ENVIRONMENTAL CONDITIONS REPORT

KENO HILL SILVER DISTRICT

YUKON

JUNE 2009

Prepared by:

ACCESS
CONSULTING GROUP

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NOTE: FOR DRAFT VERSION OF THIS REPORT THE APPENDICES ARE NOT INCLUDED AS THEY HAVE BEEN PROVIDED AS PART OF THE 2008-2009 AND THE 2007-2008 TECHNICAL STUDY SUMMARY REPORTS

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1.0 INTRODUCTION

This Environmental Conditions Report provides a description of the regional setting for the Keno Hill Silver District with regards to the physical, biological and human environments. These descriptions are not intended to provide baseline environmental conditions prior to mining as the area has had nearly a century of mining activities. The collection of data to describe baseline environmental conditions was not even a consideration during early mining development; as such, very little to no baseline data has been documented.

It should also be recognized that over the course of time the local ecosystem has changed, and in some areas adjusted or even adapted to reflect the current mining activities in the area. This has complicated the establishment of "baseline" conditions necessary to measure and assess the impacts that have occurred. The regional setting for the area is therefore based on present environmental conditions.

1.1 KENO HILL SILVER DISTRICT LOCATION

The Keno Hill Silver District is located in the north-central Yukon Territory approximately 354 km due north of Whitehorse (see Figure 1-1 "General Location Map" and Figure 1-2 "Keno Hill Property Location Map") and comprises approximately 827 mineral claims covering three adjacent mountains, Galena Hill, Keno Hill, and Sourdough Hill. The property covered by mining claims and leases is approximately 15,000 ha in a roughly east-west belt about 29 km long and up to 8 km wide.

Access to the district is provided by a two-lane paved road from Whitehorse to Mayo and an all weather gravel road running 45 km northeast from Mayo; a total distance of 452 km. The property lies along the broad McQuesten River valley and three prominent hills to the south of the valley. The elevation of the valley is about 700 m above sea level. Galena Hill, Keno Hill and Sourdough Hill rise to elevations of about 1,400 m, 1,825 m and 1,370 m, respectively.

Many buildings of the old Elsa townsite remain situated on the property. Facilities in Elsa include houses, bunkhouses, mine dry, offices, warehouse, transport shop,

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machine shop, carpentry shop and assay laboratory. A 544 ton per day concentrator and small silver refinery are also located in Elsa. Hydropower is supplied from a Yukon Energy Corporation 5 megawatt facility located near Mayo.

All the silver deposits are located within a 20 km radius of Elsa. The Elsa and Keno City area were the focus of previous exploration and mining activity from the early 20th century through to United Keno Hill Mines Ltd (UKHM) closure in 1987, when many independent miners along with a number of corporations were prospecting the area for silver.

1.2 GENERAL DESCRIPTION OF AREA

The Keno Hill Silver District lies within the Yukon Plateau, just south of the Wernecke Mountains. The terrain consists of concordant, rolling, upland areas separated by wide valleys. Alpine mountain peaks extend above the upland locally. Valley bottoms and slopes have dense boreal forest cover but the upland commonly extends above tree line and is tundra covered.

Geologically, the area is part of the Selwyn Basin and is characterized by late pre-Cambrian through Mississippian marine clastic meta-sedimentary rocks intruded by mid-Cretaceous granitic plutons. The meta-sediments are complexly deformed and thrust imbricated. Silver bearing veins are found along late brittle faults that cut the deformed package. The camp is at the western extent of the Cordilleran ice sheet thus a complex assemblage of glacial and peri-glacial landforms and deposits are present. Valley bottoms are broad and overburden covered, commonly boggy and contain thick peat deposits. Permafrost is widespread though discontinuous, and requires consideration for any development.

The Keno Hill Silver District is wholly contained within the catchment of the Stewart River. Drainage from the district enters the Stewart River at three different points due to the site straddling the drainage divides of three different tributaries of the Stewart River. Listed in the downstream order in which they enter the Stewart River, these tributaries are the Ladue River, the Mayo River, and the McQuesten River.

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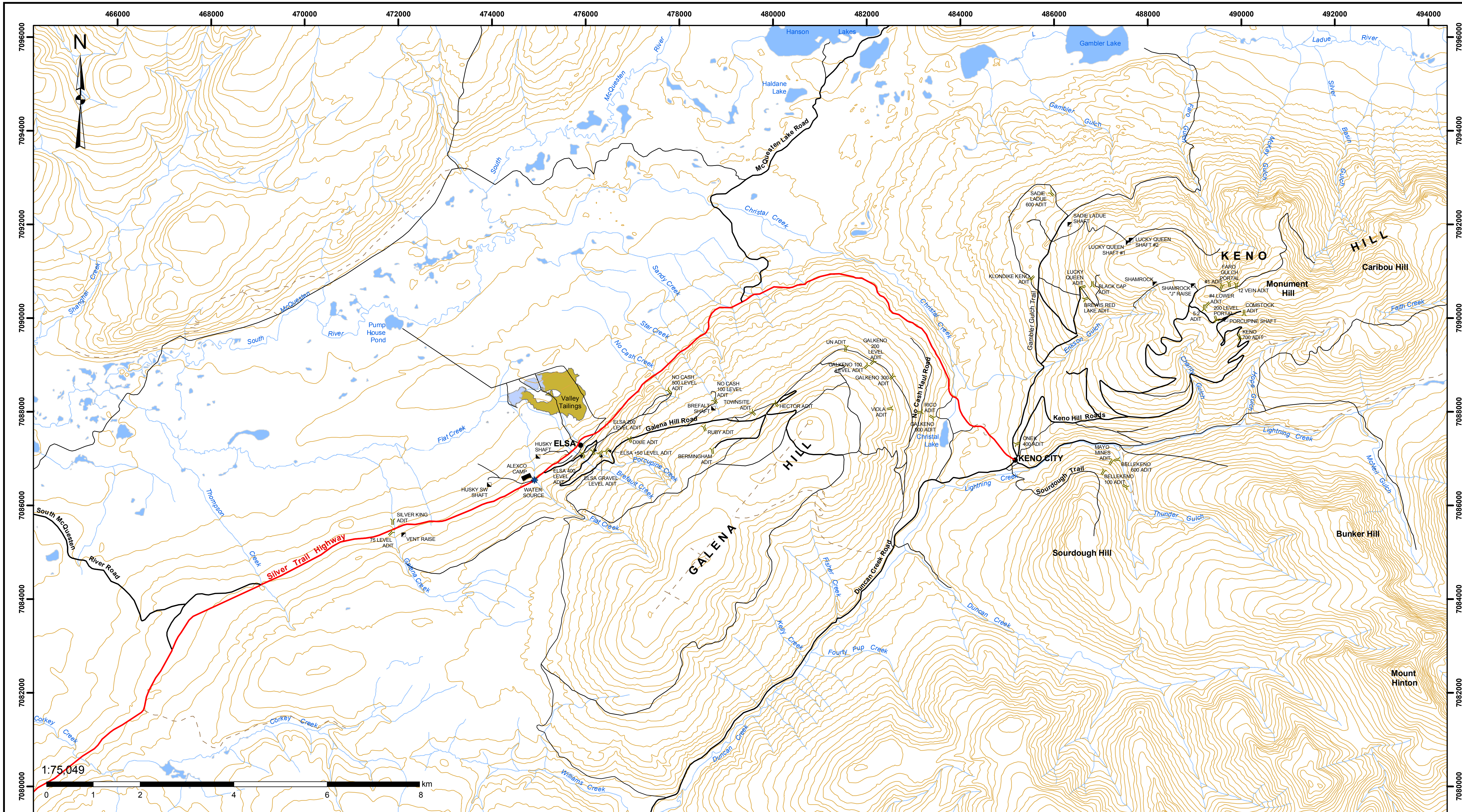
Figure 1-1 General Location Map



Notes:
This map is for illustrative purposes only.
This is not a legal document.
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 in Right of Canada, Department of Natural Resources Canada. All rights reserved.
Crown Grants confirmed by Land Titles November 2005.
Projection: UTM Zone 8 NAD83
NTS Sheet 105M/13 and 105M/14

Topography

- Town
- Silver Trail
- Secondary Road
- Limited-use road
- Trail
- Watercourse
- Waterbody

Mine Workings

- Valley Tailings
- Adit
- Shaft (to surface - connection to underground not determined)

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ENVIRONMENTAL CONDITIONS REPORT
KENO HILL SILVER DISTRICT

PROPERTY OVERVIEW

Drawn By: HD	June 2009	Figure 1 - 2
Checked by: NS	D:\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\Environmental_Conditions_Report\Fig_1_2_PropertyOverview.mxd	

The property location in the interior of Yukon, south of the Wernecke mountains, results in the area being semi-arid but subject to occasional heavy rainstorms. Snow cover is light and blankets the area from October to May. Temperature extremes are characteristic of the area. Winters are long, cold and dark. Summers are mild to cool, often rainy and grey but occasionally interrupted by hot, dry, clear spells. Stream flows generally peak in May with the spring snow melt but heavy flows also occur in summer and fall during storm events. Long daylight hours in summer are conducive to lush plant growth but the short growing season limits the overall growth rate and size of most vegetation.

The area has experienced a long history of occupation and development thus its original wilderness character has changed considerably though the habitat remains generally healthy and productive. Hardrock mining has caused an influx of population but in itself has not caused a great deal of habitat destruction. Placer mining has profoundly changed some valley bottoms causing significant changes to stream beds. Logging, partly to support mining operations, has been carried out on a small scale in many valleys, however, re-growth is progressing well. Fish populations have declined due to a combination of off shore harvest and local habitat degradation, both chemical and physical, from hardrock and placer mining as well as other undertakings. The effects of local activities on habitat do not appear to be either irreversible or necessarily long term since, based on water quality and benthic invertebrate studies as well as observations of extensive re-vegetation, there has been considerable rejuvenation in the time frame of the area developments.

This report provides further detail on the climate, geology and soils, water quality and hydrology, aquatic resources (fisheries, benthic invertebrates, stream sediments), wildlife, and vegetation in the area. Heritage resources, land use patterns, and socio-economic conditions are also discussed.

Table 1-1 provides an overview of existing environmental conditions in the Keno Hill Silver District.

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Table 1-1 Keno Hill Silver District Setting Summary

Region:	Yukon
Topographic Map Sheets:	- NTS 105M/14 & 105M/13
Geographic Location Name Code:	- Keno City
Latitude:	- 63° 54' 32" N
Longitude:	- 135° 19' 18" W
Drainage Region:	- Stewart River drainage region
Significant Watersheds:	- South McQuesten River, Lightning Creek
Nearest Communities:	- Mayo, Keno City
Road Access:	- Silver Trail Highway
First Nations Traditional Territory:	- Nä-cho N'yak Dun
Surrounding Land Status:	- YG Land
Special Designations:	- None
Ecoregion:	- Yukon Plateau (North)
Study Area Elevation:	- 945 m asl (Above Sea Level)
Vegetation Communities:	- Northern boreal forests occupy lower slopes and valley bottoms 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, dall sheep, grizzly and black bear, caribou, beaver, wolf, lynx, marten, wolverine, western tanager, magnolia warbler. - Various terrestrial bird species including ptarmigan, birds of prey, and migratory species, including various waterfowl species including snow geese; eagles, peregrine falcon, and gyrfalcon.
Fish Species:	- Bering and Beaufort Sea salmonids and freshwater species, including: Arctic grayling, lake trout, lake whitefish, broad whitefish, burbot, inconnu, Arctic Cisco, Northern pike
Valued Components:	Water quality, Arctic grayling, Chinook salmon, moose, public health and safety, trapping, traditional harvesting, tourism.

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2.0 PHYSICAL ENVIRONMENT

Chapter 2 of this Environmental Conditions Report summarizes the physical environment for the Keno Hill Silver District including climate (evaporation, precipitation), terrestrial resources (geology, physiography, soils), and water quality and hydrology for watercourses and discharging adits.

2.1 CLIMATE

2.1.1 General

An automated meteorological station (Calumet Weather Station) was installed on Galena Hill above Hector adit in June 2007. The location is shown on Figure 2-4 – Water Quality Sample Stations below in Section 2.3 (Water Quality and Hydrology). The station measures air temperature, relative humidity, barometric pressure, rainfall, wind speed and direction, solar radiation, and soil temperature. A Yukon Government monitored snow course station also exists in the area.

The following sections present the 1996 characterization of climate, which was in turn used to derive site hydrological conditions at the time. Based on comparisons with the latest site data, the original techniques and hydrological inputs were deemed appropriate in deriving site hydrological condition (Clearwater Consultants Ltd, 2008; Refer to Appendix A). The following information is therefore considered valid and accurate.

2.1.2 Available Data

The climate records from a total of eleven climate stations were assembled in 1996 to assist in characterizing the climate of the Keno Hill Silver District. Details of these stations are presented in Table 2-1. The table also identifies the type of climatic information each station provided for the study.

The region around the Keno Hill Silver District has been served by a network of climate monitoring stations. At least three climate stations have been operated within the boundaries of the silver district. Two of these stations were maintained by the Atmospheric Environment Service (AES) and were located at the Elsa townsite and on the southern flank of Keno Hill. The third station was operated on a seasonal basis by

DIAND at a site in the Flat Creek catchment near the Elsa townsite. In addition to these stations, the AES operate a principal climatological station at the Mayo Airport, located some 40 km southwest of Elsa. The data from the Mayo Airport can be combined with that of two discontinued stations in the near vicinity of the airport (i.e. Mayo Landing and Mayo) to construct a long-term climate record.

Table 2-1 Details of Regional Climate Stations

Station Name[3]	Latitude		Longitude		Elevation (m.a.s.l.)	Period of Record	Mean Annual Precipitation (mm)	Information Applicable To This Study
	Deg.	Min.	Deg.	Min.				
AES[1]								
Boundary/ Mile 34 Boundary Rd	64	14	140	21	1036	1967 - 1978	576	Precipitation
Clinton Creek	64	28	140	44	576	1964 - 1978	370	Precipitation
Dawson	64	3	139	26	320	1897 - 1979	306	Precipitation/ Humidity/ Temperature
Dawson Airport	64	3	139	8	369	1976 - 1995	340	Precipitation/ Humidity/ Temperature
Elsa	63	55	135	29	814	1948 - 1965, 1974 - 1989	413	Precipitation
Pelly Ranch/ Fort Selkirk	62	49	137	22	454	1954 - 1995	286	Precipitation/ Bright Sunshine
Keno Hill	63	56	135	12	1472	1974 - 1982	590	Precipitation
Klondike/ Dempster	64	27	138	13	960	1966 - 1995	469	Precipitation
Mayo Airport/ Mayo/ Mayo Landin	63	37	135	52	504	1924 - 1995	306	Precipitation/ Humidity/ Temperature
Snag Airport	62	22	140	24	587	1943 - 1966	339	Humidity/ Temperature
DIAND[2]								
Flat Creek	63	55	135	30	730 (approx.)	1992 - 1994 (summers only)	Not available	Humidity/ Temperature

Notes: 1. Environment Canada, Atmospheric Environment Service
2. Department of Indian Affairs and Northern Development, Fire Management Program
3. For some stations, more than one name is presented. Where this happens, the first name given is the current official designation of the station. Other names represent past designations of the station. Name changes appear to have most often been triggered by the slight relocation of the station.

2.1.3 Precipitation

Mean annual precipitation (MAP) within a mountainous region typically increases with increasing elevation. The region around the Keno Hill Silver District is no exception to this rule as illustrated by the graph of MAP versus elevation shown on Figure 2-1. The data points on this graph were obtained from the information assembled in Table 2-1 for the regional AES climate stations.

The Keno Hill Silver District is in an area of significant relief. Accordingly, MAP can be expected to vary considerably within the boundaries of the district. In order to quantify this variation, an empirical relationship was derived between MAP and elevation using the data from the two AES stations which were operated on the property, namely the Elsa and Keno Hill stations. These are suitable stations for deriving the relationship since their elevations are widely separated (i.e. 814 m versus 1472 m). Assuming a linear relationship between MAP and elevation, a line was fitted to the data of these two stations (see Figure 2-1). The slope of this line indicates that MAP increases by an average of 27 mm for every 100 m of ascent, a value not too dissimilar from that observed in other regions of the Yukon interior.

The curve fitted exclusively to the Elsa and Keno Hill data seems to also explain much of the variation in MAP observed at the other regional AES climate stations. The scatter about the line drawn on Figure 2-1 can largely be attributed to a mild drying trend as one moves from the northwest to the southeast across the region. This drying trend is made apparent by noting where the individual climate stations are located in relation to the property. All stations plotting above the line are located north and west of the property. In contrast, the two stations plotting below the line are found south of the property.

The adopted empirical relationship shown on Figure 2-1 should be viewed as providing only approximate estimates of MAP for ungauged points within the district. Although elevation is the principal control, precipitation also varies according to other variables such as slope and aspect which are not explicitly accounted for in the empirical relationship.

Figure 2-2 was prepared to illustrate the seasonal distribution of precipitation at the property. As with MAP, the seasonal distribution is influenced by elevation. To demonstrate this influence, the seasonal distributions for Mayo Airport (504 m), Elsa (814 m), and Keno Hill (1472 m) have been plotted on Figure 2-2. The following observations can be drawn from examining these distributions:

- precipitation is common throughout the year;
- the wettest period is normally the summer months of July and August;
- the driest month of the year is typically April;
- the proportion of total precipitation which falls as rain decreases as elevation increases (60% of total precipitation at Mayo Airport, 53% at Elsa, and 41% at Keno Hill); and,
- the precipitation gradient during winter is steeper than that during summer (which suggests orographic effects are more pronounced during snowfall than during rainfall).

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Figure 2-1 Mean Annual Precipitation as a Function of Elevation

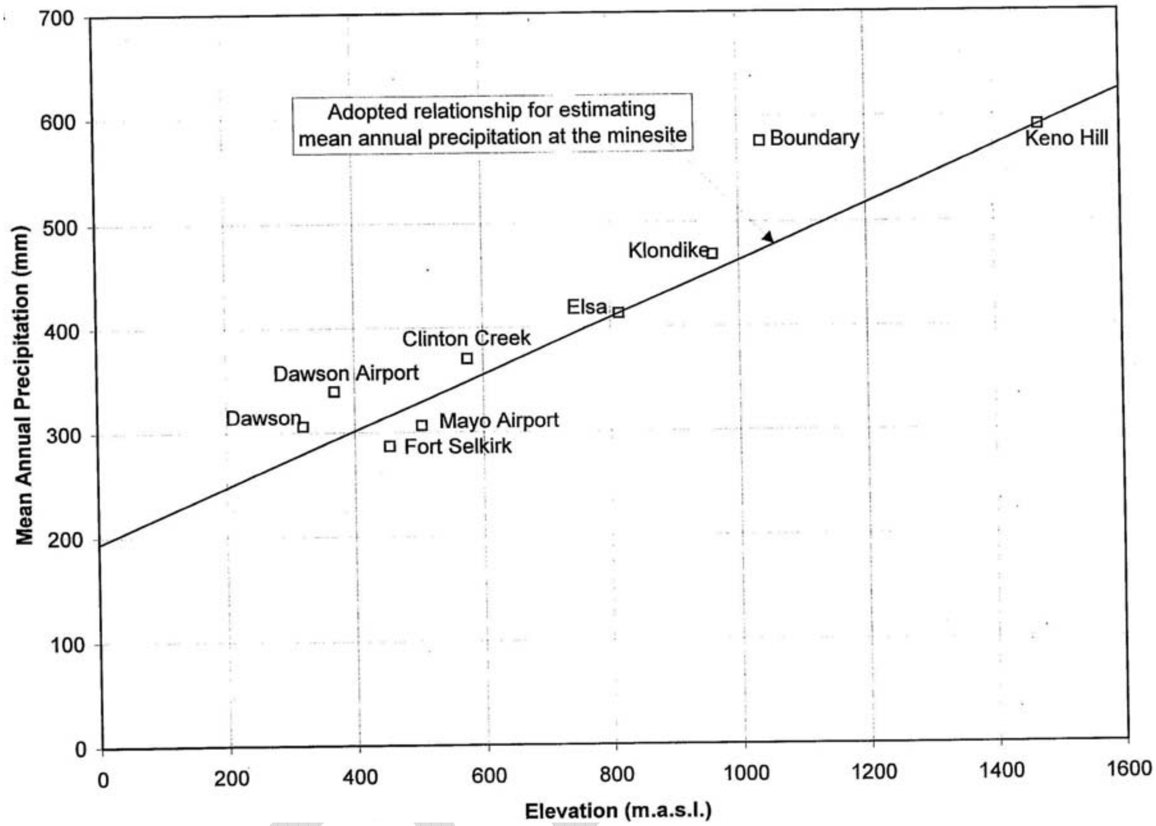

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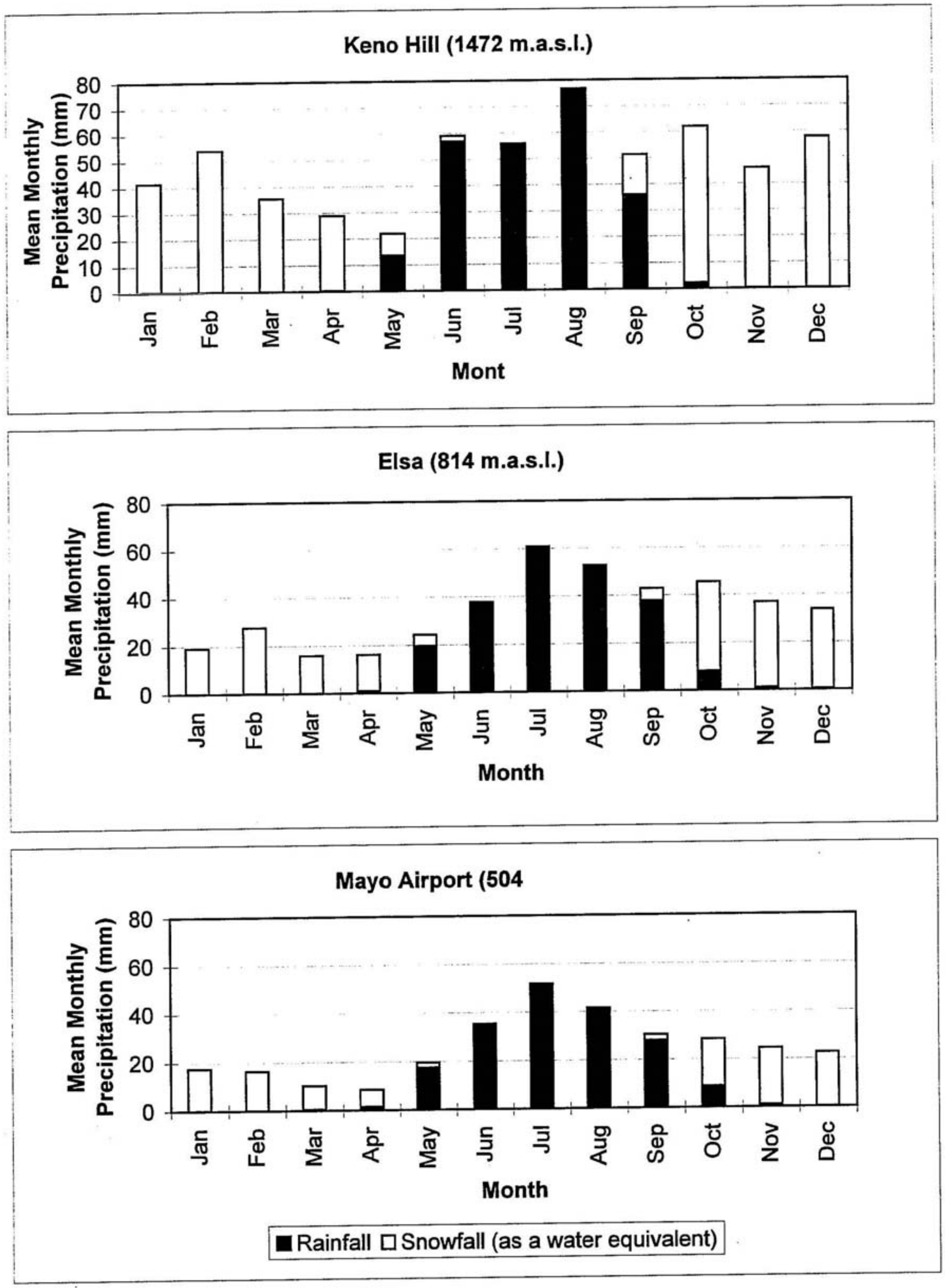
Figure 2-2 Mean Monthly Precipitation



2.1.4 Evaporation

Two rates of evaporation are of interest: lake evaporation and evapotranspiration. The former refers to evaporation from a free-water surface while the latter refers to evaporation from a land surface including transpiration from plants. Both rates were estimated from meteorological data using a computer program known as WREVAP which was developed by Environment Canada's National Hydrology Research Institute.

The meteorological inputs to the WREVAP model comprise humidity, temperature, and sunshine duration. In order to obtain valid estimates of evaporation, the model must be provided with accurate measurements of the first two climatic variables. Model results are less sensitive to the accuracy of the third input requirement (sunshine duration). Thus, the use of sunshine duration records from another nearby climate station provides adequate accuracy. With this in mind, a search was made for climate stations which met the following two criteria:

- the station experiences a comparable climate to the Keno Hill Silver District; and,
- as a minimum, the station monitors both humidity and air temperature.

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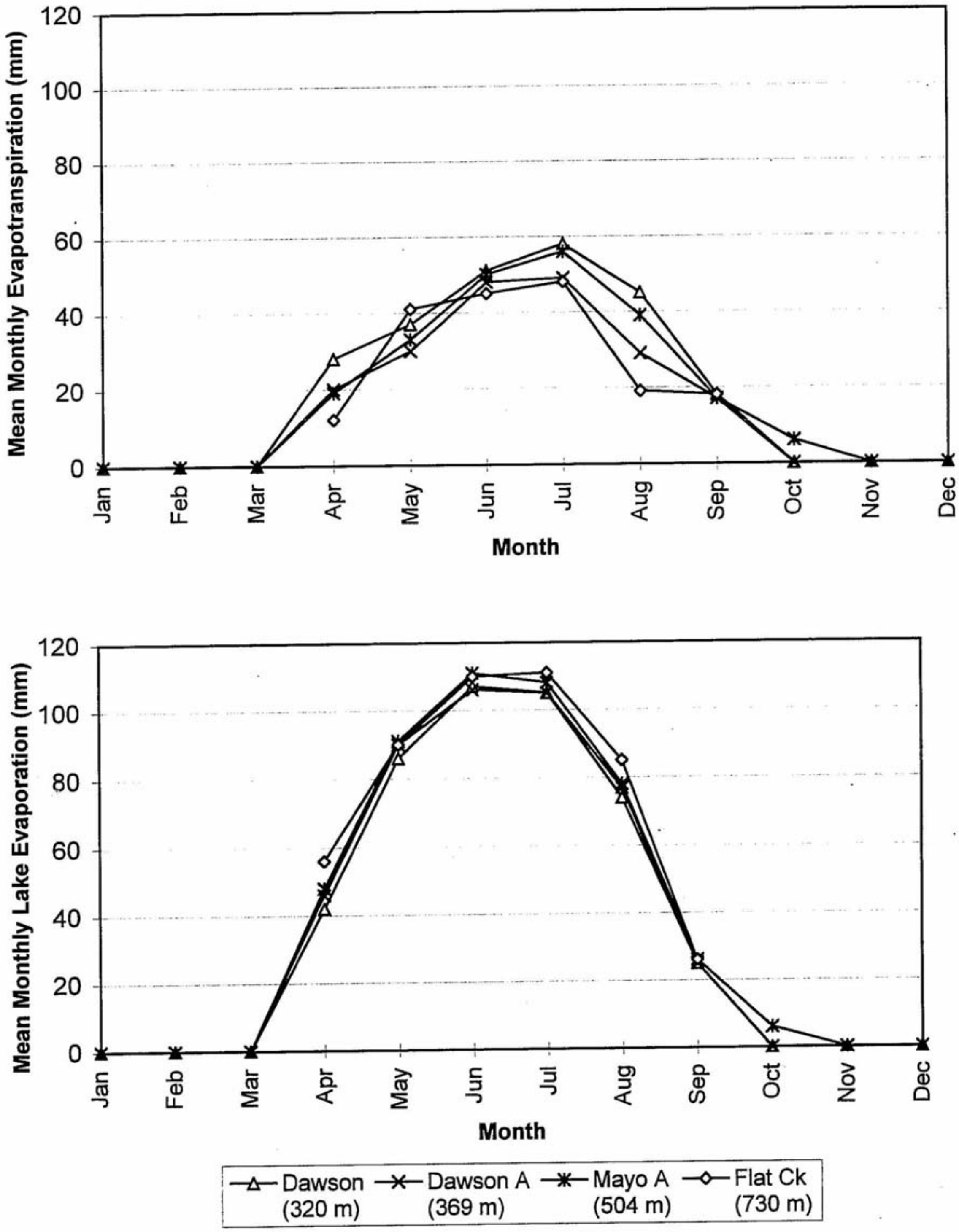
Using these criteria, a total of four climate stations were selected for the evaporation modelling, one located on the property itself (Flat Creek) and three located in the general region (Dawson, Dawson Airport, and Mayo Airport). However sunshine duration has not been maintained at any of these locations. To obtain this additional information, reference was made to the closest climate station equipped to measure sunshine duration that being Pelly Ranch or, as it was formerly known, Fort Selkirk.

Figure 2-3 displays the results of applying the WREVAP model to the meteorological conditions at each of the four climate stations. The top graph shows estimates of mean monthly evapotranspiration while the bottom graph shows the monthly distribution of lake evaporation. As can be observed, all four stations experience similar rates of both lake evaporation and actual evapotranspiration. Based on this similarity, the average of the evaporation rates at the four stations was selected to represent the conditions at the property. The average annual lake evaporation is about 460 mm while the estimated actual evapotranspiration is about 200 mm per annum, or 43% of lake evaporation.

Figure 2-3 Mean Monthly Evaporation Data



2.2 TERRESTRIAL RESOURCES

The following subsections describe terrestrial resources including regional and district geology, physiography and surficial geology as well as local soils characterization.

2.2.1 Regional Geology

The Keno Hill Silver District is located in the western part of the Selwyn Basin in an area dominated by deformed and metamorphosed Upper Proterozoic to Mississippian sedimentary rocks formed at the edge of a continental margin. During the Jurassic and Cretaceous periods, the area was subjected to compressional tectonic forces producing two major thrust sheets (Robert Service and Tombstone) and widespread folding. Early large scale deformation produced recumbent folds, resulting in local structural thickening of strata. A second (and possibly third) deformational event produced gentle south westerly plunging syn- and antiform pairs.

The Robert Service Thrust Sheet in the south is composed of Late Proterozoic to Cambrian sandstone, locally with interbedded limestone and argillite, a Cambrian to Middle Devonian succession of siltsone, limestone and chert, and Upper Devonian argillite, chert, and chert pebble conglomerate. The latter unit unconformably overlies the lower units.

The Tombstone Thrust Sheet to the north consists of Devonian phyllite, felsic meta-tuffs and metaclastic rocks, overlain by Carboniferous quartzite. This latter rock unit is locally thickened due to folding and or thrusting and hosts the mineralization of the Keno Hill Silver District.

Intrusive rocks formed during four episodes of plutonism. Early Paleozoic fine-grained diabase occurs as metre-scale dikes and sills in the Upper Proterozoic to Lower Cambrian rocks. During the Mid-Triassic, gabbros to diorites formed pods of various sizes, primarily in the Devonian and Mississippian rocks of the Tombstone thrust sheet. A third phase of plutonism took place around ninety-two million years ago in the early Cretaceous and resulted in widespread and voluminous Tombstone intrusions of commonly granitic to granodioritic composition. The youngest magmatic activity

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occurred around sixty-five million years ago in the Upper Cretaceous and resulted in the formation of peraluminous megacrystic potassium feldspar granite.

In addition to where polymetallic veins were exploited, the area hosts a number of occurrences, and showings of tungsten, copper, gold, lead, zinc, antimony and barite. Tin, tungsten, and molybdenite occurrences are possibly related to the suite of Cretaceous intrusion, whereas lead, zinc, and barite occur in stratiform calcareous sedimentary rocks of early to mid-Paleozoic age typical of sediment-hosted deposits.

2.2.2 Property Geology

The Keno Hill District is underlain primarily by Yukon Group metasedimentary rocks, locally divided into three formations; Upper Schist, Central Quartzite and Lower Schist. The Upper Schist (Hyland Group, pre-Cambrian to Cambrian age) overlies the quartzite in what is inferred to be a thrust contact (Robert Service Thrust) and consists of quartz-mica schist, quartzite, graphitic schist and minor limestone. The Central Quartzite (Keno Hill Quartzite, Mississippian age) contains thick-and thin-bedded quartzite, massive quartzite, graphitic phyllite, graphitic schist, calcareous schist and minor Triassic greenstone. This unit is approximately 700 m thick and is host to most of the past producing ore bodies. Structurally juxtaposed below the quartzite is the Lower Schist which has been correlated with the Devonian-Mississippian Earn Group. The Lower Schist includes graphitic schist, argillite, thin-bedded quartzite, calcareous schist, phyllite, slate, sericite schist, minor thick-bedded quartzite and locally significant intervals of Triassic greenstone. The greenstone forms sills and / or boudins and consists of metadiorite and metagabbro. The sills and boudins form bodies up to one kilometre long and thirty metres thick. Regional, greenschist facies metamorphism of all units is believed to have occurred in the Middle Cretaceous, about 105 million years ago.

A number of quartz-feldspar porphyritic sills have intruded the stratigraphy parallel to schistosity. The sills are most common in the Lower and Upper Schists and can reach thicknesses of up to fifty metres; reports of occurrences in the Central Quartzite are inconclusive and vague. The quartz-porphyry sills are believed to be of Cretaceous age.

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Structurally, the property is characterized by four sets of faults; many of which have been filled by hydrothermal minerals, forming veins. The oldest fault set consists of south dipping structures that are generally parallel to foliation and are apparently associated with the Tombstone Thrust Fault since movement was contemporaneous or slightly later. Locally, brittle deformation has been observed along these structures. A second fault set, known as “longitudinal veins” strikes north east to east northeast and dips steeply southeast. The latest movement along these faults is sinistral with offsets locally reaching more than 150 metres; however, more than one episode of movement commonly is indicated. Depending on the competency of the host rock, longitudinal veins can be up to thirty metres wide in an anastomosing system of sub-veins. Essentially all mineralized rock was mined from these longitudinal veins. A third set of faults, known as “transverse faults”, is north-west striking and dips steeply to the north. Transverse faults typically do not contain silver and lead mineralization but are commonly filled by quartz with trace to minor arsenopyrite, pyrite and jamesonite.

A younger set of faults, known as cross faults, strike north to north east with a dip of sixty degrees west to south west and offset vein or longitudinal faults by up to 2,000 metres. In the western part of the property, dextral movement is the most recent event along these structures, whereas in the eastern part of the property sinistral movement with less magnitude prevails.

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

Mineralization in the Keno Hill Silver District is of the polymetallic silver-lead-zinc vein type. In general, common gangue minerals include manganiferous siderite and to a lesser extent quartz and quartz breccia as well as calcite. Silver occurs in argentiferous galena and argentiferous tetrahedrite (freibergite). In supergene assemblages, silver is further found as native silver, in polybasite, stephanite, and pyrargyrite. Lead occurs in galena and zinc in sphalerite, which is iron-rich. Other sulphides include pyrite, arsenopyrite (locally gold-bearing) and chalcopyrite.

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

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

Mechanisms triggering deposition of ore and gangue minerals have been suggested by district wide studies of fluid inclusions and light stable isotopes. Fluid boiling appears to have been ubiquitous and some evidence exists for fluid mixing. The hydrothermal fluids responsible for mineral deposition contained significant quantities of CO_2 which may have “boiled” during abrupt changes in pressure produced during fluid movement from confined fractures to more open conduits formed in quartzite.

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

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

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2.2.3 Physiography and Surficial Geology

The Keno Hill Silver District lies within the northeastern part of the Yukon Plateau, and the terrain is mountainous with elevations ranging from 1,848 m (Summit of Keno Hill) to 610 m (McQuesten River valley). The area has been profoundly influenced by the latest glaciation but shows more subtle evidence of an earlier event as well.

The lower slopes of Galena Hill show clear evidence of ice marginal deposits such as kame terraces related to the glacial lobes occupying the major valley. The retreat of the Cordilleran ice sheet has had a major impact on the south McQuesten valley. Till blankets much of the valley and glacio-fluvial deposits are widespread. Glacio-lacustrine deposits formed in ice marginal lakes occur in the deeper part of the valley. Large meltwater streams have left huge meander scars. Boyle (1965) provides the following additional description of the physiography and glacial deposits in the area.

> Galena Hill trends northeast between Duncan Creek and the McQuesten River valley. It has an elevation of 4,740 feet, a moderately steep southwestern slope, and steeper north, northwestern, and southeastern slopes. The terrain above 4,300 feet is relatively flat and rolling, and marked by several level grassy meadows. The north, northwestern, and southeastern slopes of the hill are crossed by several streams that have cut steep gulches into the rock strata. The principal streams responsible for these gulches are Galena, Flat, Brefalt, and Sandy Creeks and Porcupine Gulch on the northwestern slope and Hinton and Fisher Creeks on the eastern and southeastern slopes.
>
> Keno Hill and Sourdough Hill are adjacent hills separated by Lightning Creek. Keno Hill trends northeast and lies between the Keno Ladue-McQuesten River valley and Allen, Faith, Lightning, and Christal Creeks. The hill has relatively gentle southern and southeastern slopes and a precipitous northern slope, marked by two cirques, Faro Gulch and Silver Basin Gulch. The terrain above 4,500 feet is relatively flat and rolling with five prominent rocky knolls known as Keno, Minto, Monument (the highest point on Keno Hill, elevation 6,065 feet), Caribou, and Beauvette. On the slopes of the hill several streams follow steep gulches in the rock strata, the principal ones being Gambler, Faro, McKay, and Silver Basin on the northern slope, Faith, Hope, and Charity on the northeastern and southern slopes, and Erickson on the western slope.
>
> Sourdough Hill (Pl. VI) lies southwest of Keno Hill and trends north between Thunder, Lightning, and Duncan Creeks. The part of the hill described in this report is on the northern and northwestern slopes, which are gentle up to 4,200 feet and from there rise abruptly to a steep rocky hogsback that trends southwest for some 6,000 feet.

Extensive rock outcrops are uncommon on Galena, Keno, and Sourdough Hills, and with the exception of the gulches and cirques where relatively good geological sections are present, detailed mapping can only be done by observing float. Below an elevation of 4,400 feet rock outcrops are sparse, and the slopes are covered with till, soil, rock debris, much, and muskeg, in which conifers, birch, aspen, Arctic black-birch, and other vegetation grow abundantly. Above this elevation the soil is thin, outcrops are more numerous, the ground is covered with local rock float, the terrain is treeless, and the vegetation is limited to alpine species and grassy meadows.

The lower slopes of the hills were severely glaciated during Pleistocene time by ice-sheets that spread, from the east, over the entire area. Glacial till, gravel, and other debris lie in a series of benches on the slopes of the hills and floor the valleys. The deposits are generally 5 to 20 feet thick, but in some areas as on the southern slope of Keno Hill facing Lightning Creek and north of Christal Lake, they are 30 to 50 feet thick or more.

The Keno Hill-Galena Hill area is in the region of permanently frozen ground. Wernecke (1932) has given an interesting account of the permafrost conditions, and the present investigation has added further data. The permafrost is irregularly distributed and its occurrence is dependent upon the elevation, hillside exposure, depth of overburden, amount of vegetative cover, and presence of flowing underground and surface water. At high elevations and on slopes with a northern exposure it is generally present. Thus, on Keno Hill, the mine workings on the top of the hill and on the northern slope encountered permafrost some 400 feet below the surface. On the northern slopes of Sourdough Hill and Galena Hill a similar situation prevails, and frost and ice lenses have been encountered at depths of 250 feet or more in the mine workings. On the lower southern slope of Keno Hill, however, the workings of the Onek and Mount Keno mines show little evidence of permafrost. In places where surface and underground water are flowing the permafrost has been thawed out and frostfree windows and strips are present. These provide access and egress for waters that are oxidizing the lodes.

The effects of frost action, soil creep, and slope wash are marked on the hills, particularly at the higher elevations. Frost action is responsible for features such as stone rings and stripes, and produces a general ‘boiling action’ that brings rock float, mineralized float, and soil from deeper layers to the surface, thus facilitating the mapping of both the underlying bedrock and the tracing of vein faults. On steep slopes, however, frost action and land creep have transported float downhill places, 100 feet or more, making the accurate mapping of contacts and vein faults difficult.

Glacial Deposits

The glacial deposits of the area were laid down during the advance and retreat of at least two ice-sheets that spread over the area from the east. The evidence for the first glaciation is rather meagre and is restricted to the presence of erratics above an elevation of 4,000 feet on Keno and Galena Hills and to an old till in the upper part of Dublin Gulch. The most distinctive deposits are those of the last glaciation.

These deposits floor the principal valleys and form benches on the lower slopes of the hills. They vary in thickness from a few feet to 50 feet or more and are composed mainly of till, glacio-fluvial deposits, glacio-lacustrine gravel, sand and silt, and layers of peat.

The tills, rarely more than a few feet thick, are absent in places. They are grey or greenish buff and consist of a heterogeneous mixture of fine sand, clay, small particles of schist, quartzite, and greenstone, and variously sized stones and boulders. Carbonate, mostly in the cementing materials, is present in some tills.

The clay and sand fractions are composed principally or irregular grains and broken fragments of quartz, feldspar, mica minerals, and hornblende. Heavy mineral accessories as determined by X-ray are magnetite, ilmenite, rutile, sphene, leucoxene, zircon, staurolite, garnet, monazite, epidote, tourmaline, pyrite, and red and black jasper pebbles. The till minerals are generally angular and abraded, and look fresh with little visible evidence of chemical decomposition. Most tills give a neutral or slightly alkaline reaction (pH 7-7.5).

Most of the rock pebbles and fragments and the heavy minerals in the tills are probably derived locally. Some minerals such as garnet and staurolite and the jasper pebbles may, however, have travelled considerable distances, because these minerals are not plentiful in the rocks underlying Keno and Galena Hills.

Lenses of gravel and sand are common in some tills, and thin peat layers are present locally. The gravel and sand lenses generally contain the same mineral assemblage as the tills. The peat layers are composed essentially of brownish and brownish black decomposed plant remains and much brownish material (humus). A small amount of mineral matter, consisting of quartz, feldspar, mica flakes, and a suite of heavy accessory minerals similar to that in the tills, is present throughout the peat.

The glacio-fluvial deposits are as much as 50 feet or more thick and include poorly sorted gravels and sand deposits which occur in kames, eskers, and glacial benches. Most of the pebbles and stones are relatively well rounded to subangular and consists of quartzite, schist, greenstone, diorite, and granite, all mainly derived locally. the fine sandy fractions contain the same mineral assemblage as the tills.

The glacio-lacustrine deposits range from a few feet to tens of feet in thickness. In places they are stratified, in others they consist of unsorted, washed gravels containing sand lenses. The gravels contain well-rounded pebbles, stones, and subangular schist fragments of local derivation. The mineral constitution of the sand lenses and fine fractions of the gravels is similar to that of the other glacial deposits described above.

2.2.4 Soils

The following description of soil is excerpted from Boyle's (1965) work:

> Soil development has been affected by four principal factors: the variability of parent materials, the marked relief of the country, the climatic and vegetative forces under which the soil developed, and the presence of permafrost.
>
> In the Keno Hill-Galena Hill area both bedrocks and glacial materials have served as parents for soil. The marked relief has had the effect of producing deeper soils in the valleys and on the lower slopes of the hills. The difference in the exposure of the hillsides has been responsible for the occurrence of greatly different soils within short distances. South-facing slopes are generally less densely wooded and freer from permafrost than north-facing slopes. On the former the soils are somewhat better developed; the latter are covered in most places by deposits of muck, peat, and half-bog soils.
>
> Except for a few localized areas, the soils are not strongly weathered or deeply leached. They also exhibit a poor profile development, particularly those underlain by permafrost.
>
> The soils in the area can be conveniently classified into two general types: (1) residual, and (2) muck peat, and half-bog.
>
> The residual soils were formed principally from the weathering of the various types of bedrocks, or as is evident in some places, particularly in the vicinity of Dublin Gulch, from the decomposition of a till that predates the last glaciation.
>
> The thickness of the residual soils varies, depending on the slope of the hills. On the tops of the hills they are rarely more than 3 feet thick and in places are entirely absent; lower down on the slopes the soils, thickened by slope wash and land creep, may exceed 10 feet. In most areas they are highly disturbed by solifluction and frost-boiling, and their profile development is either immature or non-existent. In places the following generalized profile is present from the surface downward:

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HORIZON	DESCRIPTION
Surface A_{00}	Trees, Shrubs, grass, moss, loose leaves, etc.
A_0	Undecomposed, partly matter organic layer consisting of roots, moss, woody fragments, humus, etc. - 3 to 6 inches thick - unfrozen during summer.
A_1	Organic layer consisting of decomposed roots, moss, woody fragments, humus, clay, sand, etc. - 3 to 6 inches thick - generally unfrozen during summer. This layer is thin or absent in places.
B + C	Residual soil - 1 foot to 10 feet thick. Frozen except locally. The soil overlying quartzite and greenstone is light reddish and yellow brown and contains much fine sand, clay, and small amounts of humus. Because of frost action angular blocks of quartzite and greenstone are generally admixed with the soil in all areas. The principal mineral constituents are quartz, feldspar, micas, clay minerals, hornblende, and limonite. The common heavy minerals are zircon, rutile, sphene, ilmenite, magnetite, epidote, monazite, tourmaline, and garnet. The soils overlying greenstones carry much sphene and leucoxene and small amounts of chromite. In the vicinity of the siderite-galena-sphalerite and pyrite-arsenopyrite lodes cerussite, beudantite, scorodite, native gold, oxidized galena cubes, goethite and limonite particles, and oxidized pyrite nodules appear in the heavy fractions. Over parts of the Dublin Gulch granodiorite mass and in the vicinity of some skarn zones the soils are weathered residuum carry scheelite. The soil overlying schists is grey or black, depending upon the type of schist. Over graphitic schists the soil is black and contains much graphitic material. Small fragments and plates of schist are universally present. The principal mineral constituents are quartz, feldspar, micas, clay minerals, graphite, and limonite. The common heavy minerals are similar to those overlying quartzite. Near the cassiterite veins north of Dublin Gulch the soils overlying schists and quartzites carry small amounts of cassiterite and tourmaline.
Bedrock D	Quartzite, phyllite, greenstone, and schist.

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Most residual soils are moderately well drained on the lower slopes of the hills, but poorly drained on the tops of the hills, where the upper layers of the soil are water-saturated all summer. The pH of most residual soils varies from 5.2 to 6.5.

The muck, peat, and half-bog soils are largely developed on the north slopes of the hills and on low-lying poorly drained ground. In most occurrences the profiles show the following sequence from the surface downwards:

HORIZON	DESCRIPTION
Surface A_{00}	Trees, grasses, low shrubs, mosses, loose leaves, etc.
A_0	Slightly compressed undecomposed organic matter consisting of woody fragments, roots, mosses, leaves, and minor amounts of mineral matter; 3 to 6 inches thick; unfrozen during summer.
A_1	Muck composed of dark brown to black decomposed organic matter and humus with a slight admixture of clay, sand, etc.; 6 to 10 inches thick; generally permanently frozen below top few inches.
B + C (Residual Soils)	Residual soil or till, gravel, and sand; generally frozen; thickness varies.
D (Glacial Materials)	Thickness varies
Bedrock D	Quartzite, phyllite, greenstone, and schist.

The muck, peat, and half bog soils are very poorly drained and are watersaturated all summer. Their pH varies from 6.0 to 7.0.

2.2.4.1 Soils Characterization – Water Treatment Sites

A preliminary soil characterization study was carried out in 2007 for six locations currently undergoing water treatment or have the potential to require water treatment (Silver King, Valley Tailings Area, No Cash, Galkeno 300 and 900, Onek, and Bellekeno). Results and maps produced from this study are provided in the *Preliminary Soils Characterization Study Report* located in Appendix B.

Five boreholes were also drilled in 2006 in an effort to characterize soils and gravels and to assess permeability for possible in-situ treatment (Valley Tailings Area (3), Galkeno

900) as well as to determine a potential gravel borrow source (Hanson Lake Road). Results of this drilling exercise are provided in the *Soils Characterization and Drilling Report* located in Appendix C.

Six additional boreholes were completed along the crests of the Valley Tailings Dams #1, #2, and #3 while six more boreholes were completed within the tailings impoundments behind Dam #1 and Dam #3. Observations taken from the drill program show that the Valley Tailings Dams were constructed on top of peat and local deposits of tailings. No permafrost was found during this study however a previous study completed by EBA in 1982 did encounter permafrost indicating that permafrost degradation has occurred in disturbed areas. Soils stratigraphy for the crest boreholes were logged with results included in SRK Consulting's *2007 Geotechnical Closure Studies Report* located in Appendix D.

Soil samples have also been collected and analyzed as part of revegetation trials occurring on Galena Hill for the waste rock dumps. See Section 3.3.4 Revegetation Trails – Galena Hill Waste Rock Dumps.

Soil samples were also collected from nine test pits in the Valley Tailings Area in 2007.

2.3 SURFACE WATERS

The Keno Hill Silver District encompasses three separate drainages, two of which report to the South McQuesten River. They are Christal and Flat Creeks (both draining into the S. McQuesten) and Lightning Creek which drains into the Stewart River via Duncan Creek.

2.3.1 Surface Water Surveillance Network

Surface water quality in the Keno Hill Silver District is monitored to assess and track changes in the condition of waters within the various watersheds on the property. Through monitoring waters can be characterized and changes or trends identified in water quality over time. Specific existing or emerging water quality problems can be identified and determine whether goals, including compliance with pollution regulations and treatment objectives, are being met. The data are useful for building site-wide and localized loading balances and in identifying closure issues and in closure planning.

The water quality surveillance program is designed to effectively meet water quality monitoring objectives at the site. The program is comprehensive and covers all three watersheds on the site, and the Valley Tailings Area. The program is continuously being reassessed for its effectiveness at canvassing the site and for its ability to help plan site activities.

A number of watercourses and adits on the property are monitored for water quality and quantity. Sample sites are categorized as:

- treatment sites – locations where water treatment systems have been implemented;
- surveillance sites & receiving waters – watercourses downstream of the property including background stations; and
- adit discharges – old mine workings with discharge.

All surface water sample station locations and monitoring frequency are listed in Table 2-2. Figure 2-4 shows these station locations.

Table 2-2 Surface Water Sample Station Locations Description and Coordinates

SITE	SITE DESCRIPTION	EXTERNAL MONITORING FREQUENCY	EASTING	NORTHING	WATER LICENCE
Treatment Sites					
KV12	Valley Tailings Pond #3 Decant	M	474310	7088278	QZ06-074
KV13	Silver King Adit	M	471887	7085572	QZ06-074
KV14	Silver King Treatment Pond #2 Decant	M	471797	7085755	QZ06-074
KV27	Galkeno 300 Adit	M	482636	7088837	QZ06-074
KV28	Galkeno 300 Treatment Pond Decant	M	482622	7088793	QZ06-074
KV31	Galkeno 900 Adit	M	483483	7087848	QZ06-074
KV32	Galkeno 900 Treatment Pond Decant	M	483512	7087719	QZ06-074
KV42	Bellekeno 625 Adit	M	487363	7087062	QZ06-074, QZ07-078
KV43	Bellekeno 625 Treatment Pond Decant	M	487318	7087147	QZ06-074, QZ07-078
KV74	Bellekeno East Decline	M	487505	7086415	QZ07-078

SITE	SITE DESCRIPTION	EXTERNAL MONITORING FREQUENCY	EASTING	NORTHING	WATER LICENCE
KV75	Bellekeno East Pond decant	M	487594	7086161	QZ07-078
Surveillance Sites & Receiving Waters					
KV1	South McQuesten River u/s Christal Creek	M	474008	7092790	QZ06-074
KV2	South McQuesten River at Pumphouse	Q	472076	7090036	QZ06-074
KV3	South McQuesten River u/s Flat Creek	Q	465846	7088534	QZ06-074
KV4	South McQuesten River 350 m d/s Flat Creek	Q	465618	7088335	QZ06-074
KV5	South McQuesten River 9 km downstream Flat Creek	Q	460691	7088873	QZ06-074
KV6	Christal Creek at Keno Highway	M	483909	7088242	QZ06-074
KV7	Christal Creek at Hanson Road	M	478657	7092413	QZ06-074
KV8	Christal Creek at mouth	M	474585	7091944	QZ06-074
KV9	Flat Creek u/s South McQuesten River	Q	465836	7088410	QZ06-074
KV10	Valley Tailings Pond #1 Decant	Q	475015	7088571	
KV11	Valley Tailings Pond #2 Decant	Q	474856	7088486	
KV15	South McQuesten River at Bridge below Haggart Creek	Q	449744	7085770	QZ06-074
KV16	Christal Creek 600 m d/s Silver Trail Highway	Q	483887	7088863	
KV21	No Cash Creek at Keno Highway	Q	477500	7088750	QZ06-074
KV29	Silver Trail Culvert #4	M	483740	7088792	QZ06-074
KV30	Christal Creek 825m d/s Silver Trail Highway	Q	483856	7089091	
KV37	Lightning Creek u/s Hope Gulch	Q	490315	7087776	QZ06-074, QZ07-078
KV38	Lightning Creek u/s Thunder Gulch	Q	488193	7087341	QZ06-074, QZ07-078
KV39	Hope Gulch u/s Lightning Creek	Q	490252	7087783	QZ06-074
KV40	Charity Gulch u/s Lightning Creek	Q	488982	7087503	
KV41	Lightning Creek u/s bridge at Keno City	Q	485429	7086764	QZ06-074, QZ07-078
KV44	Bellekeno 625 Seep	A	487361	7087195	QZ07-078
KV47	Porcupine Diversion Ditch	Q	474516	7088026	QZ06-074
KV48	Hinton Creek u/s Calumet Drive	Q	482819	7087198	QZ06-074
KV49	Hinton Creek u/s Christal Creek	Q	483582	7087009	QZ06-074
KV50	Christal Creek u/s Hinton Creek	Q	483575	7086897	QZ06-074
KV51	Christal Creek d/s Hinton Creek	Q	483600	7087010	QZ06-074
KV52	Natural spring to Christal Lake at Old Mackeno pump house	Q	483756	7087869	QZ06-074
KV54	Erickson Gulch at Road to Lucky Queen	Q	485834	7088993	QZ06-074
KV55	Sandy Creek at Silver Trail Highway	Q	478532	7089677	QZ06-074
KV56	Star Creek at Silver Trail Highway	Q	478051	7089277	QZ06-074

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SITE	SITE DESCRIPTION	EXTERNAL MONITORING FREQUENCY	EASTING	NORTHING	WATER LICENCE
KV57	Haldane Creek at South McQuesten Road	Q	461852	7086760	QZ06-074
KV58	Seepage at toe of #3 dam	Q	Unfixed	Unfixed	QZ06-074
KV59	Galena Creek at mouth (just u/s of Flat Creek)	Q	471126	7087018	QZ06-074
KV60	Galena Creek u/s of Silver King adit	Q	476604	7086892	QZ06-074
KV61	Porcupine Gulch at Calumet Road Crossing	Q	476607	7086895	QZ06-074
KV62	Brefalt Creek upstream of Porcupine Diversion	Q	476217	7086807	QZ06-074
KV63	Flat Creek upstream of Porcupine Diversion	Q	474644	7087814	QZ06-074
KV64	Flat Creek at Silver Trail Highway	Q	474906	7086535	QZ06-074
KV65	Thunder Gulch upstream of Bellekeno	Q	487464	7086873	QZ06-074, QZ07-078
KV69	Valley Tailings Decant and Seepage u/s Flat Creek	Q	474099	7088181	
KV70	Flat Creek 20m u/s KV69	Q	474140	7088260	
KV71	Flat Creek 20m d/s KV69	Q	474046	7088203	
KV72	South McQuesten River at McQuesten Lake	Q	482492	7104476	
KV73	Cache Creek at access road d/s McQuesten Lake	Q	482846	7103594	
KV76	Thunder Gulch d/s of Bellekeno 625 Adit	Q	487414	7087118	QZ07-078
KV77	Thunder Gulch u/s of Bellekeno East	Q	487742	7086013	QZ07-078
KV78	Onek Waste Rock Storage Facility	A	485726	7087518	QZ07-078
KV79	Christal Creek d/s of Mackeno Tailings	Q	483796	7087919	
KV80	Christal Creek u/s of Mackeno Tailings	Q	483790	7087869	
Adit Discharges					
KV17	Husky South West Adit	Q	485332	7092431	QZ06-074
KV18	Bermingham Adit	Q	478689	7087226	QZ06-074
KV19	Ruby Adit	Q	478504	7087748	QZ06-074
KV20	No Cash 500 Adit	Q	477728	7088508	QZ06-074
KV33	Keno 700 Adit	Q	490000	7089499	QZ06-074
KV34	Lucky Queen Adit	Q	486456	7090518	QZ06-074
KV35	Sadie Ladue Adit	Q	485832	7092768	QZ06-074
KV36	Flame and Moth	Q	483836	7086820	QZ06-074
KV45	Onek Adit	Q	485101	7087288	QZ06-074, QZ07-078
KV53	UN Adit	Q	481595	7089322	QZ06-074
KV66	Klondike Keno Adit	Q	485599	7090833	QZ06-074
KV67	Keno 200 Adit	Q	489496	7089983	QZ06-074
KV68	Brewis Red Lake Adit	Q	486789	7090194	QZ06-074

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Old UKHM #	UKHM #	LES SITE #	ACG #	NPG #	KV#	SITE DESCRIPTION
S-21	UK1	LES 1			**KV-1**	South McQuesten River u/s Christal Creek
S-10	UK2	LES 2			**KV-2**	South McQuesten River at Pumphouse
S-26	UK5	LES 3			**KV-3**	South McQuesten River u/s Flat Creek
S-11	UK3	LES 4			**KV-4**	South McQuesten River d/s Flat Creek
		LES 5			**KV-5**	South McQuesten River 9 km downstream Flat Creek
S-18	UK6	LES 6	ACG-WQ-05	NPG-05	**KV-6**	Christal Creek @ Keno Highway
S-19	UK7	LES 7 & LES 51			**KV-7**	Christal Creek @ Hanson Road
	UK8	LES 7B			**KV-8**	Christal Creek @ mouth
S-9	UK9	LES 9	ACG-WQ-09		**KV-9**	Flat Creek u/s South McQuesten River
			ACG-WQ-08a		**KV-10**	Valley Tailings Pond #1 Decant
			ACG-WQ-08b		**KV-11**	Valley Tailings Pond #2 Decant
S-1	UK13	LES 72	ACG-WQ-08c		**KV-12**	Valley Tailings Pond #3 Decant
S-13	UK14	LES 12	ACG-WQ-03b	NPG-03	**KV-13**	Silver King Adit
S-13A		LES 12A	ACG-WQ-03		**KV-14**	Silver King Treatment Pond #2 Decant
	UK4				**KV-15**	South McQuesten River at Bridge below Haggart Creek
			ACG-WQ-11 Site A		**KV-16**	Christal Creek 600 m d/s Silver Trail Highway
S-17	UK15	LES14			**KV-17**	Husky South West Adit
S-3	UK24	LES 18			**KV-18**	Bermingham Adit
S-15	UK17	LES 19			**KV-19**	Ruby Adit
S-4	UK25	LES 20			**KV-20**	No Cash 500 Adit
		LES 21			**KV-21**	No Cash Creek @ Keno Highway
S-27	UK27	LES 32			**KV-27**	Galkeno 300 Adit
			ACG-WQ-12		**KV-28**	Galkeno 300 Treatment Pond Decant
	UK27a		ACG-WQ-10		**KV-29**	Silver Trail Culvert #4
			ACG-WQ-11 Site D		**KV-30**	Christal Creek 825m d/s Silver Trail Highway
S-5	UK20	LES 31 or 31E	ACG-WQ-04b	NPG-04	**KV-31**	Galkeno 900 Adit
S-20		LES 31B	ACG-WQ-04a		**KV-32**	Galkeno 900 Treatment Pond Decant
S-6	UK21	LES 38			**KV-33**	Keno 700 Adit
S-14	UK28				**KV-34**	Lucky Queen Adit
S-7	UK26	LES 35			**KV-35**	Sadie Ladue Adit
					KV-36	Flame and Moth
S-22	UK11	LES 37			**KV-37**	Lightning Creek u/s Hope Gulch
		LES STN38			**KV-38**	Lightning Creek u/s Thunder Gulch
		LES 48			**KV-39**	Hope Gulch u/s Lightning Creek
		LES STN37			**KV-40**	Charity Gulch u/s Lightning Creek
S-24	UK12	LES 41			**KV-41**	Lightning Creek u/s bridge @ Keno City
S-12	UK18	LES 39	ACG-WQ-07b		**KV-42**	Bellekeno 600 Adit
S-12a		LES 39A	ACG-WQ-07	NPG-07	**KV-43**	Bellekeno 600 Treatment Pond Decant
S-5A	UK18A	LES 39B	ACG-WQ-07c		**KV-44**	Bellekeno 600 Seep
S-8	UK19	LES 40	ACG-WQ-06	NPG-06	**KV-45**	Onek Adit
S-23	UK10	LES 47			**KV-47**	Porcupine Diversion Ditch
		LES 53			**KV-52**	Natural spring to Christal Lake at Old Mackeno pump house
		LES 30/S2			**KV-53**	UN Adit
		LES 34			**KV-54**	Erickson Gulch at Road to Lucky Queen
		LES 63			**KV-55**	Sandy Creek at Silver Trail Highway
		LES 76			**KV-56**	Star Creek at Silver Trail Highway
		LES 10			**KV-57**	Haldane Creek at South McQuesten Road
		LES 73			**KV-58**	Seepage at toe of #3 dam
		LES 57			**KV-59**	Galena Creek at mouth (just upstream of Flat Creek)
		LES11	ACG-WQ-01		**KV-60**	Galena Creek upstream of Silver King adit
		LES 67			**KV-61**	Porcupine Gulch at Calumet Road Crossing
		LES 45			**KV-62**	Brefalt Creek upstream of Porcupine Diversion
		LES 46			**KV-63**	Flat Creek upstream of Porcupine Diversion
		LES 8			**KV-64**	Flat Creek at Silver Trail Highway
		LES 53			**KV-65**	Thunder Gulch upstream of Bellekeno

Notes:
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Projection: UTM Zone 8 NAD83
Scale 1:30,000 when plotted at A0 page size.

Water Quality
Station Name
Historic Station Number
Site Description
Water Quality Station

Mine Workings
Adit
Shaft (to surface - connection to underground not determined)
Valley Tailings
Pit

Topography
Town
Silver Trail
Secondary Road
Limited-use road
Trail
Watercourse
Waterbody

ENVIRONMENTAL CONDITIONS REPORT
KENO HILL SILVER DISTRICT
SURFACE WATER QUALITY STATIONS

ACCESS CONSULTING GROUP

Drawn By: HD	June 2009	FIGURE 2 - 4
Checked by: NS	D:\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\Environmental_Conditions_Report\Figure2_4_Surface_WQ_Stations.mxd	

2.3.1.1 Adit Discharge Survey

In the summer of 2007, adit discharge surveys were carried out to better understand adit flow paths (*Adit Discharge Survey, 2007* see Appendix E), receiving waters and down gradient water quality. Adits included in the survey were: Silver King 100, Husky South West, Bermingham, Ruby, No Cash 500, Galkeno 300, Galkeno 900, Keno 700, Onek, and Sadie Ladue.

2.3.2 Water Quality Database and Analyses

A water quality database developed by Access Consulting Group contains analytical data for many stations dating back to the mid-1980's. However, sporadic data and poor detection limits prior to 1994 limit the value of older data and restrict the assessment period from 1994 to present. This plethora of information is sufficient for assessing water quality trends for specific parameters of interest. Data collected as a part of the monitoring program stipulated by Water Licence QZ06-074 is presented in Appendix F according to the drainage basin within which the stations are located. Data collected from adits are presented according to the mountain on which they are located, as they are geologically related to one another and represent conditions from the same or similar sources. However, geologically-related adits do not necessarily flow into the same drainage. Representation of the adits as point sources to specific watersheds is achieved through a loading model. This tool uses current water quality data collected under the water licence to determine present site conditions and can be used predicatively in hypothetical loading scenarios. Access Consulting Group has developed this loading model to calculate as output the background capacity of each watershed or part thereof to either absorb or contribute metals loading downstream.

A Water Quality Assessment was carried out by consultants Minnow Environmental Inc. in 2008. A baseline for water quality was developed based on receiving environment station data that had been collected over the years from stations within the property watersheds. Water quality data were compiled, evaluated and interpreted to identify parameters and locations of concern within the downstream waters relative to established guidelines and background concentrations. Additionally, a number of contaminants of concern (COCs) and potential contaminants of concern (PCOCs) were identified from among 48 parameters with adequate data for assessment. Based on this assessment, COCs were identified as cadmium and zinc. Other parameters identified as PCOCs include: aluminum, arsenic, chromium, copper manganese, nitrite, phosphorous, selenium and silver. Baseline information established from historical and current water quality data shows that a number of contaminants are naturally elevated above CCME guidelines in the Keno Hill Silver District. Details of these and other findings are described in the report issued by Minnow (*Water Quality Assessment Report for United Keno Hill Mines*, July 2008 - see Appendix G). The findings of this report will serve to develop site-specific water quality objectives for closure.

2.3.3 Treatment Sites

Metals laden water discharges continually from various mine openings throughout the Keno Hill Silver District, and seasonally from the Valley Tailings Facility. The quality of this effluent does not comply with licensed effluent discharges for the site, and in order to reduce metals levels water treatment is required on an ongoing basis.

There are four mine wastewater treatment facilities located at Bellekeno 625, Galkeno 900, Galkeno 300, and Silver King 100 adit areas, while water from the Valley Tailings Area (VTA) is treated on an as-needed basis (depending on water quality and decant situation – normally requiring treatment only during spring freshet, between May and June). All water requiring treatment is circum-neutral pH with zinc and other metal concentrations exceeding regulated criteria. Treatment consists of conventional wastewater treatment technology using continual lime addition to treat mine portal effluent. Lime is mixed with fresh water (Flat Creek or Valley Tailings) at a central mixing facility in the town site of Elsa and delivered to the mine portals via a lime slurry tanker truck. Lime slurry is stored in, and continuously mixed in, lime holding tanks and then added to the mine effluent via a peristaltic metering reagent pump to a rapid mix tank. Galkeno 300 has clarifiers and a sludge pond. Flocculent is added at Galkeno 300 and Bellekeno 625. Treated effluent is directed to settling pond(s) for settling metal precipitates before discharge (decant) to the environment.

The VTA comprises a series of three earthen dams and associated ponds with tailings impounded behind dams No. 1 and 2. Wastewater treatment involves the addition of

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lime slurry at tailings dam decants No. 1 and 2. Tailings ponds No. 2 and 3 provide effluent treatment and settling capacity prior to discharge to the Flat Creek drainage via the dam No. 3 decant.

Discharge samples at each treatment location are taken and analyzed on a daily basis using the on-site AA machine. Review and evaluation of these results is conducted by the project manager and discussed with the treatment system operators. These results go the project manager to provide direction regarding the treatment process, (i.e. lime addition rates and pond clean-out activities). The treatment objective is to reduce zinc effluent concentrations to less then 0.05mg/L, as required under the Water Licenses. Historic correlations between zinc concentrations and other metals (i.e. arsenic, lead and cadmium) indicate that the zinc discharge treatment objective ensures that other metals are also managed. Internal records are maintained and used for analysis purposes in order to achieve the highest possible standard of treatment.

2.3.3.1 Galkeno 900 Bioreactor Cell Treatment

The Galkeno 900 bioreactor is a pilot test of sulfate-reducing bacteria (SRB) technology for treating mine drainage. The bioreactor consists of a pond filled with streambed gravels and a baffle to direct flow through the gravels. Mine waters are amended with a soluble organic carbon source mixture, primarily alcohols. The first few months of operation involve a growth phase for naturally-occurring SRB to colonize the surface of the gravels, in time forming a microbial coating over the gravels comprised primarily of SRB. The SRB metabolize the carbon source, leading to the reduction of sulfates and the formation of aqueous sulfide within the bioreactor. The sulfide reacts with soluble metals in the mine drainage, precipitating the metals within the bioreactor, where the metal precipitates are filtered by the gravels.

The pilot test is a demonstration that this SRB technology, which has been successfully employed at many sites in mine pools, wetlands, and bioreactors in warmer climates, can be successfully implemented year-round in a buried pond bioreactor in the cold climate in the Keno Hill Silver District, where temperatures of -40ºC or colder are common in the winter months. To date, there are initial signs of microbial growth within the bioreactor, and the pond has maintained flow through the winter, even with minimal fresh inputs of mine water (which is 3°C year round). This demonstrates that burial of the reactor insulates it enough to maintain flow through the winter. In the spring and summer months, the growth phase is expected to be completed and the treatment phase to be maintained. Achieving metals removal of over 90% for cadmium and zinc is primary success criteria expected to be achieved and maintained. Finally, next winter will complete the important phase of the demonstration showing that metals removal will continue even through the cold temperatures associated with wintertime.

2.4 HYDROLOGY

In 2008 Clearwater Consultants Ltd. were retained to update and refine the understanding of site hydrologic conditions that was developed in 1996. Memorandum CCL-UKHM-1 provides the detailed results of this study and is located in Appendix A.

Analysis of streamflow gauging station data for Christal Creek, Flat Creek and Lightning Creek (KV7, KV9 and KV41 respectively) was conducted to produce a mean annual runoff (MAR) for each of the stations. Table 2-3 presents specific catchment areas, MAR, and runoff depth for the three gauging stations while Table 2-4 provides details of the minesite catchments.

Table 2-3 Results of the Hydrological Update for Flat, Christal and Lightning Creeks

Site	Catchment Area	MAR	Average Runoff Depth
	km^2	m^3/s	mm
KV-7	43.5	0.304	221
KV-9	56.5	0.304 - 0.352	170 - 197
KV-41	59.1	0.645	344

Table 2-4 Details of Minesite Catchments

			Mean Annual Runoff (MAR)	
Catchment Description	Catchment Area (km2)	Catchment Median Elevation (m)	Depth (mm)	Volume (m3/yr)
Christal Creek above Station KV6	7.7	990	240	1,848,000
Christal Creek between Stations KV6 and KV7	35.8	970	230	8,234,000
Sandy Creek above LES-63	2.3	1180	290	667,000
No Cash Creek above LES-21	1.5	1200	300	450,000
South McQuesten River above S10 and below LES-1, S 19, LES-21,				
and LES-63	32.9	650	150	4,935,000
South McQuesten River above LES-1	476	940	230	109,480,000
Catchment of Dam No. 3 of Elsa Tailings Impoundment	4.3	760	180	774,000
Porcupine Creek Diversion Channel above LES-47	10.1	1110	270	2,727,000
Galena Creek above the mouth	10.9	970	240	2,616,000
Flat Creek above S9 and below LES-57, LES-47, and S1	31.2	700	170	5,304,000
South McQuesten River above S11 and below S10 and S9	29.9	670	160	4,784,000
South McQuesten River above LES-5 and below S11 and LES-10	95	850	200	19,000,000
Haldane Creek above South McQuesten Road	88.8	830	200	17,760,000

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2.5 GROUNDWATER SURVEILLANCE – VTA

Groundwater surveillance monitoring is currently limited to the Valley Tailings Area where a number of wells are monitored quarterly. Well locations and details can be found in the *2007 Geotechnical Closure Studies* prepared by SRK and located in Appendix D.

In 2006, studies were carried out in the Valley Tailings Area to develop a preliminary groundwater mass loading and contaminant mass balance. A number of drive-point piezometers were installed, four of which continue to be monitored on a regular basis. Results of these studies are reported within the *"Preliminary Valley Tailings Groundwater Mass Loading and Contaminant Mass Balance Report"* prepared by Elsa Reclamation and Development Company in March 2007.

In 2007, SRK Consulting (Canada) Inc. was contracted to develop an understanding of the physical hydrogeology of the Valley Tailings Facility to enable an estimation of groundwater flux through the facility. This flux will be used to estimate current contaminant loadings from the Valley Tailings Area into the receiving environment. The study used grain size data for samples collected during hydrogeological investigations at the Valley Tailings Facility to estimate hydraulic characteristics of the unconsolidated materials beneath the tailings and dams. Results of this investigation are reported within the *"Assessment of Groundwater Regime at the Valley Tailings Facility"* prepared by SRK in February 2008.

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2.6 MINE HYDROGEOLOGICAL MODELLING

An underground hydrologic evaluation is being undertaken for eight adits where adit plugs are being investigated for closure. Preliminary analysis has been conducted to evaluate the potential effects were an adit plug to be installed at each location. The eight adits where adit plugs were recommended were Silver King 100, No Cash 500, Galkeno 300, Galkeno 900, Bellekeno 625, Onek 400, Keno 700, and Sadie Ladue 600. Special attention has been placed on the Hector-Calumet mine workings as it is the dominant system generating zinc loading in the district. Work performed includes evaluation output from 3-D geological evaluations..

3.0 BIOLOGICAL ENVIRONMENT

The following chapter of this Environmental Conditions Report summarizes the biological environment for the Keno Hill Silver District including aquatic resources (fisheries, benthic invertebrates, stream sediments), wildlife and vegetation.

3.1 AQUATIC RESOURCES

Monitoring of aquatic resources including fisheries, benthic invertebrates and stream sediments has occurred a number of times over the years. A summary of the findings from these monitoring activities is provided in the ensuing sections.

3.1.1 Fisheries

Between August of 1994 and August of 1995 White Mountain Environmental Consulting conducted fisheries investigations in the waters influenced by mining near the Keno Hill Silver District including Christal Lake, Christal Creek, Flat Creek, the South McQuesten River and Lightning Creek. The goal of these preliminary investigations was to assess fish habitat, fish utilization and metal content of fish tissue with results reported in the *Site Characterization Report* prepared in 1996. In 2006, White Mountain Environmental Consulting conducted another fisheries investigation and for comparative purposes, had the same goals and within the same study area. As with the 1995 investigation, spring, summer and fall evaluations were conducted in 2006. Results from the 2006 investigations are reported in White Mountain's *Fisheries Assessments Conducted in the Keno Hill Mining Area, Including Metals Analysis of Fish Tissue Samples* prepared in January 2007.

In September 2008 another limited fisheries investigation was conducted by Access Consulting Group at seven sites including Christal Lake, Christal Creek, Flat Creek and Lightning Creek with the same purpose: to document fish utilization, habitat quality and metal content in fish tissues. Some additional habitat work was conducted on Christal Creek, characterizing potential fish barriers on the system. Recommendations regarding their removal was considered. Results from the 2008 investigation are provided within the Keno Hill Silver District Fisheries Assessment Project located in Appendix H of this report and also includes results from the previous 1995 and 2006 investigations. A

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summary of results from the 1995, 2006 and 2008 fisheries investigations is provided in the following sections.

3.1.1.1 Christal Lake

Christal Lake is a small, shallow sub-alpine lake with a silt bottom covered with vegetation. Beaver activity at the lake outlet controls water levels in the lake. An old tailings pile is located on the north east corner of the lake with some tailings submerged in the lake. During each of the three investigations, slimy sculpins were the only fish species observed in Christal Lake.

3.1.1.2 Christal Creek

In 2008 three locations along Christal Creek were investigated including at the Keno Road Crossing (KV6), the Hanson Lake Road Crossing (KV7) and at a walk-in site accessed via a gravel pit off the Hanson Lake Road (C4). These sites were also investigated in 1995 and 2006 as well as an additional site at the mouth of Christal Creek where it joins with the South McQuesten River. This site was not revisited in 2008.

Slimy sculpin were the only fish species recorded in Christal Creek at the Keno Road Crossing (KV6) in 1995 and 2006 and were observed in relatively similar abundance. In 2008 no fish were captured at this location. It is worth noting that due to an extended period of precipitation all streams in September 2008 were experiencing high, fast flow with increased turbidity during the investigation, which had some impact on the effectiveness of sampling at the time.

Investigations at site KV7 in Christal Creek at the Hanson Lake Road crossing resulted in no fish observed in 2006 and 2008. A single Arctic grayling juvenile was recorded at this site in 1995.

Site C4, accessed off the Hanson Lake Road is located approximately 4.7 km downstream of Christal Lake. A number of fish barriers have been observed upstream of this site, three of which remain and appear to block upstream fish movement. No fish were captured at this location in 2008 while Arctic grayling were observed below the barriers in 2006, although were less common and more widely dispersed than in 1995.

Christal Creek at the mouth (site KV8) was investigated in 1995 and 2006. In 1995 and 2006, slimy sculpin, Arctic grayling, and burbot were recorded in this area, although no fish were recorded during spring investigations likely due to high water levels.

3.1.1.3 Flat Creek

Fish utilization in Flat Creek (KV9) has been reported as being low subsequent to assessments performed in 1974 and 1995. In 1995, Arctic grayling, burbot, and slimy sculpin were recorded during summer and fall investigations with no fish observed during spring investigations.

During 2006 no fish were captured in the spring with a few slimy sculpin caught during August. During the summer months the lower reach of the creek had been colonized by slimy sculpin, burbot, Arctic grayling and northern pike. Juvenile Arctic grayling were more common in 1995 than in 2006. By September very few sculpin remained and no other species were present. Adult sculpin were recorded near the Shangai Road during all 2006 sample periods indicating the presence of some over-winter habitat further from the South McQuesten River confluence. During 2008 a single northern pike was captured.

3.1.1.4 Lightning Creek

Lightning Creek continues to undergo significant channel changes as a result of placer mining. For this reason the sample location used in 1995 could not be revisited in 2006 and two new locations were selected to allow more representative sampling of Lightning Creek. These sites were revisited in 2008.

In 1995 the reach of Lightning Creek surveyed extended from just downstream of Keno City to approximately 200 m above the influence of Thunder Gulch, which was being placer mined. Adult Arctic grayling were found upstream of turbid water from Thunder

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Gulch and sub-adult Arctic grayling were observed in the turbid waters downstream of Thunder Gulch.

In 2006, two new stations were situated adjacent to the Keno City campground (LgT K) and just upstream of the confluence with Duncan Creek (LgT D). Both sites had been placer mined in the past and have man made channels. The fast flowing waters of LgT K contained Arctic grayling while the slower waters of LgT D had greater species diversity with slimy sculpin, round whitefish, and Arctic grayling common in August and September.

In 2008 no fish were observed in Lightning Creek adjacent to the Keno City campground while slimy sculpin and Arctic grayling were observed upstream of the confluence with Duncan Creek.

3.1.1.5 South McQuesten River

Fisheries investigations were conducted on the South McQuesten River in 1995 and 2006. In 2006, five sites along the river were sampled between McQuesten Lake and downstream of Haggart Creek and covered strategic locations such as downstream of the confluences with Flat and Christal Creeks.

Arctic grayling captured near the Haggart Creek confluence in June were assessed for maturity and spawn timing, which was determined to be around May 27. On July 31, Chinook salmon were also observed near the confluence with Haggart Creek. Fish utilization of the South McQuesten River was found to generally be higher downstream of the confluence of Haggart Creek both in terms of number of fish and species diversity. Other fish species observed in 2006 include slimy sculpin, round whitefish, northern pike, Arctic lamprey and burbot.

3.1.2 Stream Sediments

Stream sediments have been collected a number of times over the past 20 years, most recently in 2007 by LES with results provided within the *"Keno Valley Stream Sediment and Benthic Invertebrate Monitoring Programs, 2007"* report (Appendix I). In the assessment of metals levels in stream sediments sampled in 2007, six of the metals analyzed were examined in detail as they may be found in ore bodies, can be toxic to aquatic organisms and have associated CCME guidelines for comparison. These six metals include arsenic, cadmium, copper, lead, mercury and zinc and of these, arsenic, cadmium, lead and zinc regularly exceeded the CCME Probable Effect Levels (PEL). All sites met the PEL for copper, however only three sites also met the Interim freshwater Sediment Quality Guideline (ISQG), while concentrations of mercury were relatively low. Generally concentrations greater than the PEL have a 50% incidence of creating adverse biological effects (LES, 2008).

A discussion of the 2007 metals analysis in stream sediments, and comparison of data collected over the years prepared by LES (2008) is provided below and shown in Table 3-1 and Figure 3-1. Please refer to the report (Appendix I) for detailed results and further discussion.

> The stream sediments at KV-9, Flat Creek u/s South McQuesten River, had the highest mean concentrations of all the examined metals. Flat Creek has been the receiving water for effluent from the tailings facility for the past few decades. The mean concentrations of arsenic were high and exceeded the PEL at all sites. The ISQG guideline for cadmium was exceeded at KV-1, KV-37 and KV-41, with the PEL for cadmium exceeded at the remaining sites. All sites met the PEL for concentrations of copper in the stream sediments, however, only the sediments at KV-1, KV-7 and KV-41 met the ISQG guideline. The ISQG for lead was met in the stream sediments at KV-1 only. The ISQG was exceeded at KV-7, KV-37 and KV-41 and the PEL for lead was significantly exceeded at the other sites. Concentrations of mercury in the stream sediments were relatively low throughout. The ISQG was exceeded at KV-38, and the PEL was exceeded at KV-9. The concentration of zinc in the stream sediments at KV-37 was the only site to meet the ISQG guideline. The stream sediments at KV-41 exceeded the ISQG with the other sites greatly exceeding the PEL for zinc.
>
> The concentration of metals in the stream sediments at KV-6 and KV-8 were relatively similar, however concentrations at KV-7, located midway between these sites, were considerably lower. Concentrations of the sediments at KV-7 were actually quite similar to the sediments at the upstream site on the South McQuesten River, KV-1. The standard deviation for the triplicate samples at KV-7 was low indicating that representative samples were collected here.
>
> There does appear to be some impact to the sediment quality of the South McQuesten River downstream of the confluences of Christal and Flat Creeks for each of the metals, as documented by slight increases at sites KV-2 and KV-4 respectively.
>
> Within the Lightning Creek drainage, the highest concentrations were documented at KV-38, upstream of Thunder Gulch. This site is located 1.8 km

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downstream of Hope Gulch, which has documented high concentrations of water borne metals (Laberge, 2006). Metal levels in the stream sediments downstream at KV-41 were very similar to the upstream site, KV-37, indicating very little overall impact to Lightning Creek.

Overall, metal concentrations have been greater in the sediments of the Flat and Christal drainages than the South McQuesten and Lightning drainages. There appears to be little change in the concentrations of metals in the sediments at KV-1, KV-37 and KV-41 over time. Metals have fluctuated over time at the other sites, notably at KV-6 and KV-7.

Typically, concentrations were higher in the sediments during the 1990s than during the first decade of 2000. The lowest concentrations tended to occur in 2004.

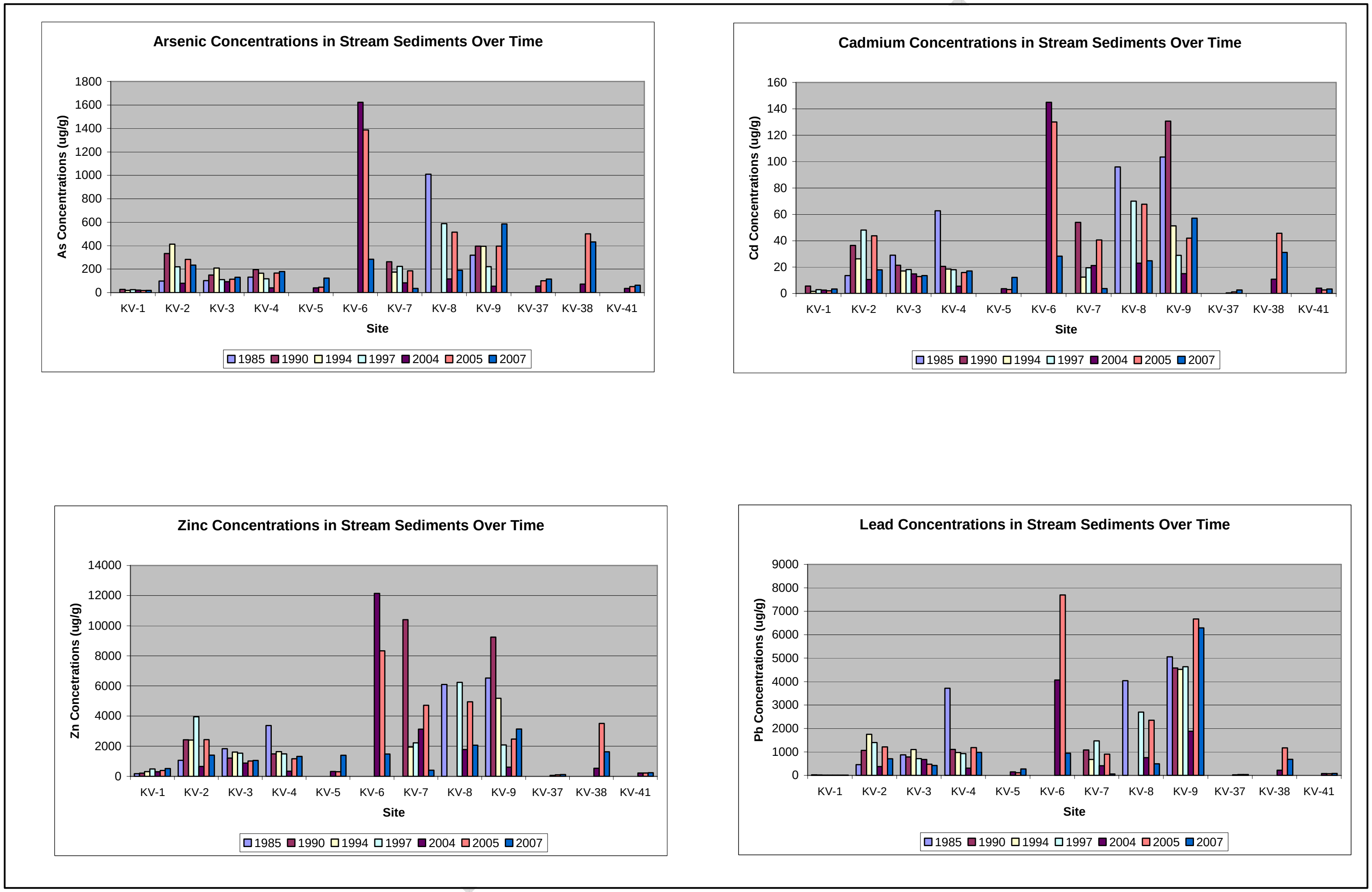
Table 3-1 Comparison of Metals in Stream Sediments Over Time

METAL & CCME GUIDELINES	YEAR	KV-1	KV-2	KV-3	KV-4	KV-5	KV-6	KV-7	KV-8	KV-9	KV-37	KV-38	KV-41
ARSENIC	1985	<8	99	102	132				1,010	319			
(ug/g)	1990	27	333	150	197			263		396			
	1994	18	413	210	166			174		395			
ISQG = 5.9	1997	25	220	111	117			224	587	222			
PEL = 17.0	2004	21	79	93	41	40	1,623	83	116	55	56	72	35
	2005	17	282	113	167	45	1,387	185	516	396	100	501	51
	2007	19	235	130	180	124	284	35	190	586	115	433	62
CADMIUM	1985	0.6	14	29	63				96	104			
(ug/g)	1990	6	37	21	21			54		131			
	1994	2	26	17	19			12		51			
ISQG = 0.6	1997	3	48	18	18			20	70	29			
PEL = 3.5	2004	3	11	15	6	4	145	21	23	15	1	11	4
	2005	2	44	13	16	3	130	41	68	42	1	46	3
	2007	3.3	18	13.5	17	12	28	3.7	24.8	57.1	3	31	3
LEAD	1985	24	463	877	3,720				4,040	5,060			
(ug/g)	1990	22	1,069	791	1,110			1,088		4,580			
	1994	10	1,750	1,100	980			680		4,520			
ISQG = 35.0	1997	16	1,397	717	930			1,469	2,697	4,637			
PEL = 91.3	2004	12	377	677	310	150	4,067	413	755	1,883	27	223	77
	2005	16	1,217	475	1,188	117	7,700	902	2,350	6,667	39	1,172	72
	2007	13.9	707	423	985	271	954	56	496	6290	40	682	82
ZINC	1985	169	1,060	1,830	3,380				6,100	6,530			
(ug/g)	1990	212	2,423	1,220	1,490			10,400		9,247			
	1994	310	2,410	1,610	1,640			1,950		5,180			
ISQG = 123	1997	486	3,950	1,540	1,487			2,217	6,237	2,090			
PEL = 315	2004	303	659	885	342	323	12,140	3,130	1,773	605	62	535	226
	2005	385	2,432	1,010	1,170	307	8,337	4,710	4,943	2,477	104	3,503	228
	2007	512	1410	1054	1333	1,400	1,483	404	2067	3143	125	1,637	247

Note: Values for 1985, 1990, 1997,2004, 2005 and 2007 are the mean for triplicate samples,
the values for 1994 are for one composite sample.

Note: Adapted from Table 4, LES 2008.

Figure 3-1 Metal Concentrations in Stream Sediments Over Time



Note: Figure 4 from LES 2008.

3.1.3 Benthic Invertebrates

Benthic invertebrate sampling has taken place sporadically over the years, dating back to 1975. Environmental Protection Services carried out biological monitoring in the area in 1975, 1985 and 1990. In compliance with past water licences, various consultants carried out benthic sampling annually between 1986 and 1990 at four locations. As part of a biological monitoring survey conducted in 1994 by Laberge Environmental Services (LES), benthic invertebrate sampling was also conducted. LES also conducted stream sediment and benthic invertebrate monitoring in 2007. All study methodologies used artificial substrate samplers with a colonization period of five to six weeks with triplicate samples collected at each site. As the same methodologies were employed for the various sample events, legitimate comparisons can be made. LES has conducted this comparison within the report entitled *"Keno Valley Stream Sediment and Benthic Invertebrate Monitoring Programs, 2007"* prepared in March 2008 (Appendix I). This comparison is provided below with results shown in the associated Table 3-2 and Figure 3-2.

> There is a data gap for several years for the upstream sites, KV-1 and KV-6. Only KV-1 (South McQuesten River u/s of Christal Creek) represents a true background site. Populations were very low here in the first years of sampling but were far greater in recent years. It is not known why populations were so depressed in 1975 and 1985. Populations at Flat Creek (KV-9) and South McQuesten River d/s of Flat Creek (KV-4) were depressed during the latter years of operation of the mine (operations ceased in 1989). Populations at both sites appear to have recovered somewhat in 1994 and 2005. Populations fluctuated at South McQuesten River u/s of Flat Creek (KV-3) over time with higher populations documented during the recent surveys. Populations increased significantly in Christal Creek near the Keno highway (KV-6) in recent studies as well.
>
> Diversity has fluctuated at the sites. The communities on the South McQuesten River generally are more diverse than those on Christal and Flat Creeks. The diversity of the communities at KV-3 and KV-4 has been relatively uniform in recent years.
>
> Diptera has usually been the dominant order at all of the sites over time. Plecoptera shared dominance at KV-3, South McQuesten River u/s Flat Creek, on several occasions. There has been a shift in recent studies at KV-1 where Ephemeroptera has also been dominant. The community at Flat Creek at the mouth, KV-9, saw the greatest shift in dominance over the years. Homoptera (true bugs) and Oligochaeta (aquatic earthworms) have shared dominance here during some of the surveys. Based on the numbers, diversity and the

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composition of the community, Flat Creek is the most impacted site of those examined in Table 3-2.

In summary with the limited data available, it appears that benthic populations were negatively affected during the years of mine operation, and have significantly recovered since. Without corresponding data from the background site (KV-1) during this time period it can not be stated definitively if this was a result of mining, or if natural regional conditions caused the depressed populations.

LES (2008) offers the following summary of benthic invertebrate sampling in 2007:

Benthic invertebrate populations were robust and healthy in the South McQuesten River and Lightning Creek drainages. There was good representation from the groups of insects that are known to be sensitive to chemical pollution, indicating healthy environments in these areas. There was a very high population at Christal Creek u/s of Keno Hwy, KV-6, however the community was the least diverse of those studied. Populations at the other two sites on Christal Creek and at Flat Creek, KV-9, were depressed. It appears that the high concentrations of metals in the stream sediments at Flat and Christal Creeks are negatively impacting the health of the benthos communities located on these drainages.

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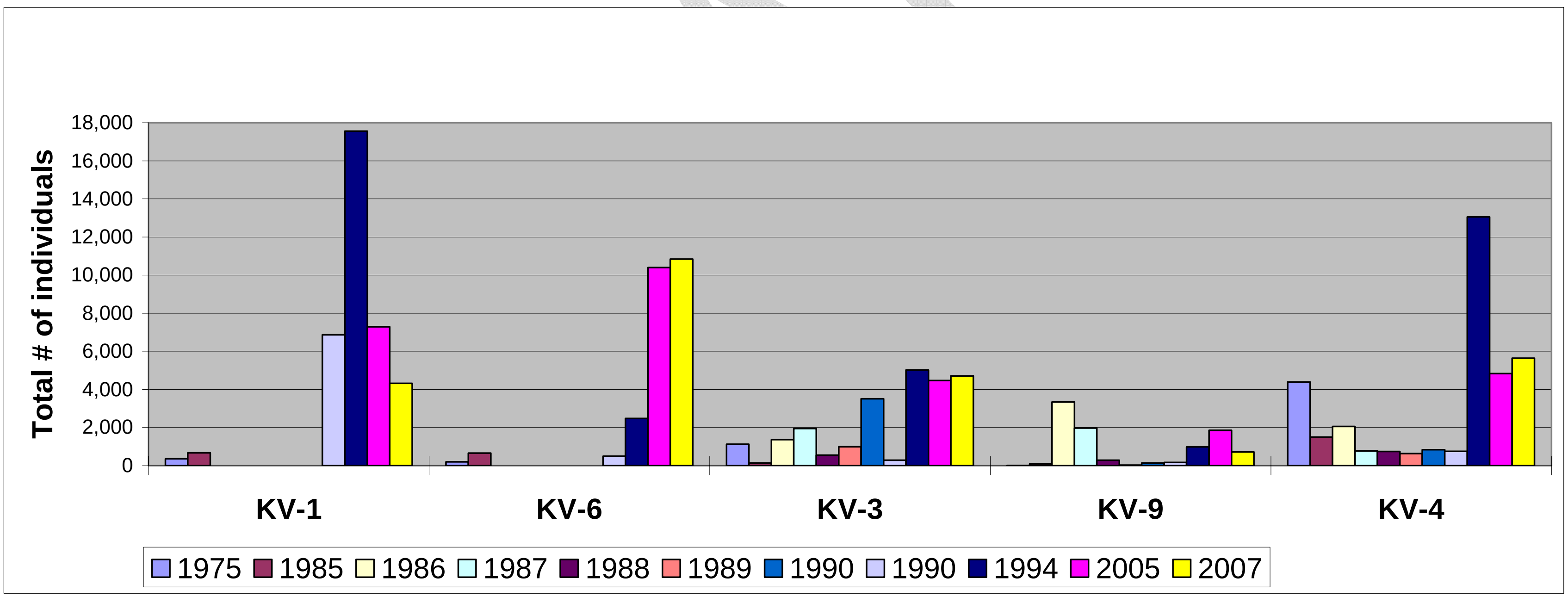
Table 3-2 Historical Benthic Data

STUDY	YEAR	S. McQuesten R. u/s Christal KV-1			Christal Cr at Keno Rd X-ing KV-6			S. McQuesten R u/s Flat Cr KV-3			Flat Cr u/s S. McQuesten R KV-9			S. McQuesten R d/s Flat Cr KV-4		
Study	Year	Total # of individuals	Total taxa	Dominance and %	Total # of individuals	Total taxa	Dominance and %	Total # of individuals	Total taxa	Dominance and %	Total # of individuals	Total taxa	Dominance and %	Total # of individuals	Total taxa	Dominance and %
EPS	1975	357	21	D 81.8	197	16	D 77.7	1129	24	D 87.9	8	5	D 62.5	4390	15	D 98.5
EPS	1985	683	26	D 76.3	655	31	D 74.2	140	20	D 32.9, P 25.7	95	14	D 42.1, P41.1	1492	25	D 92.8
N. BIOMES	1986							1370	46	D 67.9	3343	22	D 80.7	2056	34	D 64.1
N. BIOMES	1987							1955	43	D 74.4	1976	26	P 59.4, D 36.2	775	37	D 46.5
Leverton	1988							551	36	D 44.5	282	20	D 50.3 P 42.2	740	35	D 40.6, E 27.7
Burns	1989							996	39	D 43.9, P 28.0	33	10	D 51.5	636	20	P 75.6
Burns	1990							3516	55	D 89.4	143	12	P 72.7	841	45	D 71.2
EPS	1990	6876	62	D 86.6	496	41	D 40.7, P 34.7	285	41	D 28.4, P 26.3	166	24	H 46.4, P 31.3	755	42	D 58.8
LES	1994	17557	46	D 89.6	2478	46	D 48.3, O 36.3	5016	40	D 67.5	991	36	O 53.7, D 36.6	13053	48	D 89.9
LES	2005	7290	56	D 59.7, E 27.4	10391	28	D 89.0	4464	44	D 64.8	1856	44	P 50.4, D 39.6	4838	57	D 58.7
LES	2007	4316	36	E 50.5, D 27.7	10837	30	D 86.4	4713	41	D 56.5	718	31	D 69.9	5648	44	D 63.8

D = Diptera E = Ephemeroptera P = Plecoptera O = Oligochaeta H = Homoptera

Note: Table 9 from LES 2008.

Figure 3-2 Benthos Abundance Over Time



Note: Figure 6 from LES 2008.

3.2 AQUATIC RESOURCE ASSESSMENT REPORT

Minnow Environmental prepared an Aquatic Resource Assessment Report which characterizes conditions within the South McQuesten River and tributaries receiving mine discharge. Minnow provides a summary of the findings below. The full report is located in Appendix J.

The study area that was considered included Christal, Flat and Lightening Creek as well as the South McQuesten River. Christal and Flat Creeks, which capture most of the mine-influenced drainage for UKHM, drain northwest into the South McQuesten River. Lightening Creek, a tributary of the Mayo River via Duncan Creek, also receives mine drainage (adits on Keno and Sourdough Hills) and has been affected by placer mining.

A previous analysis of water quality identified cadmium and zinc as key contaminants of concern in waters downstream of UKHM. Concentrations of these substances are at levels that are potentially toxic to aquatic biota in portions of the tributaries receiving mine drainage (particularly Christal Creek). However, contaminant levels in the South McQuesten River are currently below levels of concern.

Sediment quality data from 2008 showed that arsenic levels are consistently elevated in the fine fraction of sediments (<0.15mm) at all areas downstream of UKHM, including the South McQuesten River. Concentrations of up to 34 times the Probably Effect Levels of the Canadian sediment quality guidelines have been observed. Fine sediment concentrations of cadmium, lead and zinc were also elevated at most mine-exposed stations relative to both reference area concentrations and sediment quality guidelines. However, the guidelines are based on concentrations measured in whole sediment samples (not just the fine fraction), so potential risks to benthic biota cannot be ascertained from the available data. No consistent patterns where observed in sediment concentrations over time, although the evaluation was confounded by differences in methods for sampling and analysis.

Benthic invertebrate communities in lower Christal and Flat Creeks were characterized by relatively low abundance and number of taxa compared to reference and other, mine-exposed areas. Correlation analysis suggested that reduced number of taxa may be related to elevated water concentrations of mine-related variables such as major ions (e.g., sulphate, hardness, conductivity), cadmium and zinc. The fish communities of the tributaries and South McQuesten River are dominated by Arctic grayling and slimy sculpin. The presence of both adults and juveniles in most watercourses indicates availability of suitable spawning and rearing habitats for both species. Portions of Christal Creek showed limited fish diversity and densities, particularly at KV7 where no fish were found in 2006. Although some differences in diversity were evident in comparison to a previous study (1994-95), no consistent patterns were evident in mine-exposed areas that would suggest either that conditions had either improved or degraded in 2006.

Whole body analysis of slimy sculpin showed levels of arsenic in excess of reference sediment concentrations and wildlife consumption benchmarks at most areas

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downstream of UKHM, particularly in Christal and Flat Creeks. These observations are consistent with elevations in sediment arsenic and lead levels observed in the same areas. Metal concentrations in Arctic grayling muscle were less than human or wildlife consumption benchmarks in almost all samples from all areas. Again, no consistent increases or decreases were evident over time based on comparison of data from 2006 to data from 1994-95.

3.3 WILDLIFE

The Elsa-Keno Hill area supports a variety of wildlife including ungulates, fur-bearers, small mammals, upland game birds and waterfowl.

This area is included in the range of the Mayo woodland caribou herd, although only anecdotal information on the herd is available. Little is known about the caribou population in the area, as no recent inventories have been carried out. Caribou are occasionally harvested in the area.

Moose are the most important sustenance animal in the Elsa, Keno City and associated historic mining area. Repeated surveying in the last 15 years indicates that the moose population in the area is very healthy and stable (Lortie, 2009). Aerial moose surveys in the Mayo area in 1988 and 1993 included the area between the Mayo-Elsa-Keno highway and the South McQuesten River. The estimated density in 1993 was 119 moose/1000 km^2 compared to a density of 104 moose/1000 km^2 in 1988. The estimated average density for the entire Yukon is 127 moose/1000 km^2 (Ward, 1993). The resident non-native harvest in the survey area (game management zones 2-58, 4-01, and 4-04) averages about 11 moose per year. The area is not currently hunted by non-residents. No accurate record for the First Nation harvest of moose is available.

The Elsa-Keno area no longer supports thin-horn sheep. A small population had existed on Keno Hill, but was hunted out during the 1920's (Carey, 1992). There has been some discussion regarding the re-introduction of sheep to Keno Hill, but some believe that the habitat has been too much altered by mining development and access roads to make sheep re-establishment viable.

The South McQuesten River area is known as good quality fur-bearer habitat, although fur harvest records for traplines in the area are not currently available. The most

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commonly harvested fur-bearers are marten, wolverine and lynx. A total of 5 registered traplines occur wholly or partly in the Galena - Keno Hill area.

Other small mammals common to the area include muskrat, beaver, ground squirrel, red squirrel, varying hare, fox, mink, weasel, vole and shrew. Less common are porcupine, river otter and chipmunk. Alpine areas have local populations of hoary marmot and pika. Large carnivores include black bear, grizzly bear and timber wolf.

Information on waterfowl populations is restricted to casual observations. No systematic surveys have been carried out. There are reports of Canada geese nesting on wetlands in the area, and large numbers of Canada, snow and white-fronted geese have been seen to use the area during spring and fall migrations. Loons, grebes and diving ducks have been seen on larger water bodies such as McQuesten Lake and dabbling ducks have been observed in the wetlands.

Game birds common to the area include spruce grouse and ptarmigan. Less common are ruffed grouse, blue grouse and sharp-tailed grouse.

The health of the local wildlife populations near the Galena - Keno Hills area has not been studied. Within the last two years local people have expressed concern over the health of local wildlife which are routinely consumed. Government programs have attempted to address this issue by collecting wildlife muscle, kidney, and liver tissue; particularly for caribou and moose, and analyzing these tissues for metal and organo chlorine levels. To date, a limited number of moose (2 samples) and caribou samples have been specifically collected from the South McQuesten River area. Although a detailed comparison is not possible, metal levels from the moose tissue were not atypical of other animal results in the territory. A detailed summary of all wildlife test results by local communities is being compiled (M. Palmer, M. Gamberg, 1996) Y.T.G. Renewable Resources routinely accepts wildlife tissue samples for metal analyses. It is expected that a database of metal levels in local wildlife species will develop as additional data is compiled.

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<u>Yukon Species at Risk</u>

Species at risk in Yukon and all of Canada as identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Yukon Wildlife Act, and whose ranges could conceivably overlap within the study area include:

- wood bison, peregrine falcon Anatum subspecies (identified by COSEWIC as Threatened);
- grizzly bear, wolverine, short-eared owl, peregrine falcon Tundra subspecies (identified by COSEWIC as Special Concern); and
- mule deer, elk, cougar (identified by the Yukon Wildlife Act – at risk in Yukon but not elsewhere).

A Community-based Fish and Wildlife Management Plan for the Nacho Nyak Dun Traditional Territory for 2002 – 2007 has been compiled and will be referred to for community concerns about moose, caribou, bears, wolves, and fish populations, along with habitat, harvest, and wildlife viewing.

3.4 VEGETATION

The Keno Hill Silver District is located within the Yukon Plateau-North ecoregion. The region is characterized by discontinuous widespread permafrost, with much of the area poorly drained and underlain by perennially frozen ground. 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 meters.

Predominant tree cover in the area consists of white spruce (*Picea glauca*), black spruce (*Picea mariana*) and willows (*Salix spp*.). Less commonly occurring trees are trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and white birch (*Betula papyrifera*). Alpine fir (*Abies lasiocarpa*) is common at higher elevations and alder (*Alnus crispa*) occurs along creek banks and in disturbed areas. Isolated pockets of lodgepole pine (*Pinus contorta*) can also be found.

Most south-facing slopes are covered with white spruce along with aspen, balsam poplar and willows, while north-facing slopes are underlain by permafrost and covered with

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stunted black spruce. Much of the drier south-facing slopes have been burned at some point.

The shrub layer on the north facing slopes and peatbog areas consists of dwarf birch (*Betula glandulosa*), willows (*Salix spp*.), shrubby cinquefoil (*Potentilla fruticosa*), crowberrry (*Empetrum nigrum*), cloudberry (*Rubus chamaemorous*) and dwarf raspberry (*Rubus acaulis*), as well as ericaceous shrubs such as Labrador tea (*Ledum decumbens*), bearberry (*Arctostaphylos rubra*), blueberry (*Vaccinium uliginosum*), cranberry (*Vaccinium vitis-idaea*) and bog cranberry (*Oxycoccus microcarpus*). The drier south-facing slopes have a shrub layer which includes rose (*Rosa acicularis*), twinflower (*Linnaea borealis*), and gooseberry (*Ribes oxyacanthoides*).

Alpine areas support a variety of a plant communities. The low ground vegetation mainly consists of mat forming plants such as moss campion (*Silene acaulis*) and ericaceous shrubs such as heather (*Cassiope spp*.). A variety of alpine flowering forb species are also found. Dry areas, particularly well-drained rocky alpine sites, have extensive lichen development.

Wetland species are mostly graminoids, including sedges such as Carex aquatilus and Carex lugens, cotton-grass sedges (*Eriophorum augustifolium, Eriophorum russeolum and Eriophorum vaginatum*), and grasses such as reed-bentgrass (*Calamagrostis canadensis*). Forb species such as Sudeten lousewort (*Pedicularis sudetica*), wintergreen (*Pyrola spp*.) and coltsfoot (*Petasites spp*.) are also scattered throughout wetland areas.

Aquatic plants commonly found in the area include water-milfoil (*Myriophyllum exalbescens*), pondweed (*Potamogeton richardsonii*), mare's-tail (*Hippuris vulgaris*) and bur-reed (*Sparganium spp*.).

Common horsetail (*Equisetum arvense*) is the predominant species of vegetation occurring on the unsubmerged portion of the Elsa tailings impoundment. Squirrel-tail grass (*Hordeum jubatum*) is found in large patches in the higher, drier areas. Hairgrass (*Deschampsia caespitosa*) and willows (*Salix spp*.) are scattered throughout. Sedge (*Carex aquatilus*) is the predominant plant in the wetter tailings and shallow water, along

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with occasional occurrences of willow, water horsetail (*Euisetum arvense*) and sloughgrass (*Beckmannia syzigachne*).

3.4.1 Metals Levels in Wetlands Testwork

Metal levels in local wetland plant species were investigated as part of the Galkeno 900 pilot wetlands testwork in 1995. Samples for metal analyses were collected from wetland plant tissue and sediments to determine the extent of metal uptake by plants. Test results indicate that sediments contain considerable quantities of metals, while plant tissue metal levels remain near reported values for non-enriched sites. Results from this study including a discussion of metals uptake by plants was reported in the *"Design of a Passive System for Treatment of Discharges fro the Galkeno 900 Adit at the United Keno Hill Mine Camp"* prepared by Microbial Technologies in 1995 and included as an appendix to the *Site Characterization Report*.

3.4.2 Lichen as an Indicator of Airborne Contamination Near the VTA

In 2007, EDI Environmental Dynamics Inc. was retained to complete phase 1 of a Terrestrial Effects Study in the vicinity of the Valley Tailings Area. The objective of this phase of the study was to determine if aerial dispersion of metals has occurred and, if so, the extent of such dispersion into the terrestrial ecosystem. While the terrestrial ecosystem includes plants, soils and animals, this study focused on lichens as they receive most of their nutrients from air and rainfall and can be used as indicators of airborne contamination. Results of the study indicate aerial contamination of metals in a limited spatial extent around the eastern 'dry' portion of the Valley Tailings Area. To confirm the extent of ongoing aerial contamination, deployment of moss bags has been recommended to assess airborne and precipitation based deposition of contaminants. Results from this study are reported in the *Elsa Tailings Terrestrial Effects Assessment – Phase 1* prepared by EDI in March 2008 and can be found in Appendix K.

A second study was conducting by EDI in 2008 based on recommendations in the 2007 project report (Refer to Appendix L) and a community based request to provide information on metals in plants traditionally harvested and consumed for medical purposes by NND. The objectives of the phase 2 study were to determine if, and to what extent the plants had been impacted by metals in and around the study area. The

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second study added two additional sites to the 2007 study design to include; one mine tailings (Mackeno) and one site used by the NND for traditional harvesting of medicinal plants. The results of the second study resulted in evidence of elevated heavy metal concentrations at sample sites in the immediate areas around the Elsa and Mackeno tailings sites. The findings of the second study reflected those found in the Phase 1 report. Further results of this study are reported in the *Elsa Tailings Terrestrial Effects Assessment-Phase 2* prepared by EDI in 2008 and can be found in Appendix L.

3.4.3 VTA Revegetation Assessment

In the summer of 2007, an inventory of the state of natural revegetation occurring on the Valley Tailings Area was carried out and the vegetation types delineated on an aerial photograph of the area. Results from this study are provided in the *Keno Hill Property Valley Tailings Revegetation Assessment* prepared by S.P. Withers in January 2008.

3.4.4 Revegetation Trials – Galena Hill Waste Rock Dumps

To establish effective measures for revegetating waste rock dumps in the Keno Hill Silver District, three revegetation test sites were established on Galena Hill in 2007. A preliminary assessment of the three sites (Simes and Hector waste rocks dumps and one control site) was carried out which included an inventory of the naturally occurring vegetation. Soil and vegetation samples were collected from the surfaces of the waste rock dumps prior to recontouring and seed and fertilizer application. Results from this work in 2007 is documented in the *Keno Hill Property Revegetation Trials – Galena Hill Waste Rock Dumps* prepared by S.P. Withers in January 2008.

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4.0 HUMAN ENVIRONMENT

The following sections provide an overview of the human environment within the Keno Hill Silver District including heritage resources, current land uses and socio-economic conditions.

4.1 HERITAGE RESOURCES

The Keno Hill Silver District includes numerous old historic mine workings and the old company town of Elsa. Elsa Reclamation and Development Company's closure plan for the property will recognize the heritage potential of a number of these older historic workings.

A Cooperation Agreement has been negotiated with the NNDFN which specifically refers to Heritage Resources.

Initial discussions have taken place with the local Silver Trail Tourism Association and YG Heritage Branch regarding the status of older mine workings and tourism potential. Older historic sites which are of interest have been identified. The company is prepared to work with the Silver Trail Tourism Association, the local Chamber of Commence and YG Heritage Branch to select sites for restoration and possible tourism potential. The company plans to support these initiatives, while maintaining adequate public safety and closure objectives for the property.

4.2 LAND USES

Land use within the Keno Hill Silver District has evolved from a long history of occupation and development. Significant development activity and local population increases have historically occurred in the area. Historically, regional land use has been influenced by the following activities:

- the area has been utilized by First Nations for centuries;

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- a variety of anthropogenic activities have occurred throughout the region including both hardrock and placer mining, forestry, hunting and gathering, transportation, recreation and residential;
- a total of 5 trapline concessions occur entirely or partially within the regional area (currently there is some active trapping occurring on Galena Hill);
- numerous historic mining related building and structures exist on the property and are of interest to local community groups and government; and,
- the area is known and used for recreational pursuits and has potential for significant tourism development.

Today the Hamlet of Keno City is much smaller than it was historically and no major population influx is expected in this community. The maintenance of a dedicated community to support mining activity is now considered unnecessary and inappropriate for a mining company. Any increase in development activity could affect the community of Mayo which is now considered the major population centre for the area.

Increased human activity in the area may have negatively impacted local trapping concessions in the area. This is not considered a long term impact as local community populations have been reduced. Continued efforts to improve wildlife habitat will also improve trapping efforts.

It is expected that the area will continue to see both hardrock and placer exploration activities. Alexco's renewed exploration program with supporting camp in the Keno Hill Silver District is expected to continue providing local employment opportunities. Alexco is currently undergoing an environmental assessment for the Bellkeno mine, with a proposed mill site in the vicinity of Christal Lake with hopes of moving forward with mine production in 2010.

A placer mine operated by Bardusan Placers Ltd. (headquartered in Mayo Yukon) is located along Lightning Creek upstream of Thunder Gulch. The Water Licence that supports water use for this activity (PM04-408) expires May 1, 2013. A maximum of 5,400 m^3/day may be obtained from Seepage Pond, Lightning Creek and Thunder Gulch. Water / wastewater is discharged back into Lightning Creek and Thunder Gulch.

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A Joint Use Agreement with Bardusan Placers Ltd. will be completed which includes road use and general agreements regarding exploration in the area.

Underground workings in the district once supported numerous small scale logging operations mainly to provide timber for mine development. Local estimates for timber use in underground developments are approximately 5 million board feet. The potential for further logging exists as the area has regenerated over the years.

It is expected that the area will continue to see both tourism and recreational uses. The local tourism association is actively pursuing options for development in the area. The remnants of past mining activities could enhance some of these initiatives in this regard.

The Keno Hill Silver District is located within the Nä-cho N'yak Dun First Nation (NNDFN) traditional territory. The NNDFN R-Block 20B is situated northwest of the project area. Land tenure in the study area is composed of various mining claims and leases, and commercial, recreational, and residential surface properties (leases, titled fee simple and determinable, crown grants, etc.). There are several other quartz and placer claim holders in the area, many of which lie within or adjacent to the area being explored. Regional land status and current land use in the area is described in Table 4-1.

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Table 4-1 List of Current Land Use Activities near Keno Hill Silver District

General Area		
Activity Type	**Holder/Operator**	**Comments**
Outfitting		
ROC #4	Alan Young	Midnight Sun Outfitting Ltd. - Whitehorse
ROC #7	Fred Lackie	Rogue River Outfitters Ltd. - Duncan, BC
Tourism		
Charter Air Service	Mayo Flying Service	Sport Fishing Excursions
Charter Air Service	Black Sheep Aviation	Sport Fishing Excursions
Charter Air Service	Action Aviation	Sport Fishing Excursions
Camping		
Recreational	YTG	Hanson Lake (Lease #2973, 0.81ha.)
Campground	YTG	Land Lease #1241 Campground at Hanson Lake (Lot 1064, Group 1054, Hanson Lake 49.30ha.)
Keno Valley West (NTS Quad. 105 M/13)		
Activity Type	**Holder/Operator**	**Comments**
Trapping Concessions		
RTC #43	Alvin Peterson, Peter Hart	
RTC #44	Keith Hepner, Rafe Hepner, Sonia Stange	Includes 1.0 ha. Trappers Residence on Cache Creek, 1km south of McQuesten Lake
RTC #82	No Listing, not settled	Concession Transfer Pending Estate Settlement (Current Holder Deceased)
RTC #85	Denis Buyck	Resident of Mayo
RTC# 81	Bruce MacGregor, Mary Beattie	
Land Tenure		
Lease #1679	ERDC	Elsa Campsite (56.16ha.)
Lease #1734	ERDC	In Vicinity of Elsa Camp (26.82 ha.)
Other	ERDC	Two other surface Leases East of Elsa at Hector Calumet Adit and No Cash Adit
Keno Valley East (NTS Quad. 105 M/14)		
Activity Type	**Holder/Operator**	**Comments**
Tourism		
Historic Interpretation	Mike Mancini	Keno City Mining Museum
Hiking and Scenic Viewing	Silver Trail Tourism Association	Various hiking trails and scenic viewing area in around Keno City and along the Silver Trail
Outdoor Adventure Guiding	Dick Brost	Subarctic Wilderness Tours - Keno City
Outdoor Adventure Guiding	Keno City Packers	Keno City Packers
Camping		
Keno City Community Campground	Keno City Community Club	Vicinity of Keno City at Lightning Creek
Trapping Concessions		
RTC #83	Christine Hager	Registered Category 1 (NND authorized)
RTC #86	Michael Arden	
Land Tenure		
Lease #1660	ERDC	Galena Hill (41.81ha.)
Lease #1672	ERDC	Lot 24, Group 1054, (18.55ha.)
Lease #1661	ERDC	Lot 223, Group 1054, (18.29ha.)
Other	ERDC	Two other surface Leases at Keno 700 Adit and Keno Summit
Block Land Transfer	YTG	Keno City PC 1987-1703 (Various fee simple properties, YTG - Fire Hall reserve, YTG- communications reserve Northwest Tel/Canadian Broadcasting Company)

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4.3 SOCIO-ECONOMIC CONDITIONS

The Keno Hill Silver District has been the focus of intensive and wide spread mining and related activities for the past ninety or so years. Consequently, the intervening years can be characterized as a time when mining and related activities have replaced virtually all other activities in the area. Similarly, and in spite of the fact that there will be an effort to improve the general quality of the area, it is extremely unlikely that any interest will be developed in the establishment of outfitter or hunting and fishing camps in the area. Currently, the land use is primarily for trapping and hunting by members of the local community.

With the shutdown of the mining operations in the 1980's, there was an evacuation of the population of the Hamlet of Elsa, its housing stock, and much of the domestic infrastructure that was in place when the community flourished. Road access to Keno City has not changed, nor has the power and other services to Keno City. Road access to the workings on Galena Hill, Sourdough Hill and Keno Hill is currently maintained as required and such access for other legitimate mining interests should not be impaired. Access for potential users of other resources in the area such as forestry, recreation, and the like, is available since all access through the property to Keno City and beyond, or to the Hanson Lakes and beyond, is on government roads.

Future activities in the Keno Hill Silver District are expected bring about an economic upswing in the local area. Increasing expenditures for exploration and development, and reclamation work are expected to be significant in the near future (next 1-5 years). In addition, continued care and maintenance expenditures will benefit the local economy. The majority of these full time care and maintenance employees reside in Keno City or Mayo. Seasonally the number of employees increases during the exploration season and will increase significantly should Alexco move forward with production at Bellkeno and/or some of the other site that have production potential.

Public awareness and transparency of proposed exploration and preliminary development in the district is integral to Alexco's operations. The office in Elsa is open to local visitors and general inquiries.

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On September 25, 2007 Alexco and the NNDFN announced that they had entered into a Negotiation Agreement relating to the activities of Alexco's subsidiary, Elsa Reclamation and Development Corp. ("ERDC") on and around the former United Keno Hill Mine property. The Negotiation Agreement provides for the negotiation and settlement of two further agreements between ERDC and the NNDFN. The first of these is a Cooperation Agreement concerning the care and maintenance and exploration activities currently undertaken by ERDC. The second is a “Comprehensive Cooperation and Benefits Agreement” to be concluded if ERDC determines as a result of its exploration activities that any portion of this large property should be developed into a mine operation. Under the Negotiation Agreement, ERDC has provided funding to the NNDFN to cover their costs of negotiation expenses.

The Negotiation Agreement provides for collaboration by ERDC and the NNDFN as well as support in principle by the NNDFN in relation to current activities at the property. It contemplates that ERDC and the NNDFN will work collaboratively in good faith with one another in order to facilitate and ensure the meaningful participation of the NNDFN in regulatory processes concerning the Keno Hill Project.

4.3.1 Mayo

The following socio-economic information for Mayo has been summarized from the “Yukon Community Profiles” website, which was produced by Human Resources Development Canada in partnership with the Yukon Chamber of Commerce:

Website address: http://www.yukoncommunities.yk.ca.

The community of Mayo is located at the confluence of the Mayo and Stewart Rivers, about 400 km northwest of Whitehorse, and serves as a distribution and service centre for the surrounding area. In addition to being a tourist destination, the community is a base for wilderness tourism, canoeing, hiking, big-game hunting and fly-in fishing.

In 2003, the average population of Mayo was 409, which is down from an average of 504 in 1997. The NNDFN comprise 60 – 70% of the community population. In Mayo more people are over the age of 65 (11%), compared to the Yukon average of 7%.

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There are fewer people proportionally in the 25 to 44 age group, which reflects some movement out of the area by people looking for work elsewhere.

The Nä-cho N'yak Dun Development Corporation is establishing a number of training, work, and apprenticeship programs in the community. The First Nation works toward participation in land developments in their traditional territory and employs approximately 60 people.

The economy of Mayo is linked to the provision of services to the people of Mayo and the surrounding areas. One third of the jobs in the community are related to Government services, including First Nation and territorial administration. Placer mining and mineral exploration also provide an economic base for the community. Construction is a variable sector, but provided a significant share of employment in 2001. Tourism in the Mayo area is a growing industry. Accommodations, food services, recreation services (i.e. guiding and outfitting) and retail cater to tourists provide work for local residents. Tourist attractions in the area have to do with the history of mining around Mayo, Keno and Elsa including a mining museum and interpretive centre. Camping and hiking, hunting and fishing, and other outdoor pursuits comprise the activities undertaken by tourists in the area.

Some of the community services in Mayo include:

- J.V. Clark elementary level to post secondary level school with Yukon College Mayo Campus;
- Mayo Nursing Station;
- RCMP detachment;
- Community social services (YG Health and Social Services, Yukon Housing Corporation, Yukon Family Services (Dawson City), NNDFN social services);
- Village of Mayo community and municipal services (volunteer firefighting services, recreation and leisure services, etc.);
- Ambulance services (provided by community volunteers in partnership with YG);
- Yukon Energy Corporation supplies electric power from the Mayo hydroelectric dam;
- Mayo airport with weather station;

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- YG Department of Environment office, Energy, Mines and Resources office, and a Mining Recorder's office;
- Post office;
- Internet services;
- Banking services;
- Tourist services (two motels, three campgrounds, two restaurants; two service stations, a store, businesses catering to wilderness tours and fishing);
- Helicopter, float-plane and taxi services; and
- The Silver Trail Area, including Keno, offers a lodge, cabins and eating facilities for tourists.

4.3.2 Keno City

Keno City is located within the Keno Hill Silver District and has approximately 12 residents. Keno City has a small but steady tourism economy based on recreational use of the area. In addition to a comprehensive mining museum, which provides historical perspective on the Keno Hill Silver District, a unique population of butterflies also exists in the region and attracts interested individuals. The "signpost" viewpoint on Keno Hill Summit also attracts numerous tourists throughout the summer months. In recognition of this, significant efforts have been made to ensure public safety around historic sites.

4.4 CONSULTATION

As part of its comprehensive campaign of exploration, care and maintenance, and closure and reclamation in the Keno Hill Silver District, Alexco will continue its multi-faceted consultation efforts. Having embarked upon consultation efforts towards development of the district-wide closure plan, the public and First Nation of Nacho N'yak Dun are becoming generally more aware of Alexco, and developing a greater familiarity with the Companies' approach to the Keno Hill Silver District.

Alexco will support its commitment to the local communities of Mayo and Keno City and to the First Nation of Nacho Nyak Dun by routinely providing opportunities for discussion about activities in the district.

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