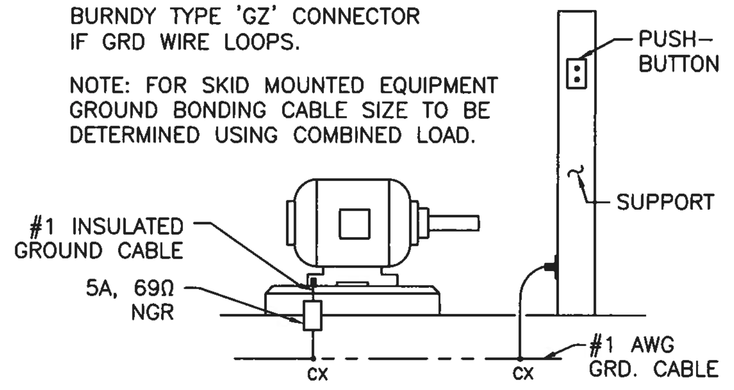
| | |
|---|---|
| ◉ | GROUND ROD OR ELECTRODE |
| — | BARE COPPER CABLE (#2/0 AWG. EXCEPT AS NOTED) |
| ━ | GROUND BUS |
| ┴ | COMPRESSION CONNECTION (CX.) |
| ─┤ | ABOVE GROUND BOLTED CONNECTION |

## NOTES:

1. GENERATOR NEUTRAL IS 5A RESISTANCE GROUNDED.
2. GROUNDING ELECTRODES SHALL CONSIST AS ONE OF THE FOLLOWING 3 OPTIONS:
   A. TWO MANUFACTURED GROUND RODS AT LEAST 3M APART BURIED FULL DEPTH.
   B. A MANUFACTURED GROUND PLATE BURIED AT LEAST 600MM DEEP OR AS DEEP AS GROUND CONDITIONS ALLOW.
   C. AT LEAST 6M OF #4/0 AWG (OR AS PER TABLE 43 OF CEC) BARE COPPER CABLE BURIED LEAST 600MM DEEP OR AS DEEP AS GROUND CONDITIONS ALLOW.
3. MINIMUM GROUNDING CONDUCTOR SIZES SHALL BE AS FOLLOWS:
   A. #1 AWG COPPER AT 455KW GENERATOR
   B. #3 AWG COPPER AT SURFACE DISTRIBUTION CENTRE
   C. #6 AWG COPPER AT PORTAL DISTRIBUTION CENTRE AND REMUCK LOCATIONS UNDERGROUND
4. AT THE PORTAL DISTRIBUTION CENTER AND SHOP INSTALL GROUND ROD AND BOND SKID, MAIN INCOMING FUSED DISCONNECT SWITCH, AND TRANSFORMER SECONDARY TO GROUND WITH #6 GREEN INSULATED GROUNDING CONDUCTOR.
5. ENSURE ALL GROUND RODS ARE FULL DEPTH. IF THAT IS NOT POSSIBLE INSTALL GROUND PLATE OR BARE CONDUCTOR AS PER NOTE 2. DO NOT MODIFY ROD OR PLATE.

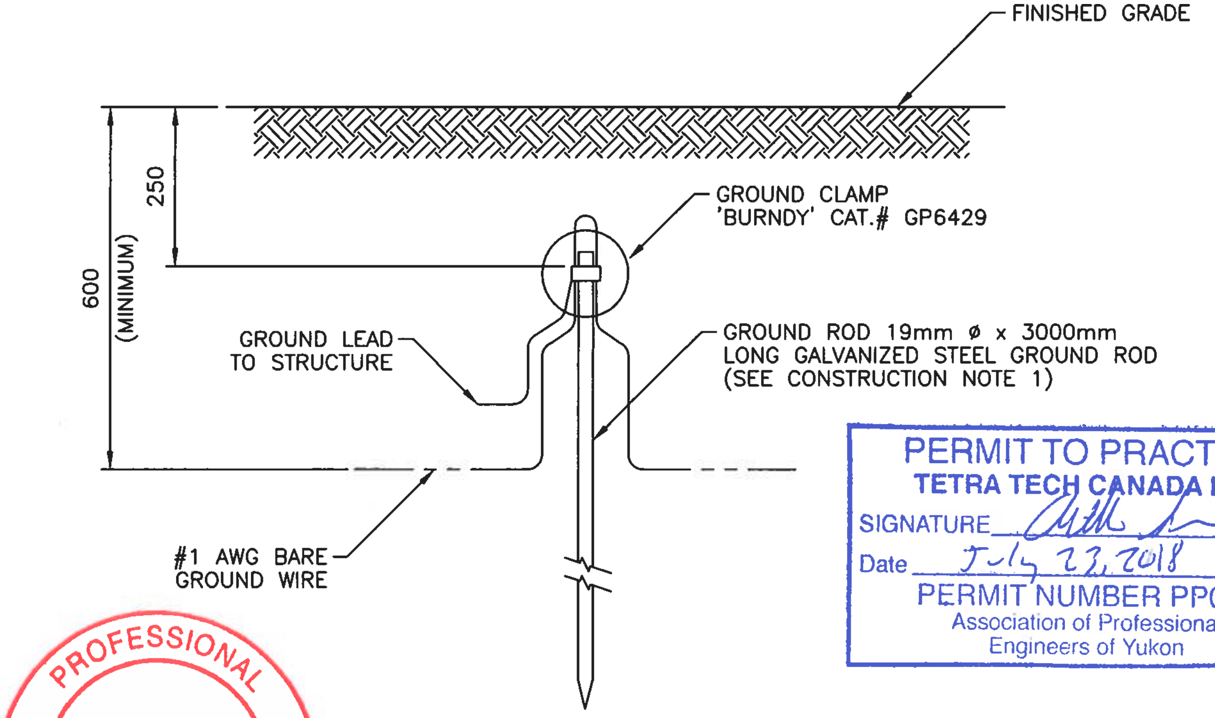
DRILL & TAP MOTOR BASE 6mm x 20, DO NOT DRILL MOTOR HOUSING. ATTACH BURNDY CONNECTOR TYPE QA-3 OR TYPE 'GL' COMPRESSION LUG, WITH EVERDUR BOLT IF GRD. WIRE ENDS AT MOTOR. USE BURNDY TYPE 'GZ' CONNECTOR IF GRD WIRE LOOPS.

NOTE: FOR SKID MOUNTED EQUIPMENT GROUND BONDING CABLE SIZE TO BE DETERMINED USING COMBINED LOAD.



## 2 – MOTOR/GENERATOR GROUNDING

NTS



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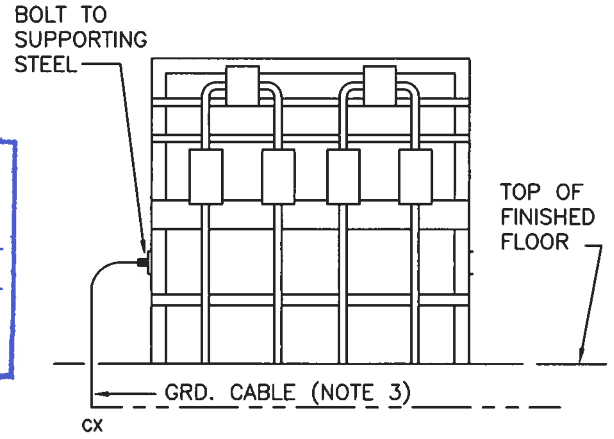

## 1 – GROUND ROD ASSEMBLY

NTS

## 3 – SWITCHRACK GROUNDING

NTS

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ALEXCO RESOURCE CORP
Bermingham Mine

Figure 4-3

| DEPT. | APPROVED BY | DATE | COMMENTS |
|---|---|---|---|
| SURVEY | | | |
| ENGINEERING | | | |
| GEOLOGY | | | |
| ALEXCO MANAGER | | | |
| PROCON SUPER | | | |

TITLE: GROUNDING LAYOUT & DETAILS
BERMINGHAM
PAGE 1

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|---|---|
| Drawn by: D. MAH | Scale: AS NOTED |
| Date: JULY 20, 2018 | Approval: Date: |
| File: 217301-EL-03 | Revision: 0 |

## 4.5 COMMUNICATIONS

While the Keno Hill Silver District is within the Yukon grid for cell phone communication, a dedicated on site radio communication system has been installed for the Bellekeno mine. The system in place will function for the Bermingham mine. A leaky feeder system will be installed at Bermingham which allows surface radio communication to extend to underground operations.

## 4.6 COMPRESSED AIR

The Bermingham mine will be supplied with compressed air via the existing air compressor that is located adjacent to the Bermingham portal. A 6-inch Victaulic airline will provide air to the working face.

## 4.7 VENTILATION

A main ventilation raise beginning near the bottom of the current decline to surface will be constructed and serve as both a ventilation and secondary escape raise. It will deliver fresh air and will be equipped with a manway to provide a second exit from the mine.

The maximum ventilation flow for Bermingham is 47 cubic feet per second (cfs), equivalent to 100,000 cfm based on a ventilation model. Peak horsepower for the ventilation requirements are estimated at 600 hp.

A schematic design of the Bermingham ventilation system is shown in Figure 4-4.

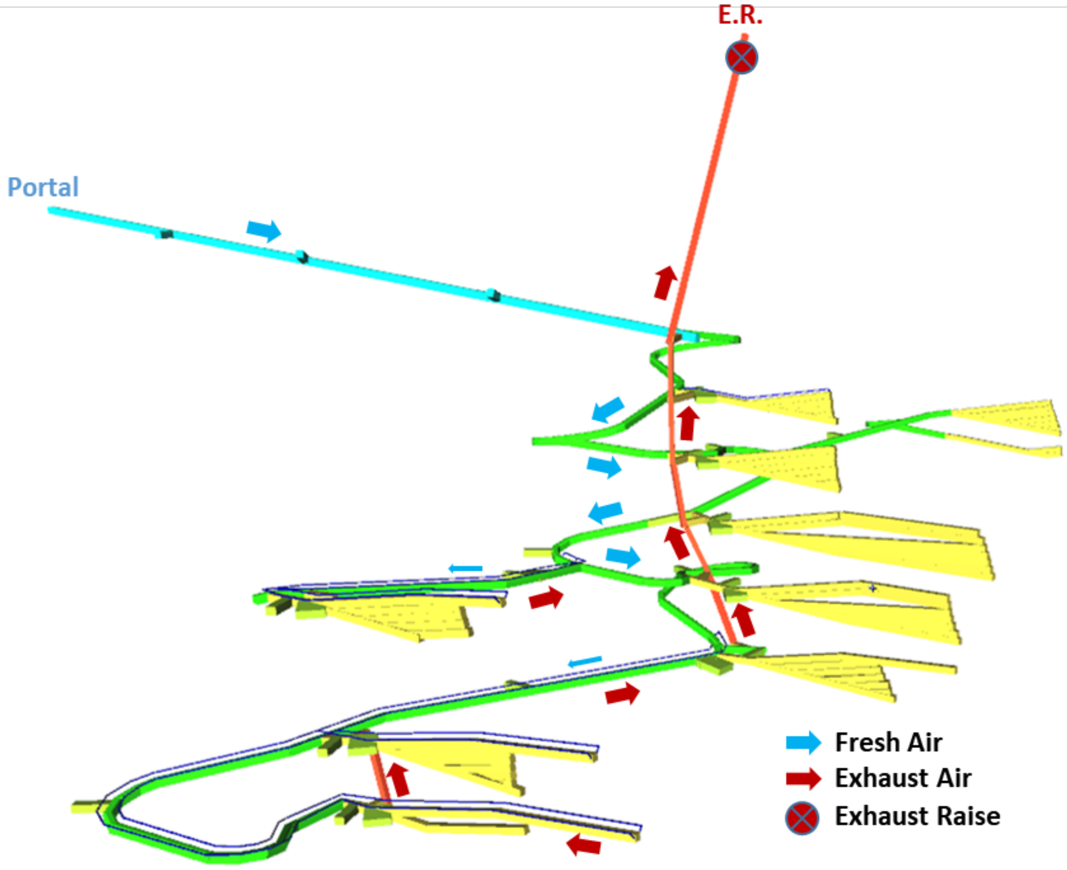

**Figure 4-4 Bermingham Ventilation Schematic**

## 4.8 SUPPORT FACILITIES

Most of the underground mobile equipment maintenance will be performed in a planned surface shop, to be constructed near the Bermingham portal. The mine area is relatively small and it will not be difficult to bring underground equipment to the surface shop. An additional small maintenance shop will be set up underground to handle small repairs and routine servicing.

The maintenance department will have a fuel/lube truck, a mechanic's service truck, a tractor, and access to a scissor lift and a boom truck.

In addition to the mobile equipment, the mine maintenance department will be responsible for the stationary equipment consisting of air compressors, main ventilation fans, propane air heaters, underground electrical distribution system, and main dewatering pumps.

There will be several laydowns on the portal bench for ground support materials. The majority of the mining gear will be stored at the shop and office location as shown in Figure 3-3

## 4.9 SITE ACCESS AND TRANSPORT

Although the road through Keno City is a public highway, over the course of operations at Bellekeno, the vast majority of traffic including light and heavy service vehicles have been routed away from Keno City and diverted onto newly constructed access and haul roads.

Mine traffic associated with the Bermingham mine will use both the Galena Hill road from Elsa to Bermingham to access the mine from the Flat Creek camp during shift changes.  Ore haulage using 35 tonne surface trucks will travel on the Calumet Drive road from Bermingham to the Keno District mill.  There will be no additional traffic through Keno City for the Bermingham mine.

## 4.10 WORKER HEALTH & SAFETY

Operations at the Keno Hill Silver District fall under the jurisdiction of the Occupational Health & Safety Act and Regulations administered by the Yukon Workers' Compensation Health & Safety Board. Alexco has in place a Health & Safety Policy (Appendix A) and both will continue to be adhered to during the course of operations at Bermingham. The safety record at the Keno Hill Silver District is exemplary with over 500,000 manhours worked without a lost time accident.

All personnel and Contractors will meet the standards outlined in the Occupational Health and Safety Legislation, Mine Safety Rules, and Regulations of the Worker's Compensation Board.

The Emergency Response Plan has been submitted to YG under a separate cover page.

Alexco has an established program for achieving and maintaining a healthy and safe workplace. In the Keno Hill Silver District, there are currently emergency first aid responders providing 24-hour service. There are multiple first aid rooms and an ambulance on the site as well.

Alexco policy requires that all employees (including contractors' employees) have pre-employment medical examinations including a drug and alcohol test. All employees will be fully equipped with the proper personal protective equipment standard for working underground, taking into consideration hazards caused by noise level, air born particulates and confined work space.

All new employees will have a site wide and safety orientation and another orientation of the underground work site prior to commencing work. Regular safety meetings with supervisors, safety officer and employees are mandated. Any changes in procedures, equipment, or hazards require immediate notification to employees.

Underground contractors, Alexco personnel and others will have to comply with the Yukon OH&S regulations in addition to Alexco and contractor's in-house standards.

A Safety Coordinator/Officer specific for the underground operation will ensure all workers are orientated to all aspects of the work site including hazard identification, protective equipment requirements and that medical and health requirements are followed according to legislation. That position is also charged with ensuring continued training and skill development for all personnel.

### 4.10.1 Emergency Measures

The Bermingham Mine will be equipped with stench gas on the fresh air intake and the compressed air line. A procedure will be in place for the release of the stench gas during an emergency situation. The mine will have a secondary exit via a raise to surface, refuge station and communications using a leaky feeder system. A secondary communications system will be in place, this system will use Femco phones.

## 4.11 MANPOWER

Alexco plans to undertake development and operations using a combination of contractor support and with our own employees. Some specialty tasks such as diamond drilling, alimak raising, and raise boring will be contracted out.

Table 4-1 shows the estimated labour requirements for the development and operations of the Bermingham mine. There are additional shared positions with other mines in the district (Bellekeno, Flame and Moth, and Lucky Queen) shown in the summary table.

**Table 4-1: Estimated Labour Requirements**

| Common Mine Operations | |
|---|---|
| **Function** | **Number** |
| **Mine Supervision** | **10** |
| **Safety & Training** | **4** |
| **Technical Services** | **12** |
| **Maintenance Supervision** | **3** |
| **Maintenance** | **16** |
| **Surface Trucking** | **2** |
| **Sub-total Mining** | **47** |
| **Bermingham Development/Production** | |
| **Function** | **Number** |
| **Lateral Development** | **12** |
| **Stoping** | **12** |
| **Vein & Waste Trucking** | **6** |
| **Backfill** | **4** |
| **Mine Services** | **4** |
| **Sub-total Mining** | **38** |

# Appendix A

## Health & Safety and Environment Policy

ALEXCO

# Health, Safety and Environmental Policy Statement

Alexco Resource Corp. is committed to preventing the accidental loss of any of its resources, including employees and physical assets.

In fulfilling this commitment to protect both people, property and the environment, Alexco management will provide and maintain a safe and healthy work environment, in accordance with industry standards and in compliance with legislative requirements, and will strive to eliminate any foreseeable hazards which may result in property damage, accidents, or personal injury/illness.

Alexco recognizes that the responsibility for health, safety and environment are shared. All employees will be equally responsible for minimizing accidents, incidents and spills within our facilities and on our work sites. Safe work practices and job procedures will be clearly defined in the company's Health and Safety Manual for all employees to follow.

Accidental loss can be controlled through good management in combination with active employee involvement. Safety is the direct responsibility of all managers, supervisors, employees, and contractors.

All management activities will comply with company safety requirements as they relate to planning, operation and maintenance of facilities and equipment. All employees will perform their jobs properly in accordance with established procedures and safe work practices.

I trust that all of you will join me in a personal commitment to make safety a way of life.

Sept. 25 '11

Clynt R. Nauman. President and CEO

Date

***The safety information in this policy does not take precedence over Yukon Occupational Health and Safety Regulations. All employees should be familiar with the Yukon *Occupational Health and Safety Act* and the *Regulations*.**