KENO HILL SILVER DISTRICT

CLOSURE ISSUES REPORT

PREPARED BY:

MARCH 2009

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

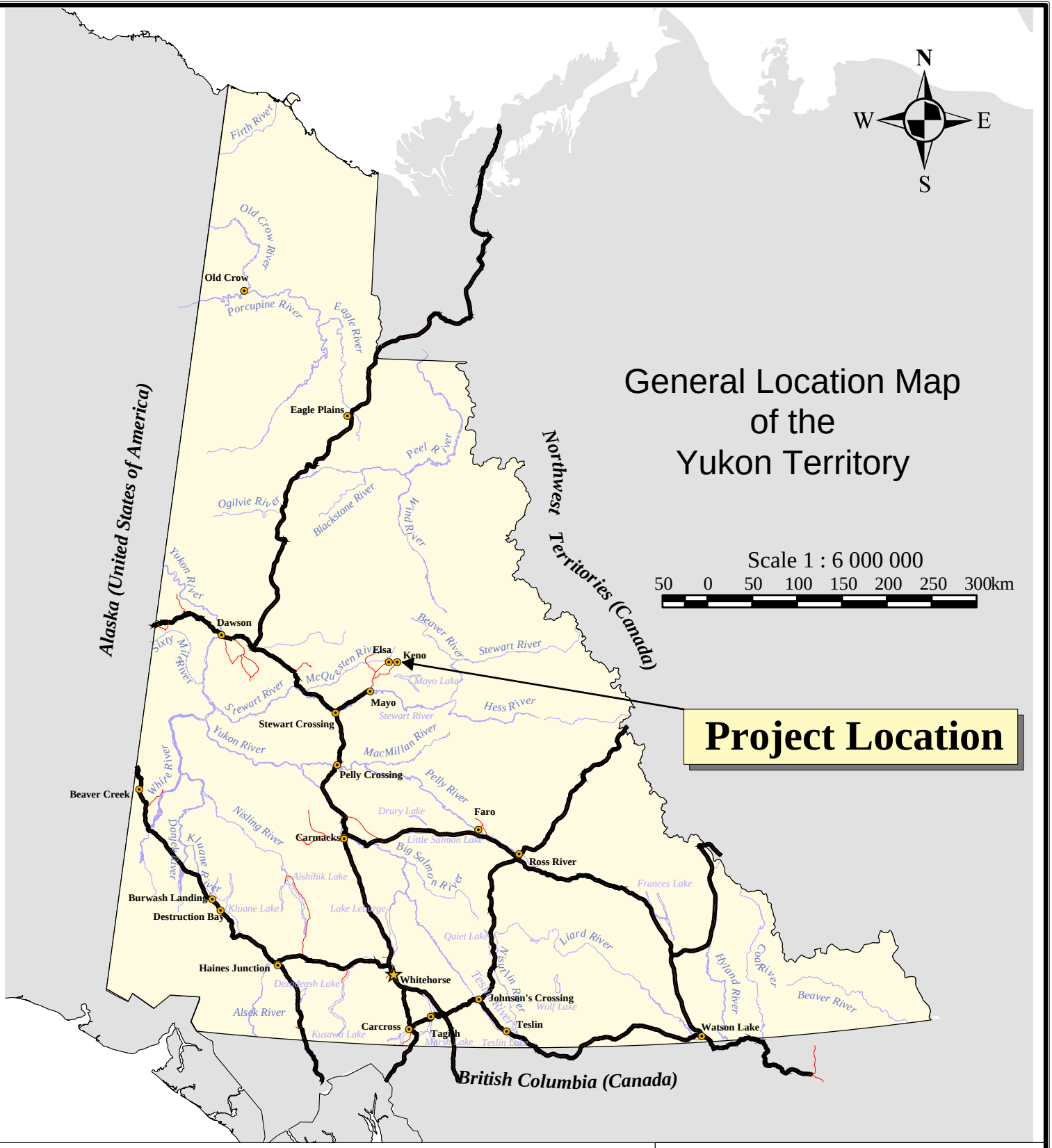
1.0 INTRODUCTION

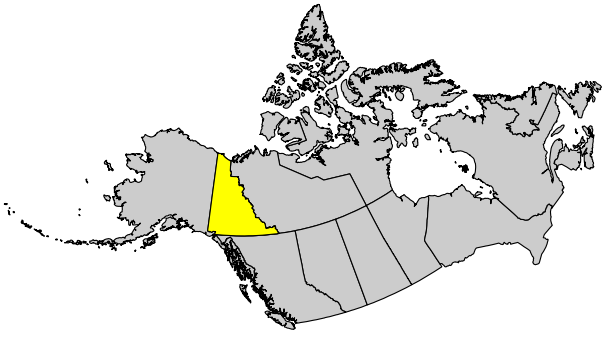
The Keno Hill Silver District is located centrally in the Yukon Territory, Canada (Figure 1). The property is found north of Mayo on the Silver Trail Highway in and around Galena Hill, Keno Hill and Sourdough Hill. The property layout and sites investigated are displayed in Figure 2.

Alexco Resource Corp. (Alexco) was selected in 2005 as the preferred purchaser of the assets of United Keno Hill Mines Limited and UKH Minerals. In February 2006, following negotiation of a Subsidiary Agreement between the Government of Canada, the Government of Yukon and the Company, the Supreme Court of Yukon approved the purchase of the assets of UKHM by Alexco through its wholly owned subsidiary, Elsa Reclamation & Development Company Ltd. (ERDC). In December, 2007, Alexco registered the vesting order at the Mayo Mining Recorder Office, the Yukon Land Title Office and the Yukon Lands Branch. This action brought to "Final Close" the acquisition by ERDC of the assets of UKHM, and followed the granting of Water Use Licence QZ06-074 to ERDC by the Yukon Water Board on November 14, 2007.

The property is currently under a care and maintenance program administered by Yukon Government. As part of closure planning, issues present at several sites have been identified as relating to closure activities. This document forms a descriptive summary of closure issues present at 44 key sites in the Keno Hill Silver District. Site descriptions, potential information gaps and a summary table of current closure issues are included for each site where closure issues are considered to exist.

The purpose of this document is to aid in the development of closure and reclamation plans.

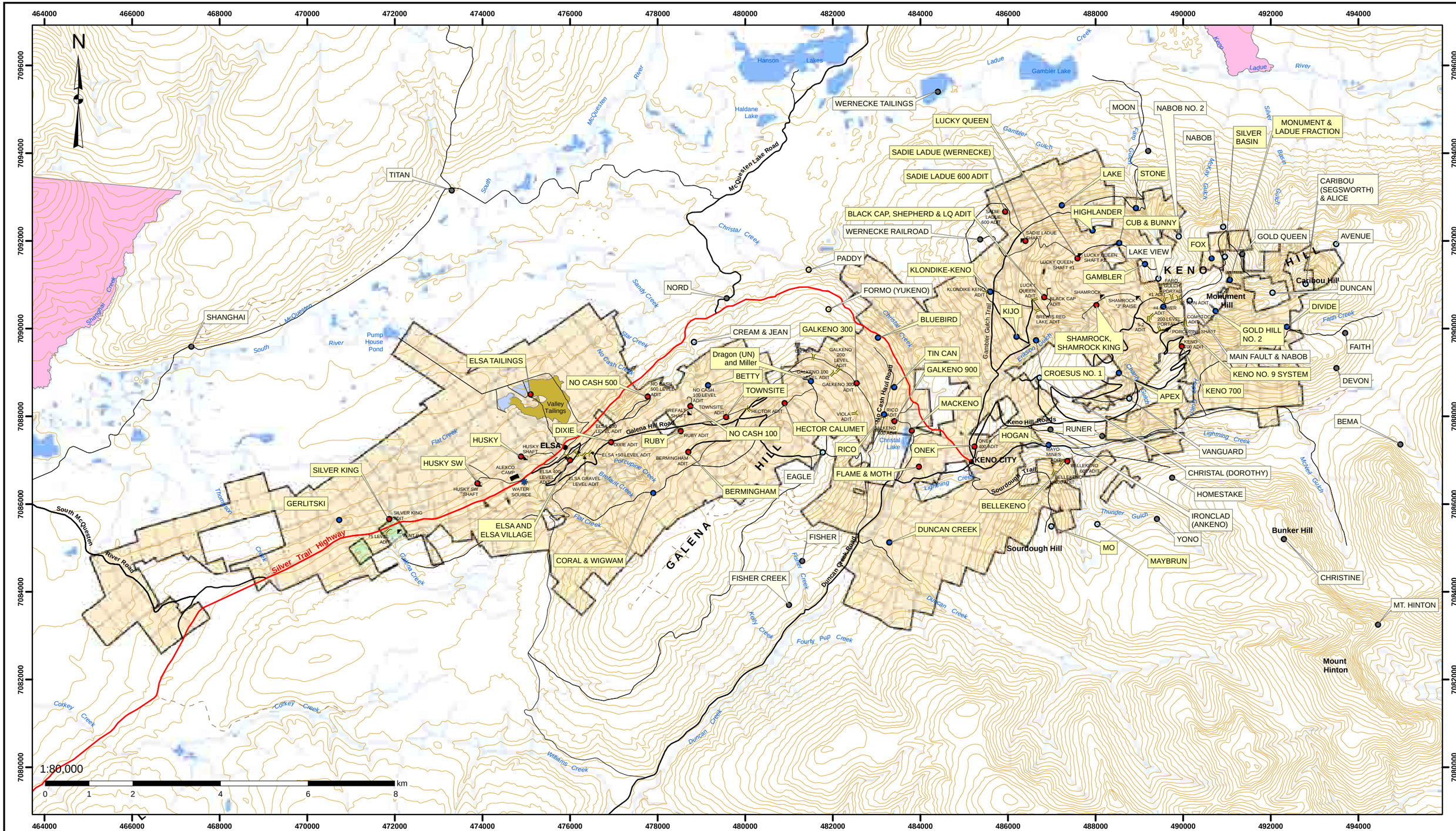




ELSA RECLAMATION & DEVELOPMENT COMPANY LTD.

Drawn By: HD	**FIGURE 1**
Checked By: DC	Date: March 2007

Our file: D:\Project\AllProjects\ALEX-05-01\gis\mxd\UKHM\ClosurePlan2007\ExistStateMineReclPlanScopDoc\Fig1_GenLoc.mxd



Legend

- 2005 Inspection (On Alexco Claim)
- 2006 Inspection (On Alexco Claim)
- 2005 Inspection (Off Alexco claim)
- 2006 Inspection (Off Alexco claim)
- Site not Inspected (off Alexco Claim)

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)

Quartz Claims

- UKHM Claim Package

Note:
Map does not depict all mining claims in the district.

- First Nation Settlement Land
- Crown Grant

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. Cadastral data compiled by Natural Resources Canada. Reproduced under license from © Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.
Quartz Claim boundaries are current as of October 14, 2005. Data source: http://geomaticsyukon.ca.
Crown Grants confirmed by Land Titles November 2005.
Projection: UTM Zone 8 NAD83
NTS Sheet 105M/13 and 105M/14

ALEXCO

DRAFT BASELINE ENVIRONMENTAL REPORT, UNITED KENO HILL MINES PROPERTY

UKHM Property Boundaries and Site Locations

Drawn By: HD	Date: January 2007	**FIGURE 2**
Checked by: RM	File: D:\Projects\AllProjects\ALEX-05-01\gis\mxd\UKHMBEAJan07Fig1_SiteInsp.mxd	

2.0 ASSESSMENT METHODS

44 key sites were reviewed for issues that could be encountered during closure activities. Table 1 lists the sites reviewed for this report.

Table 1 Key Sites Reviewed

• Silver King	• Lucky Queen
• Husky & Husky SW	• Lake
• Elsa Mine	• Shamrock
• Dixie	• Highlander
• Coral & Wigwam	• Cub & Bunny
• Bermingham	• Stone
• No Cash 500	• Keno 700
• Betty	• Keno No. 9 System
• Hector Calumet	• Gold Hill No.2
• Dragon (UN) & Miller	• Fox
• Galkeno (Galkeno 300 and Galkeno 900)	• Divide
• Bluebird	• Silver Basin
• Tin Can	• Monument & Ladue 600
• Rico	• Apex
• Flame and Moth	• Eagle
• Onek	• Gerlitski
• Klondike Keno	• Christal (Dorothy)
• Sadie Ladue (Wernecke)	• Townsite
• Bellekeno	• Sadie Ladue 600
• Kijo	• Elsa Village
• Croesus No. 1	• Elsa Tailings
• Black Cap	• Mackeno

The sites described in this report are sorted according to the identification numbers assigned during a Public Works and Government Services Canada (PWGSC) Baseline Environmental Assessment completed in 2000. The sites described have been identified as key locations that present issues associated with closure activities. Site maps created by the PWGSC and appended by SRK Consulting in a 2007 Baseline Environmental Assessment are included as figures in each of the sections describing the sites. Maps and plans created from air photo interpretation by Access Consulting Group describing above ground infrastructure and underground workings are also included.

Key reports (see Section 2.1) and maps were reviewed, and issues related to closure activities were identified. A Closure Issues Matrix was then created for each site using the issues identified in the review. Each matrix describes the location of each issue as well as referencing the locations indicated on each associated site map. The issues noted in each matrix are identified as belonging to any of the following groups:

- Human and Wildlife Health and Safety
- Chemical Control
- Water Management
- Physical Stability
- Community Concerns
- Other

Human and Wildlife Health and Safety Issues are those items identified as presenting threats currently or in the future to humans and animals entering the site. These issues could include risks such as open adits and buildings, harmful objects and materials such as scrap wire and improperly stored chemicals, and the lack of adequate signage to warn of dangers.

Chemical Control issues were noted when a site component displayed uncontrolled chemical activities that could introduce a deleterious substance into the surrounding environment. Instances where ore, or waste rock material is exposed to weathering processes were noted. Also instances where material previously held in containment

and found to be escaping were noted. These containment control breaches include unwanted transport of materials by wind and water and through anthropogenic means.

Water Management issues were identified where uncontrolled water activity was presenting and structures intended to control surface water, or mine workings drainage require maintenance, upgrade or installation. These include culverts, ditches, discharge pipes, rainwater erosion and evidence of pooling or seepage.

Physical Stability was noted as an issue where site infrastructure has degraded or collapsed, uncontrolled erosion is occurring or where freeze/thaw activities have affected site conditions forming subsidence or failure.

Community Concerns can be described as those issues affecting the socio-economic environment in the areas influenced by the site. Items considered to be closure issues related to Community Concern issues are those negatively influencing aesthetic, economic, traditional and environmental values.

Those items identified as closure issues but not belonging to the categories of Human and Wildlife Safety, Chemical Control, Water Management, Physical Stability or Community Concerns are indicated under the category of Other. These issues are considered to be notable, but unique to that site.

Examples of issues falling under the above the above categories are listed in Table 2.

Table 2 Keno Hill Silver District Closure Issue Categories and Associated Issues

Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Access barriers not standing	Acid Rock Drainage	Adit discharge	Collapsed adit	Access	Access
Closed building is accessible to public	Building contaminants	Discharge pipe	Collapsed building	Aesthetics	Highway Access
Collapsed adit	Contaminated material missing	Ditch maintenance	Collapsed raise	Heritage	Old cabin location
Collapsed building	Fugitive dust	Diversion maintenance	Collapsed shaft	Hunting / Fishing	Slow revegetation
Collapsed raise	Fugitive metals	Erosion Activity	Desiccation cracks forming	Noise	
Collapsed shaft	Fugitive sludge	Flood control	Deterioration of supporting structures (partial)	Tourism / Recreation	
Deterioration of supporting structures (partial)	Hydrocarbon staining	Pooling water	Deterioration of supporting structures (complete)	Traditional uses	
Deterioration of supporting structures (complete)	Iron staining	Rainwater erosion	Dump failure	Trapping	
Exposed piping	Metal leachate	Receiving environment discharge	Erosion activity		
Exposed support structures	Minor waste rock spillage	Seepage	Geotechnical concern		
Hidden hazard	Sludge management	Settling pond	Mass movement (from freeze / thaw action)		
Lack of signage	Water treatment system	Spillway	Mass movement (from structural degradation)		
Major debris		Uncontrolled discharge	Mass movement (from slumping)		
Minor debris		Uncontrolled surface water invasion	Permafrost concern		
Open Adit (no barriers)			Piping		
Open hole			Pond stability		
Open shaft (no barriers)			Sink hole		
Sink hole			Subsidence		
Unstable building foundations			Tension cracks		
Unstable slope or high wall			Toppling failure		
Unstable timber supports			Unstable adit		
Unused ore cars			Unstable building foundations		
			Unstable shaft		
			Unstable slope or high wall		
			Unstable timber supports		

2.1 REVIEW OF DOCUMENTS

A review of key documents that describe the Keno Hill Silver District and characterize individual sites and the environmental conditions present at each site was conducted. The following documents were reviewed:

AMC (1996). Project No. UKH/96/01 - Site Characterization, by Access Mining Consultants. This report provides a baseline description of mines in the Keno Hill Silver District, summarizes the regional setting and local environmental setting, and documents the historic mine development on the property. In addition, this report contains summary data on waste rock and mine drainage geochemistry.

AMC (1996). Project No. UKH/96/02 - Closure Plan for Current Conditions. Provides a closure philosophy and environmental setting. Closure priorities and closure planning for key sites is described along with a summary of costing and assessment of impacts.

PWGSC (2000). Keno Valley/Dublin Gulch Environmental Assessment, by Environmental Services Public Works and Government of Canada. This report, comprised of 5 volumes, describes the Keno Hill/Dublin Gulch environmental setting, land uses other than mining present in the area, hydrology information and a summary of the assessment methods. The 4 accompanying volumes describe each of sites 1 through 96 with figures, photos and analytical results. The numbers for sites created in this report are used in future reports and memorandums.

ACG (2006). Keno Hill Property Physical Hazard Reduction Program, by Access Consulting Group. This report contains a background review, describes the site investigation performed and contains a physical hazard registry and rating system. The physical hazard registry rates each site by Severity of Consequence, Likelihood of Exposure, and Likelihood of Probability. Hazards reduced to date for the Keno Hill Silver District are also described as well as the 2007 remediation work.

ACG (2007a). Project No. ALEX-06-ESP-06 - Soil Contamination Along Haul Routes: Memorandum, by Access Consulting Group. The memorandum describes the results of soil sampling along transects considered to representative of haul route conditions, and the results of metals in soil samples collected.

ACG (2007b). Project No. ALEX-06-ESP-06 – Hydrocarbon Contaminated Soil: Memorandum, by Access Consulting Group. This memorandum is a summary of the extent of hydrocarbon contamination documentation to date, the inspection results for 23 sites, some with numerous locations, where specific attention was paid to any evidence of hydrocarbon contamination in the soil, or any evidence that hydrocarbons were stored in the vicinity. Assigned site number, site name, location, group responsible for identifying hazard, description of contamination and if samples were taken are described in table format.

ACG (2007c). Project No. ALEX-06-ESP-06 – Building Contamination: Memorandum, by Access Consulting Group. The memorandum describes 18 sites, some with numerous contaminated buildings, where asbestos or lead containing materials were found while conducting the inspections. Sites with evidence of lead or asbestos bearing materials were compiled and correlated with the sites documented the previous year and with areas reported in the March 2000 Environmental Baseline Assessment performed by Public Works. Results are described in table form with site number, site name, location, group responsible for identifying hazard, and a description of the contamination suspect.

GWS (2007). Baseline Environmental Assessment of Valley Tailings Water Impacts: Memorandum, by Green World Sciences. This memorandum describes the impacts on shallow flows at the interface between the Valley Tailings and the subsurface soils. A determination was made as to the existence of loading to Flat Creek and the South McQuesten River, if lead and zinc present in the tailings are mobile, and if the mass load of contaminants from the un-reclaimed Valley Tailings are a source of pollutant loading to the McQuesten River Valley.

SRK (2007). Project Reference No. SRK 1CA009.000 – Draft Baseline Environmental Report, UKHM Property, by SRK Consulting. This report forms a baseline environmental assessment of the key sites on the property, describes conditions at individual sites mentioned in previous reports, and notes observations pertaining to: physical stability, valley tailings facility structures, water quality, water treatment systems, public access, historic valley tailings spill, Elsa tailings groundwater, soil contamination along haul roads, hydrocarbon-contaminated soils, building contamination and third party interests. Recommendations were also included in the Draft Baseline Environmental Report.

3.0 CONDITIONS AT INDIVIDUAL SITES

3.1 SILVER KING

3.1.1 Description

The first discovery in the Elsa silver camp was in Galena Creek in 1906; the area of the historic Silver King mine. Hand mining began in the area in 1912.

The area comprises both the open pit, which was mined from 1983 to 1984, and the underground workings.

Underground mining began in 1912 with the development of the Aitken shaft and the 50 and 75 adits. The shaft was located in the Galena Creek Canyon and extended to the 300 level. Mining from this shaft continued until 1918.

In 1928 underground workings were established on the No. 1 & 2 Veins, to the northeast of Galena Creek. Mining continued until 1939 from shafts, shallow adits and lateral development on the 100, 200 and 300 levels.

In the 1980's, access to underground was from the 100 level (1140 ft) adit. The Silver King open pit was also mined during this period, primarily for crown pillar recovery from the No. 3 shaft located in the open pit. Some timbering is still evident at surface but the surrounding rock has caved into the shaft.

The third stage of development was begun in 1994; primarily exploration and associated development of a decline from the 300 to 400 levels. Two raises were driven to surface. One collapsed, and the other is now used as an escape-way (1-5-735 Raise). The 75 level adit, located in Galena Creek Canyon, is connected to the 100 level adit and is now used for ventilation. The portal was re-timbered recently and mesh screening placed across the entrance.

Rehabilitation of the underground workings prior to the recent exploration program included establishment of a simple water treatment system to remove dissolved metals from the water pumped from underground at the 100 level adit. Lime slurry is added to the water as it is pumped from underground. Two settling ponds, constructed at the portal, allow the sludge to settle prior to discharge of the treated water. The treated discharge ultimately reports to Galena Creek and then to Flat Creek.

Old site plans and reports indicate that there may be up to seven additional raises and nine shafts to surface from the No.1 and 2 Veins, associated with the early years of mining (1928 to 1939). Most of these are reported to have caved and are no longer readily evident from surface, however this will be confirmed.

3.1.2 Closure Issues

Silver King is a free draining adit with moderate zinc content in adit discharge which, it is anticipated, will continue at least in the short term. Rock dumps do not appear to pose a significant potential for added loadings. The topography of the pit is similar to the nearby Galena Creek Canyon, and thus poses few hazards not also posed by the Galena Creek Canyon. Rock dumps are physically stable. Several old shafts need further investigation. At closure, adit discharge will be directed to a swamp before reaching Galena Greek. The discharge will continue to be monitored and a contingency can be implemented if monitoring indicates contaminant concerns.

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 3.

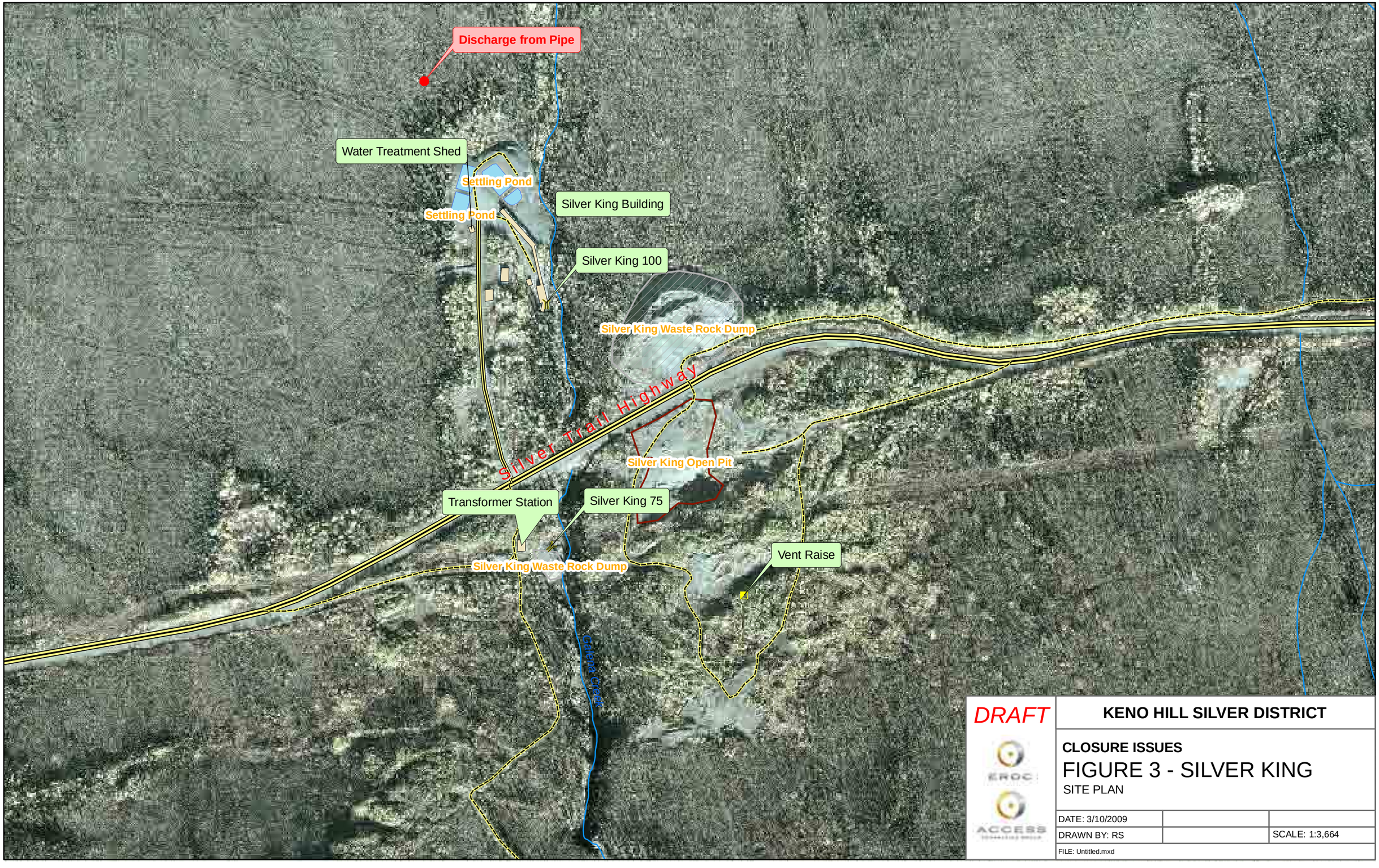
An ortho-map of the site is provided in Figure 3 while a map created by the PWGSC and appended in the SRK report follows as Figure 4. Diagrams showing the site plan, composite plan, underground workings and cross sections are presented as Figures 5 to 8 respectively.

Table 3 Silver King Closure Issues Matrix

Common Site Name: **Silver King**
PWGSC site #: 1

Site coordinates:	easting	northing	
	471871.69	7085658.17	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	SRK BEA Report Map Reference Number	Closure Issue Categories					
		Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Waste Rock Dump	*1*		✔	✔	✔		
Silver King open pit	*4*	✔			✔		
Silver King pit (north apex)	*5*	✔			✔		
Silver King pit	*8*	✔			✔		
75 Adit	*3*				✔	✔	
75 Adit waste rock dump / Galena Creek	*13*		✔	✔	✔		
Silver King settling ponds	*15*	✔	✔	✔	✔		
Buildings	*9,17,18*	✔	✔				
Silver King 100 adit	*12*				✔		
Low grade ore pile	*20*		✔	✔	✔		
Vent (for underground workings south of Silver King pit)	*9*	✔					
Backfill hole (south of power line)		✔					
Within disturbed area behind settling pond tenches			✔				✔
Downstream of discharge pipe	*16*		✔				
Sinkhole next to vent (backfill hole south of power line)		✔					



DRAFT

EROC

ACCESS

KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 3 - SILVER KING

SITE PLAN

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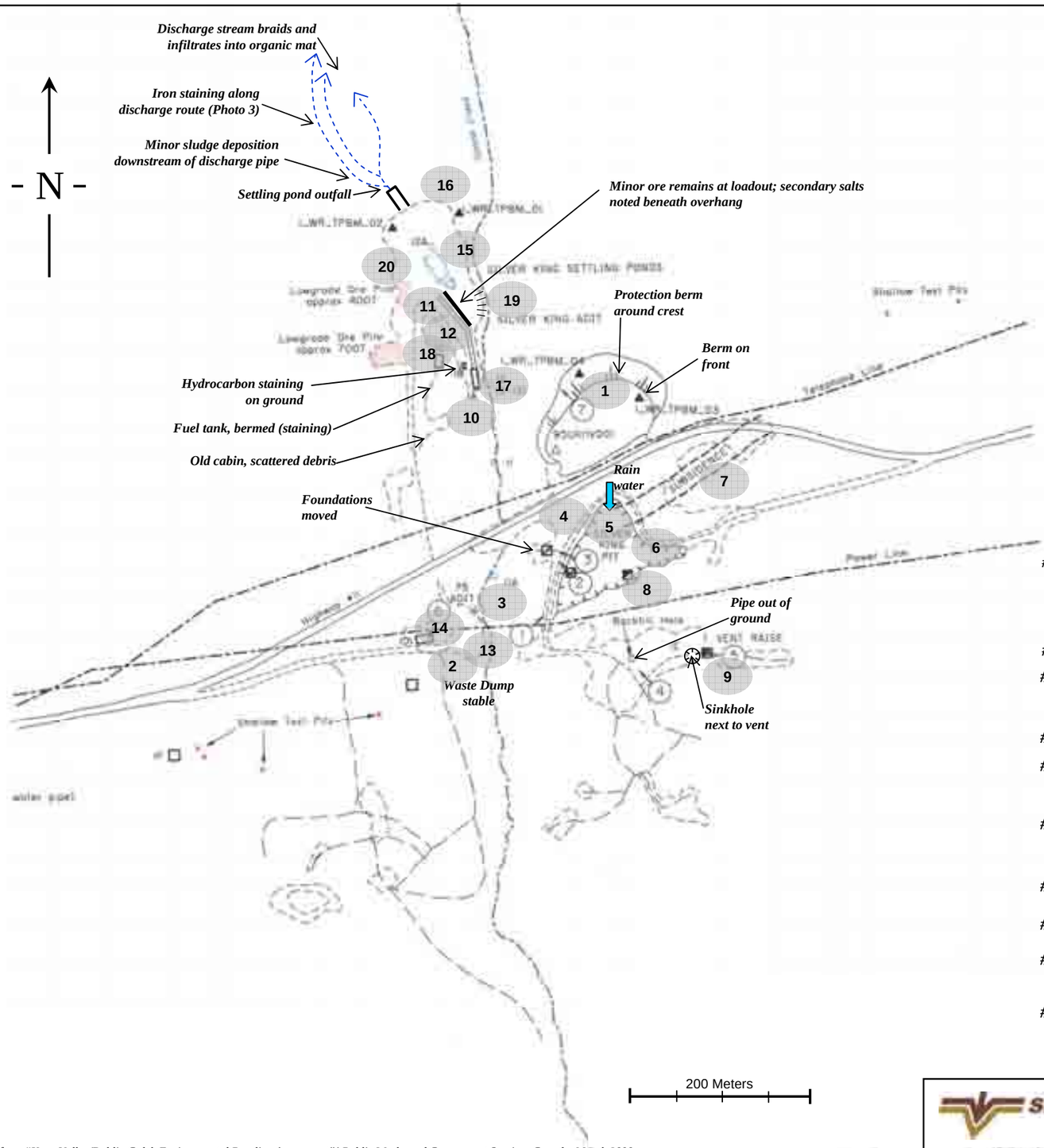


Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

#1 *- Drainage channel eroded into face of dump - channel does not extend up face through dump crest.*
- The dump in general is stable, with no new tension cracks – no toe heave observed.
- Subsidence on the top of the dump is an old feature.
- The dump has a protection berm around the crest.

#2 *- This dump is generally stable especially as the waste material appears to be of limited thickness.*
- Over time, the timber within the dump area may rot, resulting in some movement of material down the slope.
- Some limited creep cracks and desiccation cracks are noted on the top of the dump.

#3 *The adit area is stable and the adit itself is sealed with welded screen and a black geofabric.*

#4 *The Open Pit is stable, with limited unravelling of the slope walls.*
- No water is noted in the pit.
- Temporary barriers that were installed to prevent access have fallen down. There are no berms around the edge of the pit to prevent access.

#5 *A rainwater gulley was noted on the north apex of the pit, allowing access of water into the pit.*
- There are what looks to be recent flows of silt into the pit, but there is no free standing water in the pit. During periods of pooling of water, this probably seeps down into the underground excavations.

#6 *A small sinkhole has formed, but this is in the upper east area of the pit and is away from the rain gulley that goes down to the bottom of the pit.*

#7 *As a result of the extensive overgrowth in this area it was not possible to judge whether depression in this area was related to subsidence or just trenching*

#8 *The timber support around this raise is proud of the ground surface with the hole sealed up with growing tress, timber and soil.*

#9 *Vent house building has a sheet of plywood over the raise.*

#10 *Ventilation station with wiring for heater*
- 3 large blowers and heater

#11 *Lime addition system*
- lime slurry tank
- mixer
- peristaltic pump
- lime slurry drips into mixing basin immediately above settling pond

#12 *Low Dam at portal directs adit discharge into collection pipe. Heavy sludge build up behind dam.*

#13 *Waste rock material light yellow staining common, dark orangey brown staining rare*
- looks like surface veneer of waste
- minor waste over edge of cliff into floodplain of Galena Creek

#14 *Transformer station (Active)*

#15 *Unknown volume of sludge in sedimentation ponds*
- not known if sedimentation ponds are lined
- no seepage observed at toe of waste rock pad

#16 *Orange precipitate marks bed of flow below settling pond outfall; unclear whether this is sludge escaping (short residence time), or continued Fe oxidation. Quality of precipitate decreases with distance along stream. Flow forms gently inclined wetlands in stunted open black spruce forest.*

#17 *Building 1A accessible to public, contains hazards not limited to trip & fall, and roof collapse.*

#18 *Building 1C accessible to public, contains 3 generators/compressors, hydrocarbon staining on crushed gravel floor inside*

#19 *Scouring of toe of waste dump by Galena Creek (Photo 4)*
- dark orangey brown staining noted adjacent to waste pile in Galena Creek

#20 *appears to be <400t in low grade pile: material may have been used for berms around settling ponds*

SRK Consulting Engineers and Scientists VANCOUVER

ALEXCO

Silver King Site #1

Job No: 1CA009.000

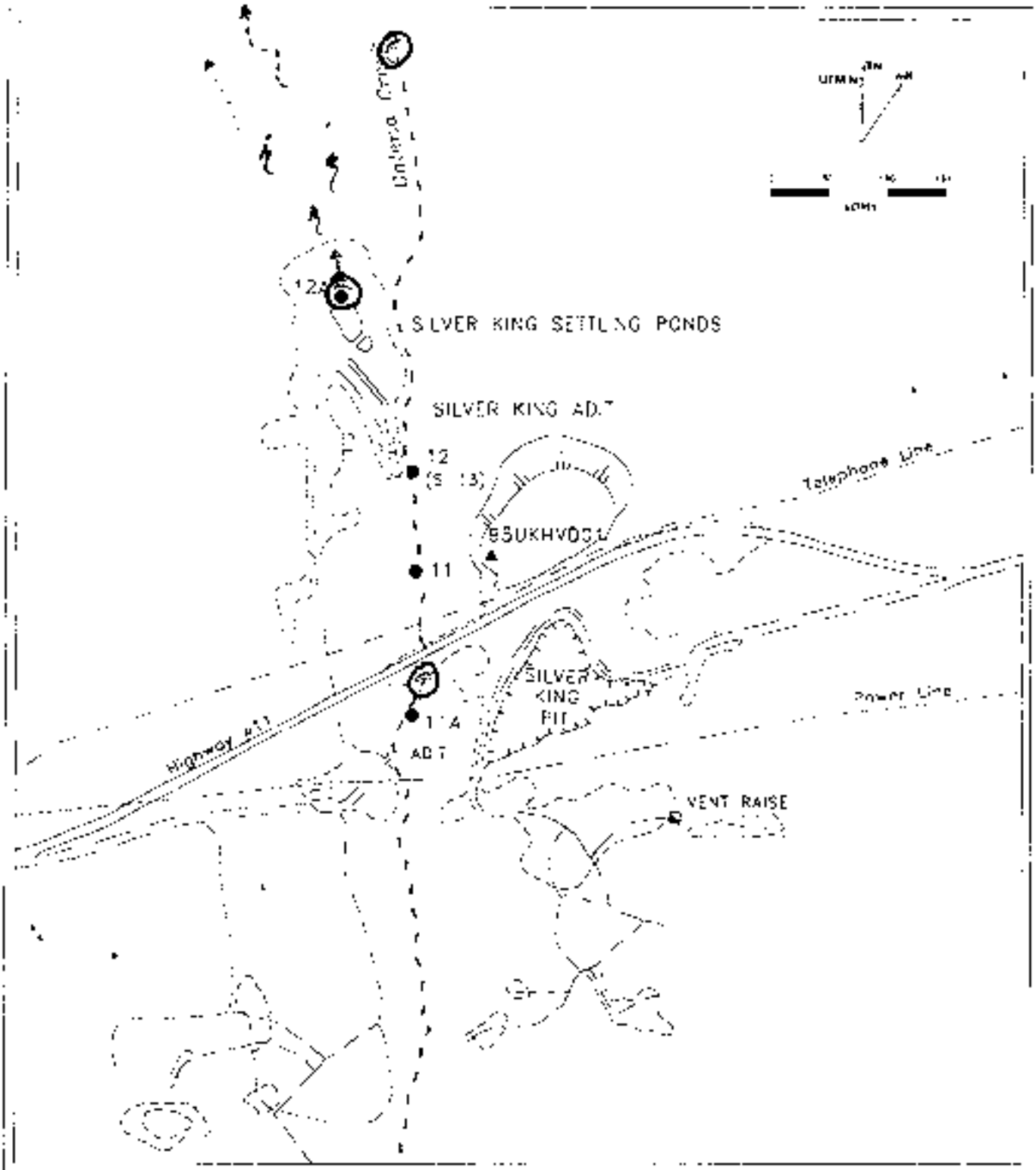
Filename: Site 1_Silver King_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007

Approved:

Figure: **4**

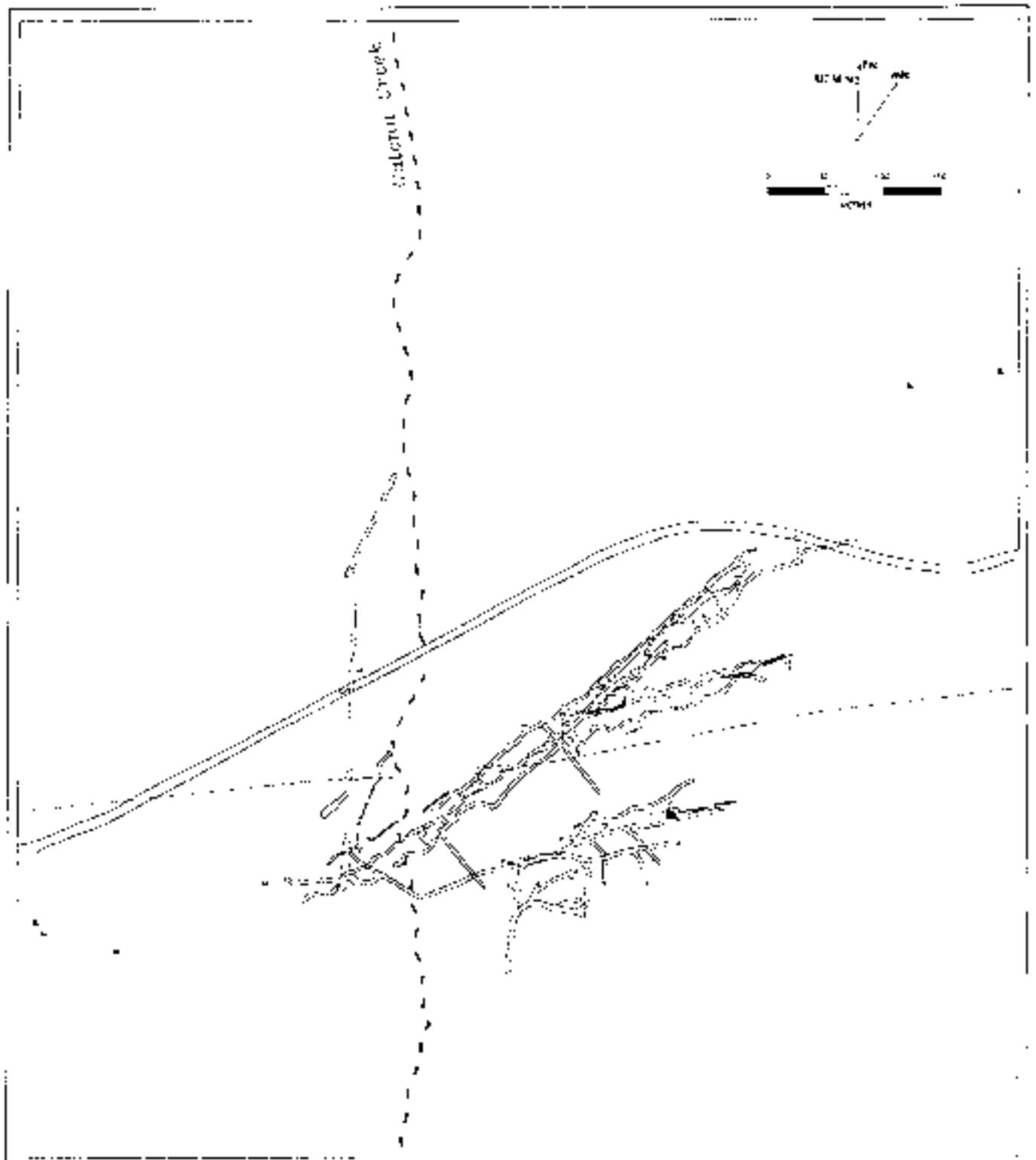


LEGEND

UNITED KENO HILL MINES LIMITED

SILVER KING

SITE PLAN

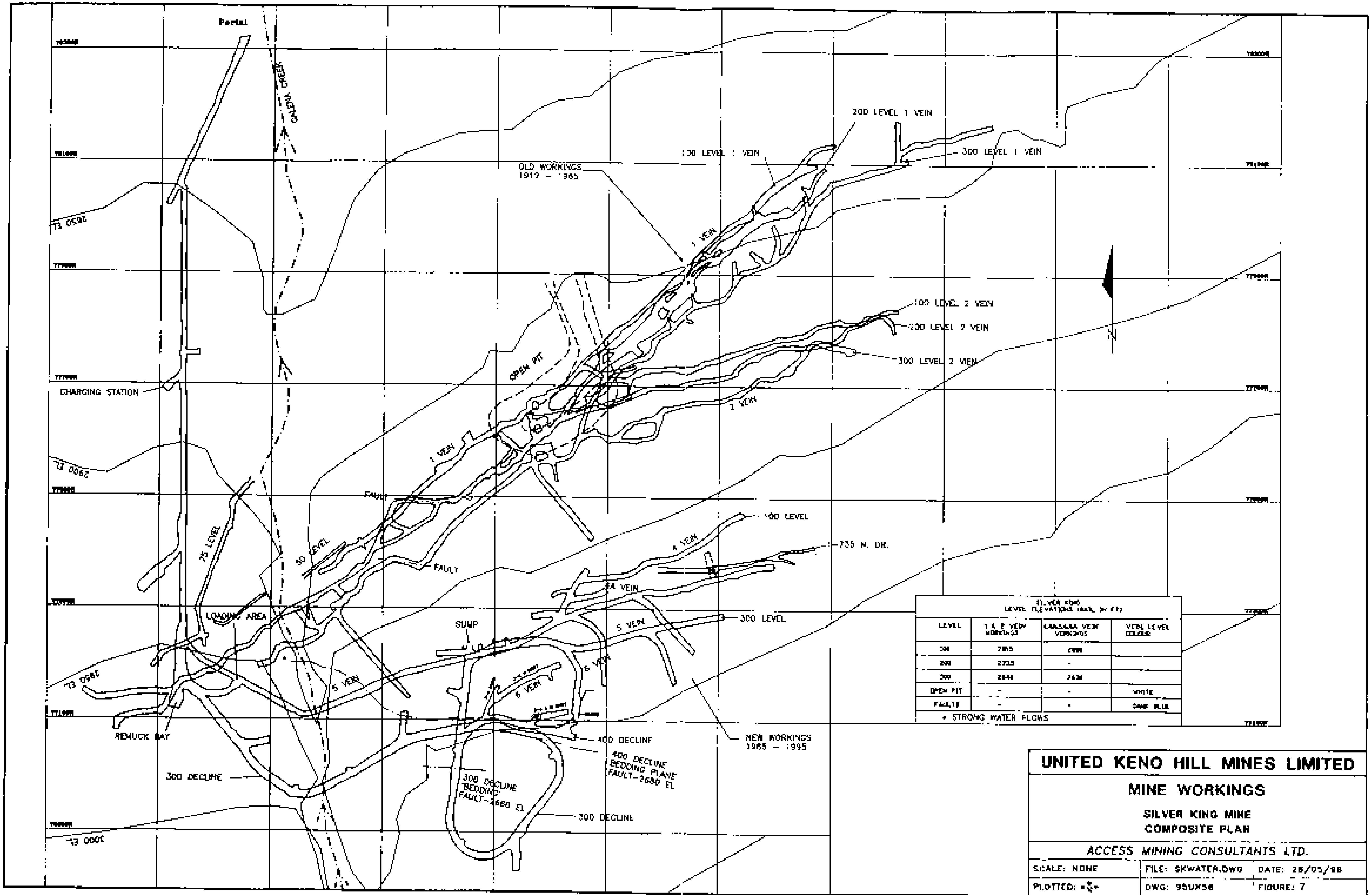


LEGEND

UNITED KEND HILL MINES LIMITED

SILVER KING

UNDERGROUND


Portal
GALENA CREEK
200 LEVEL 1 VEIN
100 LEVEL 1 VEIN
300 LEVEL 1 VEIN
OLD WORKINGS
1 VEIN
100 LEVEL 2 VEIN
200 LEVEL 2 VEIN
300 LEVEL 2 VEIN
2 VEIN
OPEN PIT
CHARGING STATION
FAULT
75 LEVEL
50 LEVEL
FAULT
100 LEVEL
4 VEIN
735 N. DR.
4A VEIN
LOADING AREA
SUMP
5 VEIN
300 LEVEL
5 VEIN
6 VEIN
6 VEIN
REMUCK BAY
400 DECLINE
400 DECLINE BEDDING PLANE FAULT-2680 EL
NEW WORKINGS
300 DECLINE
300 DECLINE BEDDING FAULT-2660 EL
300 DECLINE
N
LEVEL
OPEN PIT
- WHITE
STRONG WATER FLOWS
UNITED KENO HILL MINES LIMITED
MINE WORKINGS
SILVER KING MINE
COMPOSITE PLAN
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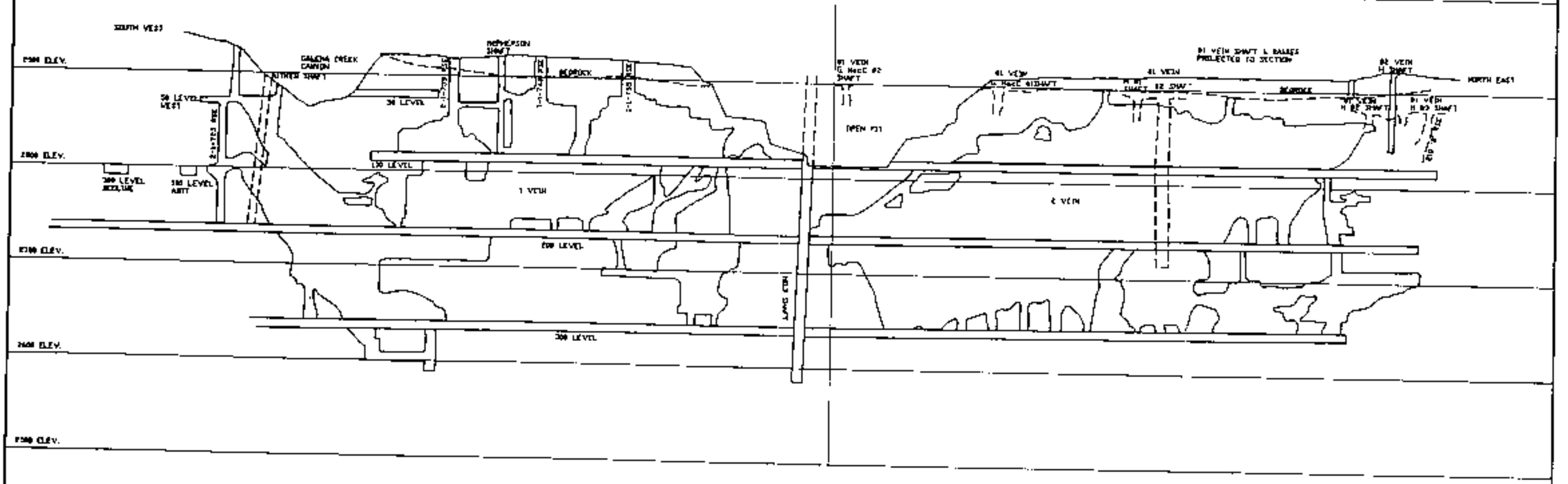


Figure 8

UNITED KENO HILL MINES LIMITED		
MINE WORKINGS		
SILVER KING MINE, VERTICAL AND LONGITUDINAL SECTION 1 & 2 VEINS, (Looking Northwest)		
ACCESS MINING CONSULTANTS LTD.		
SCALE: NONE	FILE: SKLONG.DWG	DATE: 28/05/94

3.1.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pits:

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ARD and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Areas:

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Buildings and Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.2 HUSKY SW

3.2.1 Description

The Husky SW underground workings were developed in the two years following mining of the Husky underground. Contract miners were used, and all equipment removed at the end of mining. Significant ore (60,000 tons) remains at Husky SW and the plan is to mine it out in the near future.

Access to underground was via the shaft and there are no other openings to surface from the underground. The head frame and a shop building are still in place.

The Husky SW workings are connected (hydraulically) to the Husky underground at the 250 level. As with the Husky, the Husky SW workings are also flooded. Most of the recharge to these workings is through the water bearing Flat Creek Cross Fault and through the Tick - Brefalt Fault from the Elsa and/or Husky Mines. Some of the underground water is discharged from the shaft via a pipe and culvert, to maintain the water level in the shaft.

There are waste rock piles and some low grade ore around the Husky SW shaft. Waste rock was used for local road construction and fill in this area. On the road to Husky SW from the main road, there is also a small waste rock pad and building. This was

reported to be an explosives magazine, although all explosives have been removed (AMC, 1996a).

3.2.2 Closure Issues

Issues are similar to Husky Mine[1] with the exception that there is discharge from the Husky SW shaft. Monitoring downstream of the discharge shows removal of the relatively small zinc load associated with the shaft water, and thus does not represent a geochemical concern. There is an added "safety factor" in that the drainage from the Husky SW flows through a natural wetland area prior to discharge to the creek (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 4.

An ortho-map of the site is provided in Figure 9 while a map created by the PWGSC and appended in the SRK report follows as Figure 10. Diagrams showing the Husky site plan and cross sections are presented as Figures 11 and 12 respectively.

[1] The Husky mine is flooded but the shaft remains open. Blockage of the shaft will be required and various buildings need to be cleaned up, however, this area and Husky SW fit the public's connotation of a mine and could be useful centrepieces of a future tourism attraction. Chemical issues appear minor since known loadings from the site to the receiving environment are small, the shaft does not discharge, and seeps from the waste rock used for foundations do not show elevated metals.

Table 4 Husky SW Closure Issues Matrix

Common Site Name: **Husky SW**
PWGSC site #: 2

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	473886.07	7086470.58	

General Location Description	SRK BEA Report Map Reference Number	Closure Issue Categories					
		Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Conc	Other
Waste Dump	*1*		✔	✔	✔		
Till bank (behind Husky SW shaft)	*2*				✔		
Dozer Tracks behind till bank (south of Husky SW shaft)				✔			
Boiler house		✔					
Storage shed		✔					
Workshop		✔					
Shaft house and headframe		✔				✔	
Hoist house		✔					
ATCO trailer		✔					
Out-flow area for burried drain pipeline	*4*		✔				

Husky

Alexco Camp

Kitchen

Lower Bunkhouse

Upper Bunkhouse

House 3

House 1

House 4

House 2

House 5

House 7

House 6

House 8

Subside

Husky SW

Silver Trail Highway

DRAFT

ERDC

ACCESS

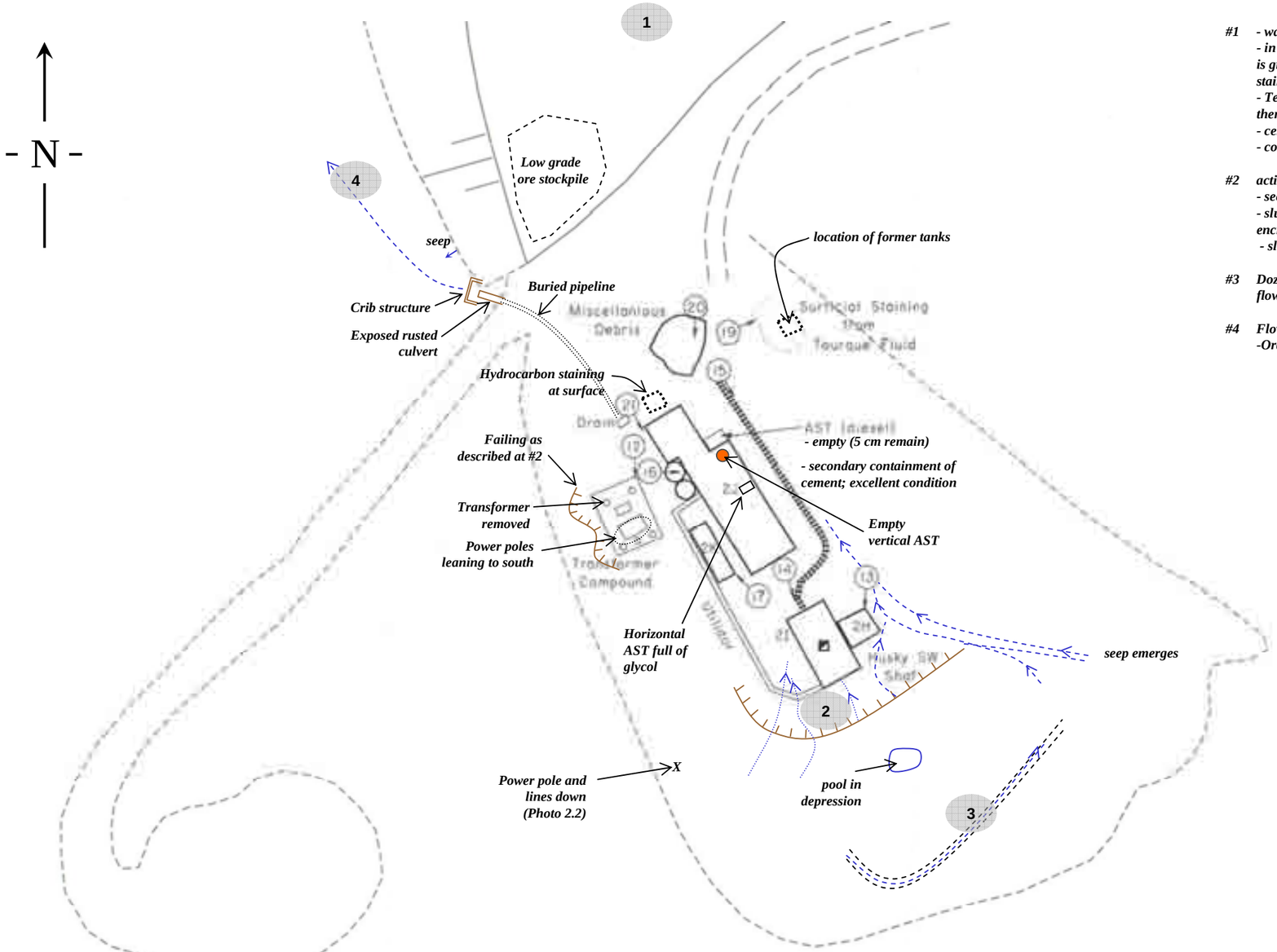
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 9 - HUSKY MINE & HUSKY

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:5,854
FILE: Untitled.mxd		



#1 - waste dump has tension cracks up to 15 cm wide
- in lowest bench, material contains rounded clasts (overburden?), but colour is greenish brown to greenish gray, with pale yellow to orange dark brown stains on clasts
- Tension cracks (12 m back from crest) parallels dump crest (Photo 2.3), then curves to intersect dump crest at NE end
- central part of zone of cracking has subsided by ~0.5 m
- could be permafrost in dump foundation

#2 actively failing till bank
- seepage forms rivulets across entire face
- slumped material is very soft, saturated; encroaching on headframe structure (Photo 2.1)
- slope is ~2V:15H

#3 Dozer trail with water seeping into it. Flow observed towards northwest, but flow diffuses into broad area of willows and grass

#4 Flow visually estimated at 1 l/s
-Orange staining and precipitation along flow path

20 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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VANCOUVER

ALEXCO

Job No: 1CA009.000

Filename: Site2_Husky+Husky_20070131.ppt

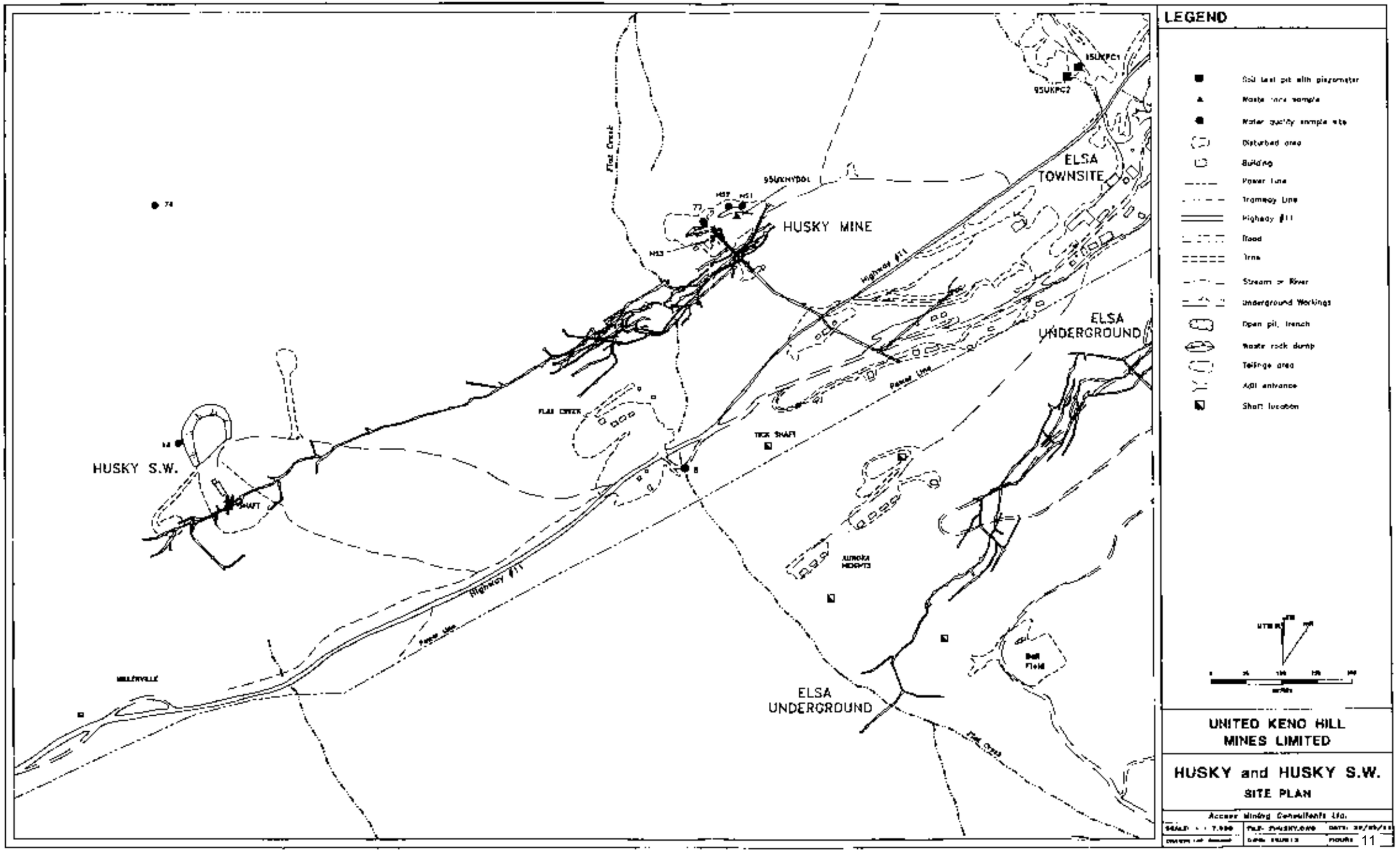
Baseline Environmental Report,
United Keno Hill Mines Property

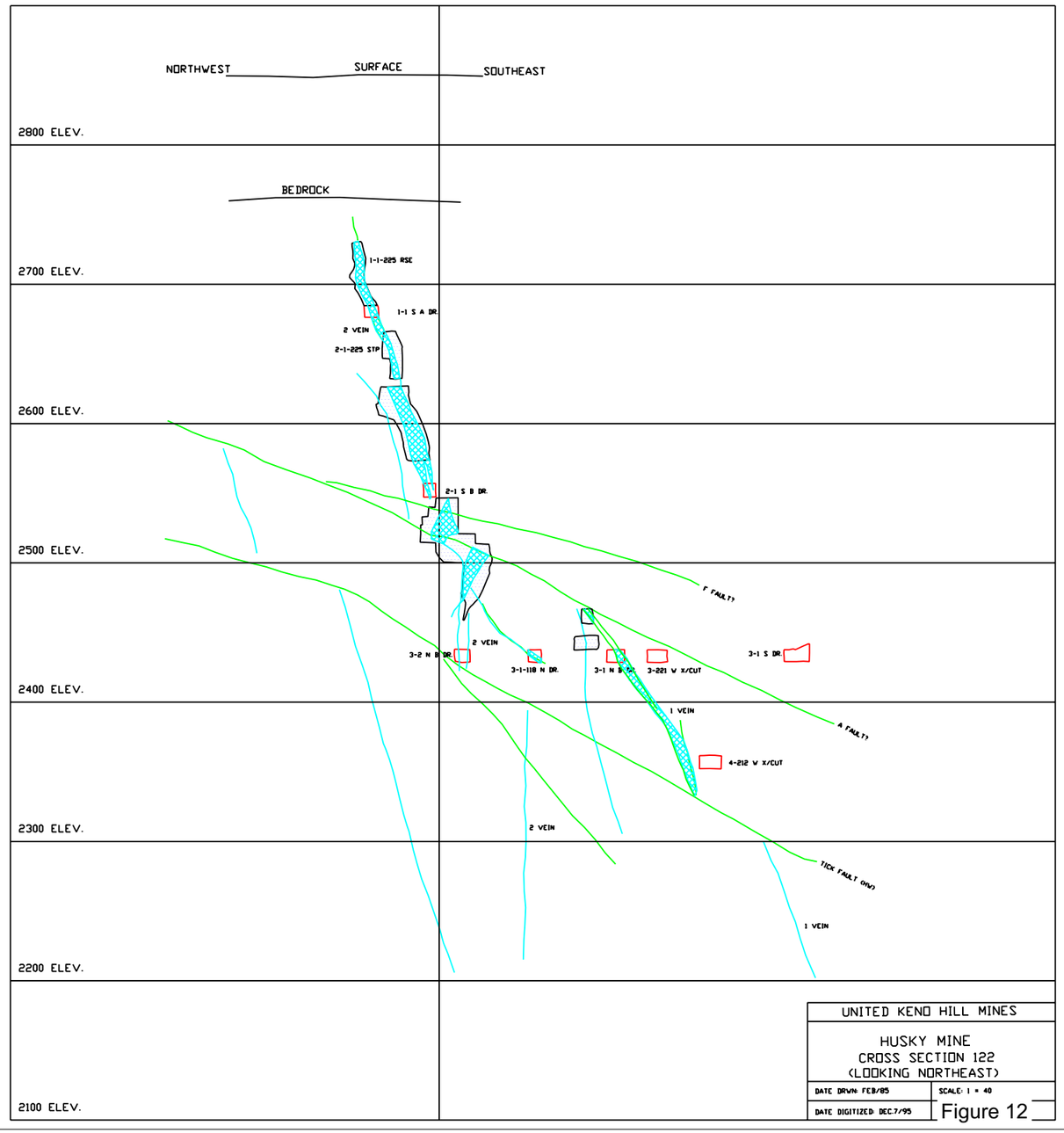
Husky SW Site #2

Date: Jan. 2007

Approved:

Figure: 10


LEGEND
Soil test pit with piezometer
Waste rock sample
Water quality sample site
Disturbed area
Buildings
Power Line
Tramway Line
Highway #11
Road
Trail
Stream or River
Underground Workings
Open pit, trench
Waste rock dump
Tailings area
Adit entrance
Shaft location
95UKPC1
95UKPC2
95UKHYDO1
HS1
HS2
HS3
74
77
Flat Creek
HUSKY MINE
ELSA TOWNSITE
ELSA UNDERGROUND
Highway #11
Power Line
FLAT CREEK
TICK SHAFT
HUSKY S.W.
SHAFT
AURORA HEIGHTS
MILLERVILLE
Power Line
Highway #11
Shell Field
ELSA UNDERGROUND
Flat Creek
UTM NAD 83
UNITED KENO HILL MINES LIMITED
HUSKY and HUSKY S.W.
SITE PLAN
Access Mining Consultants Ltd.



UNITED KENO HILL MINES

HUSKY MINE
CROSS SECTION 122
(LOOKING NORTHEAST)

DATE DRWN: FEB/95	SCALE: 1 = 40
DATE DIGITIZED: DEC.7/95	Figure 12

3.2.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area:

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.3 ELSA MINE

3.3.1 Description

Elsa Mine System

The Elsa underground mining area is the oldest and second most extensive of the mining areas, and was the second largest underground producer of the district, after Hector-Calumet. First mined from three levels in the 1930's, UKHM worked the 400 and 200 levels until 1988. Mining was done on a total of eight levels, representing about 800 feet in elevation.

There are six adits associated with the Elsa Mine (+50, 50, 100, 200, 400 and Gravel). Most of the adits are timbered at the portal, and have ice year-round. The older +50, 50, and 100 portals are reported caved. Metal gates have been installed on the 400 and 200 portals.

The only shaft at Elsa was an internal shaft. There are, however, raises to surface associated with both the old and newer workings. The status of the old raises is unknown and will be investigated. One is covered by a small shed. The status of the other is unknown. It is assumed that closure measures are required for both.

The only adit with any significant waste rock production was at the 400 level. Most of this rock has since been used as fill or road material around the mill and camp and no significant waste rock piles remain.

The Elsa mine workings are drained to some extent from the 400 level. There is a gravity fed sump on 400 level and the water from it is pumped into the shaft. It is

anticipated that the majority of the underground water reports from the shaft to the Husky workings, via the Brefalt Creek Fault. This assumption is based on the records of development and dewatering of Husky, and on the observations of site geologists. It is believed water from Elsa also flows via the Brefalt Creek fault and comes out on surface just above Highway No. 11 between the Husky Mine turnoff and the old Elsa school (AMC, 1996a).

Elsa Village

Elsa Village is located on the south side of Highway #2, roughly 11.5 km by road west of Keno City. The village is roughly 2 km by 0.5 km in size and is situated on a hillside between 790m and 850m elevation. Entrances off the highway are located at both the east and west ends of the village. Almost all of the roads can be accessed by vehicle; however, the road to the sawmill is blocked by a locked gate.

Elsa village is located on the north-western tow of Galena Hill. The village was built on several flat terraces (essentially cut/fill areas connected by roadways). The natural slope of the area is to the northwest, towards the Elsa tailings and Husky mine site. The village site is clear of bush/vegetation within its boundaries.

Porcupine Gulch, Brefalt Creek and Flat Creek all flow north-westward through the village. Porcupine Gulch drains into the Elsa tailings, and tailings drainage flows a short distance before joining with Brefalt Creek. Both Porcupine Gulch and Flat Creek enter the western end of a large marsh, which drains into a tributary of the McQuesten River, located 4 km to the west at 200m lower elevation. A small creek also flows past the Elsa Dump.

The village of Elsa originated in association with the 1929 opening of the Elsa mine (the vein was discovered in 1925). The village expanded in 1935 with the relocation of the Werneke Mill to Elsa. Since then, the population has fluctuated in response to a variety of events, including the mine closure from 1942 to 1947 (due to World War 2 and the death of mine director Werneke), the 1949 mill fire, and the current mill closure (which

began in 1989 sure to world market conditions). Over 400 people lived in Elsa just before the village's recent shutdown.

Today, the village is largely comprised of closed industrial and commercial buildings near the village centre. Several buildings are relatively new and appear to be in good condition, including the addition to the school, a recreation (curling) centre, swimming pool building, and a new bunkhouse at the east end of Elsa (PWGSC, 2000).

3.3.2 Closure Issues

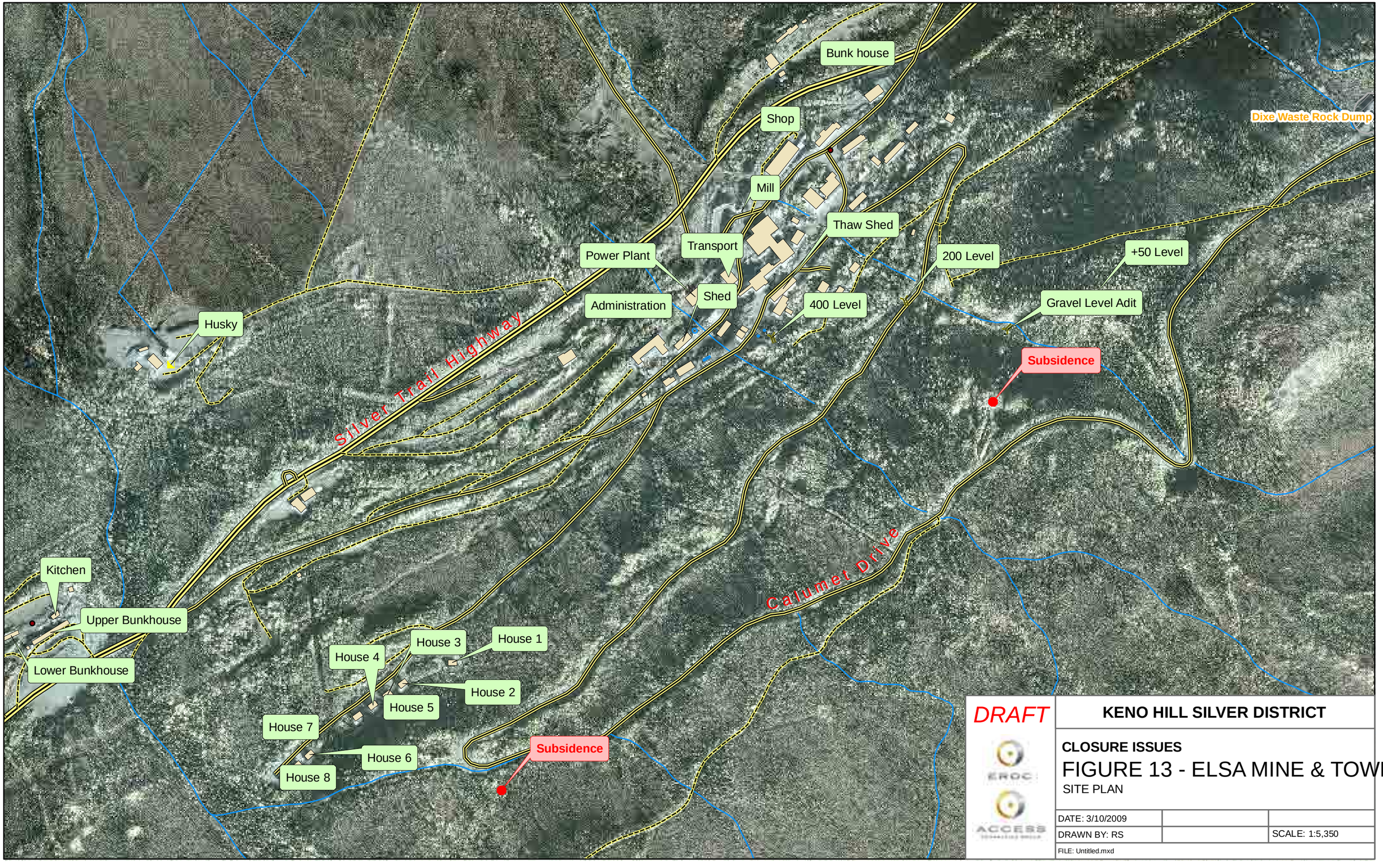
Elsa Mine was a large underground operation with several adits and small rock piles. It does not free drain now but might once pumping from the sump to the shaft stops. The closure issues are primarily those of physical safety - limiting access to the workings. There is currently no discharge of water from the Elsa workings (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 5.

An ortho-map of the site is provided in Figure 13 while a map created by the PWGSC and appended in the SRK report follows as Figure 14. A diagram showing the underground workings is presented as Figure 15. Diagrams showing the site plan and underground workings are presented as Figures 16 and 17 respectively.

Table 5 Elsa Mine Closure Issues Matrix

General Location Description	SRK BEA Report Map Reference Number	Closure Issue Categories					
		Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Elsa Mine							
Between Aurora Heights and Bell Field	*1*				✔		
Powderhouse corner vent rise - crossing Calumet Drive					✔		
Brefault shafthouse	*4*	✔					
+50 Adit	*2*	✔					
Gravel Level Adit	*3*	✔					✔
Loadout structure (-200 Adit)	*5*	✔			✔		
General site (waste rock)	*6*		✔				
Elsa Village							
Elsa Dump			✔				
Several buildings within Elsa Village		✔			✔		



DRAFT

KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 13 - ELSA MINE & TOWN

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:5,350
FILE: Untitled.mxd		

#1 - Subsidence through to Elsa underground workings

#2 - +50 adit confirmed collapsed; minor debris in the form of piping, rails, barrels, sheet roofing noted in front of collapsed adit.
- Collapsed raises appeared stable and are overgrown with moss and shrubs; difficult to locate and access due to dense underbrush.

#3 - Gravel level adit confirmed collapsed. Waste dump appears to be composed mainly of overburden, but steep slopes appear to be preventing revegetation, as only isolated colonization has occurred.

#4 - Only one shaft was located in this area. "Shed" noted in PWGSC (2000) was collapsed, and further investigation revealed that the debris was situated over an unstable shaft that appeared to be open. Ground subsidence was observed immediately adjacent to the shaft house debris on all sides. Access to the site is somewhat difficult due to dense alder growth, but the immediate vicinity is cleared and the collapsed shaft house presents an intrigue risk.

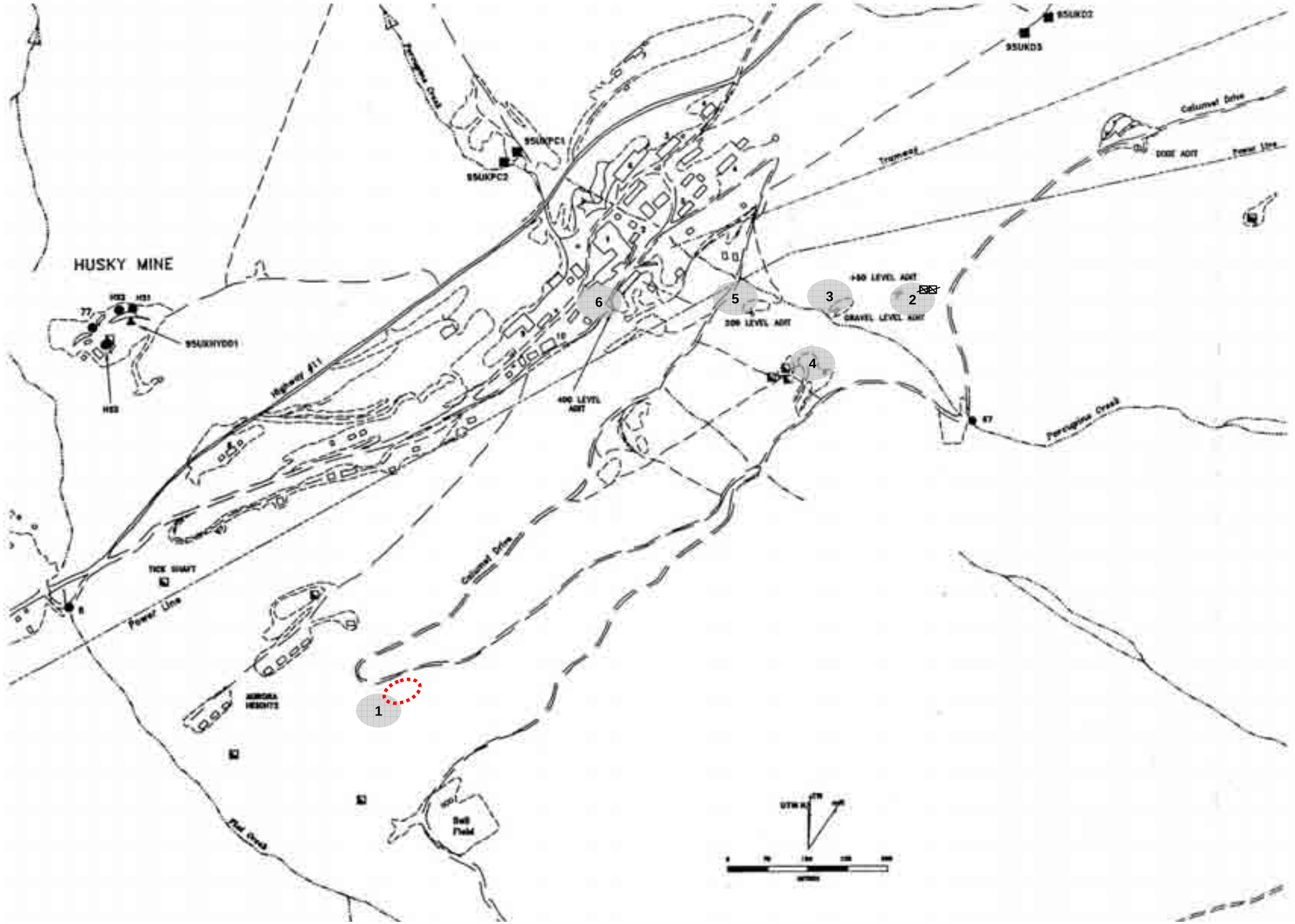
#5 - 200 level adit confirmed gated and secure; timber portal supports remained intact. Timber loadout structure beginning to deteriorate; this structure is visible from Calumet Drive, and has ore cars sitting on rails that are also visible. The loadout structure and ore cars present an intrigue risk.
- Minor rusty brown staining observed on waste rock surface of working area between adit and loadout.

#6 - 400 level adit confirmed gated and secure; portal support remained intact. Adit was partially full of ice at time of inspection; observed drainage was clear and colourless, with small flow volume (visual estimate up to 5 L/min) and no staining along flow path.

GENERAL COMMENTS:

- Most of the waste rock brought to surface from the Elsa Mine has been used for construction rock within the area of the townsite. Although this waste rock was not assessed in detail, orange staining along isolated seepage flowpaths and secondary salts beneath some overhangs suggest that the Elsa waste rock is a potential source of metals and acidity.

- Timber support structures throughout the townsite are deteriorating, with minor failures of retaining structures observed in 2005 and 2006.



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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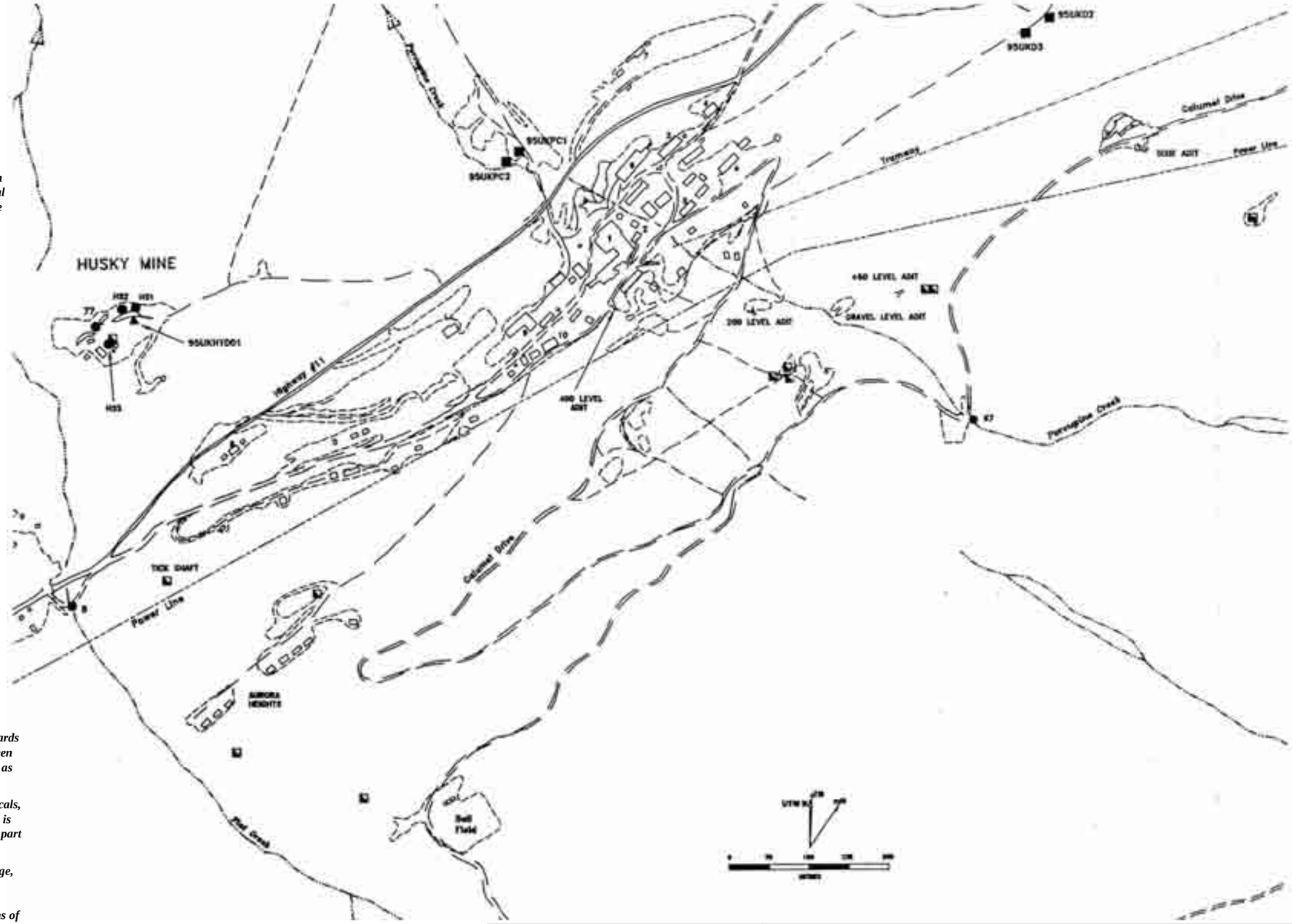
ALEXCO

Elsa Mine Site #3

Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site3_ElsaMine_20070131.ppt			Figure: 14

1



#1 - The Elsa Dump is located the position indicated. Seven other solid waste disposal sites are noted in PWGSC (2000).
- Existing contaminants of concern, and concentrations of those contaminants, at the Elsa Dump and at other solid waste dumps reported in PWGSC (2000) are poorly understood at this time. In addition to municipal solid waste, it is possible that industrial chemical wastes, derived from mine and mill operations, are disposed at this site.
- As is typical for solid waste dumps, there is no record of the types and quantities of waste disposed at this location. Although PWGSC (2000) provides an estimate of dump composition, actual dump composition may be different than reported.
- No characterization of groundwater or surface water downgradient of the Elsa Dump has been carried out, and the presence and quality of landfill leachate remains uncertain.

GENERAL COMMENTS

Notes from inspection of Elsa Mine workings can be found on Site #3- Elsa Mine plan

Several buildings within Elsa Village have been identified as structural hazards by others. All buildings in service under current site operations have been inspected and approved as safe for work, with rehabilitation carried out as required to meet that standard.

Past operations at Elsa Village have made extensive use of industrial chemicals, fuels, and lubricants. Potential chemical contamination at Elsa Village is documented elsewhere; no investigation or sampling was carried out as part of this work.

PWGSC (2000) reports summary descriptions of each building at Elsa Village, including observations of physical and chemical hazards. These observations were not verified as part of the 2005/ 2006 inspections. Appendices E and F contain tables recording known or suspect locations of hydrocarbon and building contamination; this information is derived, in part, from PWGSC (2000).

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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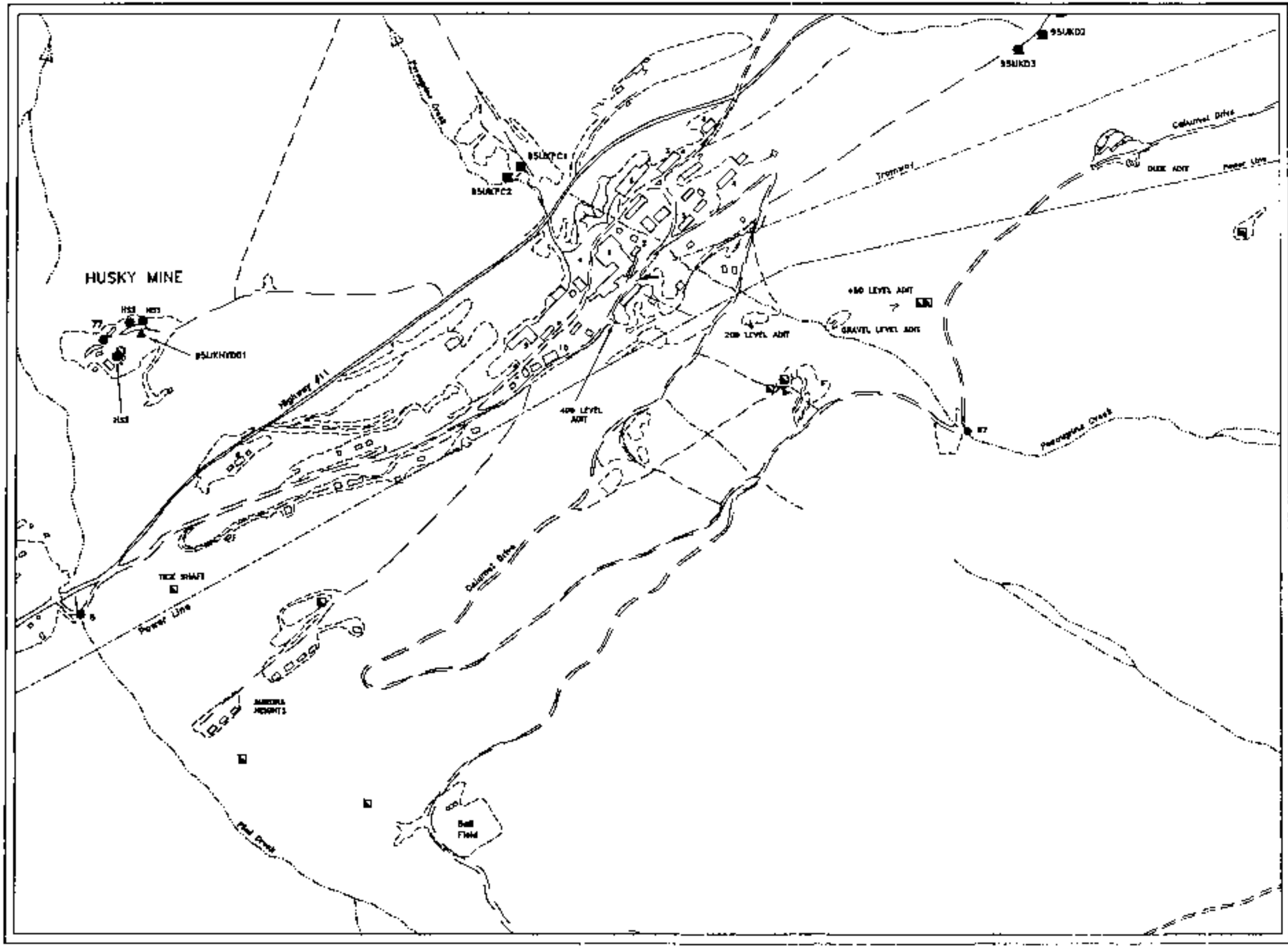
ALEXCO

Elsa Village Site # 78

Job No:	ALEX-06-ESP-05
Filename:	Site78_Elsa_Village_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**15**



LEGEND

- Soil test pit with piezometer
- Waste rock sample
- Water quality sample site
- Disturbed area
- Building
- Power line
- Tramway Line
- Highway #31
- Road
- Trail
- Stream or River
- Underground Workings
- Open pit, trench
- Waste rock dump
- Tailings area
- Adit entrance
- Shaft location

1. Mill
2. Smelter
3. Geology / Engineering Office
4. Bunkhouse
5. Snack Bar
6. Warehouse
7. Framing Shop
8. School
9. Curling Rink
10. General Store

UNITED KENO HILL MINES LIMITED

ELSA TOWNSITE and MILL
SITE PLAN

Aspase Mining Consultants Ltd.

UNITED KENO HILL
MINES LIMITED

ELSA TOWNSITE and MILL
UNDERGROUND

3.3.3 Information Gaps

These sites are indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Elsa Mine

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

Elsa Village

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.4 DIXIE

3.4.1 Description

The small Dixie underground workings were developed by UKHM in the 1970's, and produced about 24,000 tons of ore. There is one adit at the 200 level and two raises to surface. Doors are installed at the portal to block access. Reports show that the raises have also been secured.

There is a cribbed loadout platform at the Dixie adit which was filled with waste (development) rock, with additional waste rock deposited around the platform. Downslope from the waste rock there is an area of surface silt accumulation and dead

vegetation. The area appears to have been affected by erosion from spring runoff from upslope, in the dump glaciation, or possibly acidity from rocks in the dump.

However, anecdotal evidence indicates that the dead vegetation may in part be associated with the high flows of water from two periods of underground dewatering, prior to mining. The adit is now essentially dry, and has not discharged water in recent memory.

There are also some older underground workings at the Dixie Mine. These were accessed via the Dixie shaft. The shaft is located to the northwest of the portal. The condition of this shaft will be confirmed, although it is reported to be caved.

3.4.2 Closure Issues

Dixie was an underground mine with a small adit portal dump. There are a few safety issues to resolve with regard to underground access, particularly from old workings and cribbing at the portal. The dump is small and, based on its location, not likely to be a significant environmental risk though more field and laboratory testing data is being collected to confirm this.

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 6.

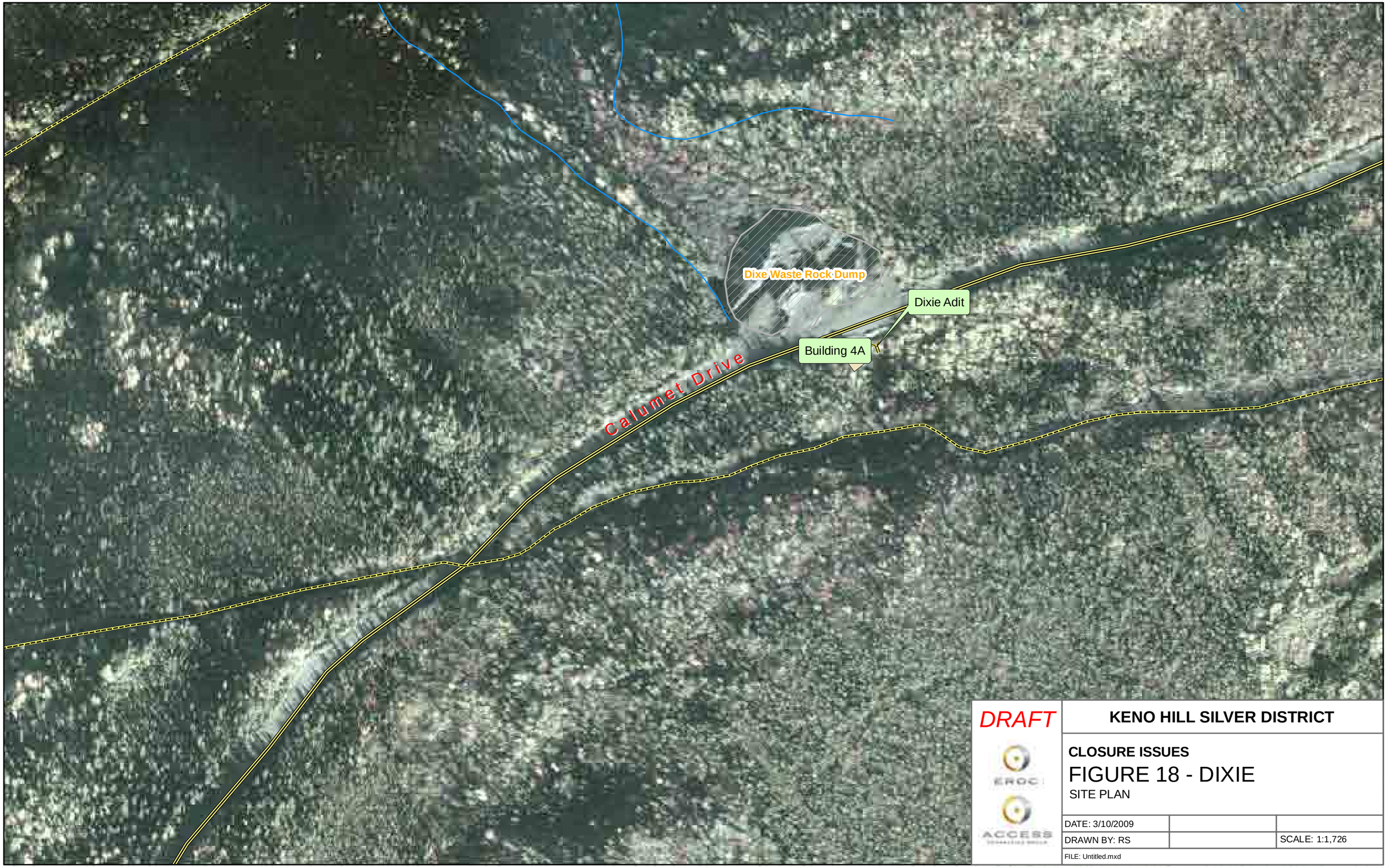
An ortho-map of the site is provided in Figure 18 while a map created by the PWGSC and appended in the SRK report follows as Figure 19. Diagrams showing the site plan, mine plan and underground workings is presented as Figure 20 – 22 respectively.

Table 6 Elsa Mine Closure Issues Matrix

Common Site Name: **Dixie**
PWGSC site #: 4

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	476936.54	7087409.45	

General Location Description	SRK BEA Report Map Reference Number	Closure Issue Categories					
		Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Solid waste disposal site	*1*		✔				
Portal		✔			✔		
Vent raises					✔		
Buildings	*2,3*		✔	✔	✔		



DRAFT

EROC

ACCESS

KENO HILL SILVER DISTRICT

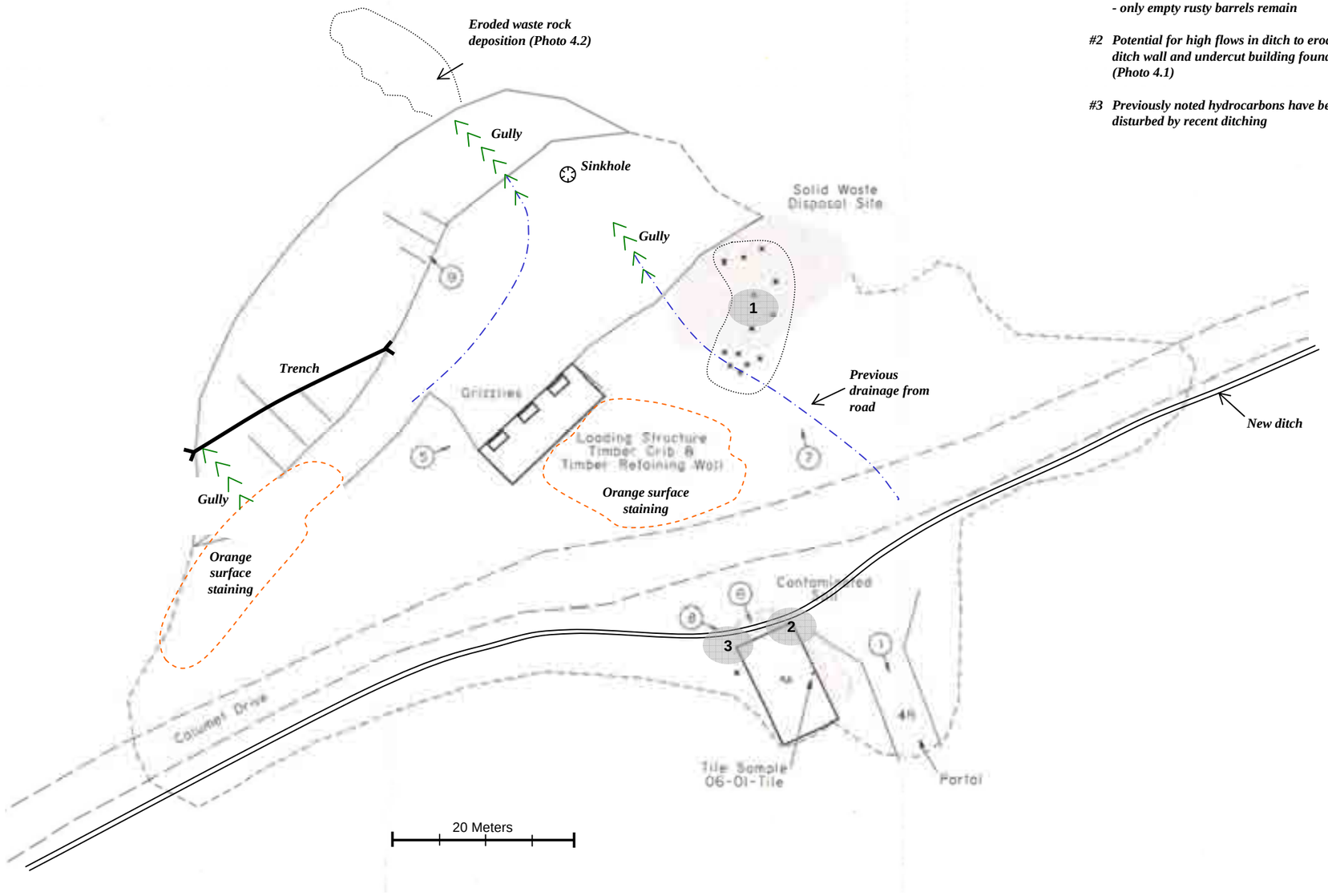
CLOSURE ISSUES

FIGURE 18 - DIXIE

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,726
FILE: Untitled.mxd		

- N -



#1 -Several barrels removed - only empty rusty barrels remain

#2 Potential for high flows in ditch to erode ditch wall and undercut building foundation (Photo 4.1)

#3 Previously noted hydrocarbons have been disturbed by recent ditching

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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ALEXCO

Dixie Site #4

Job No: 1CA009.000

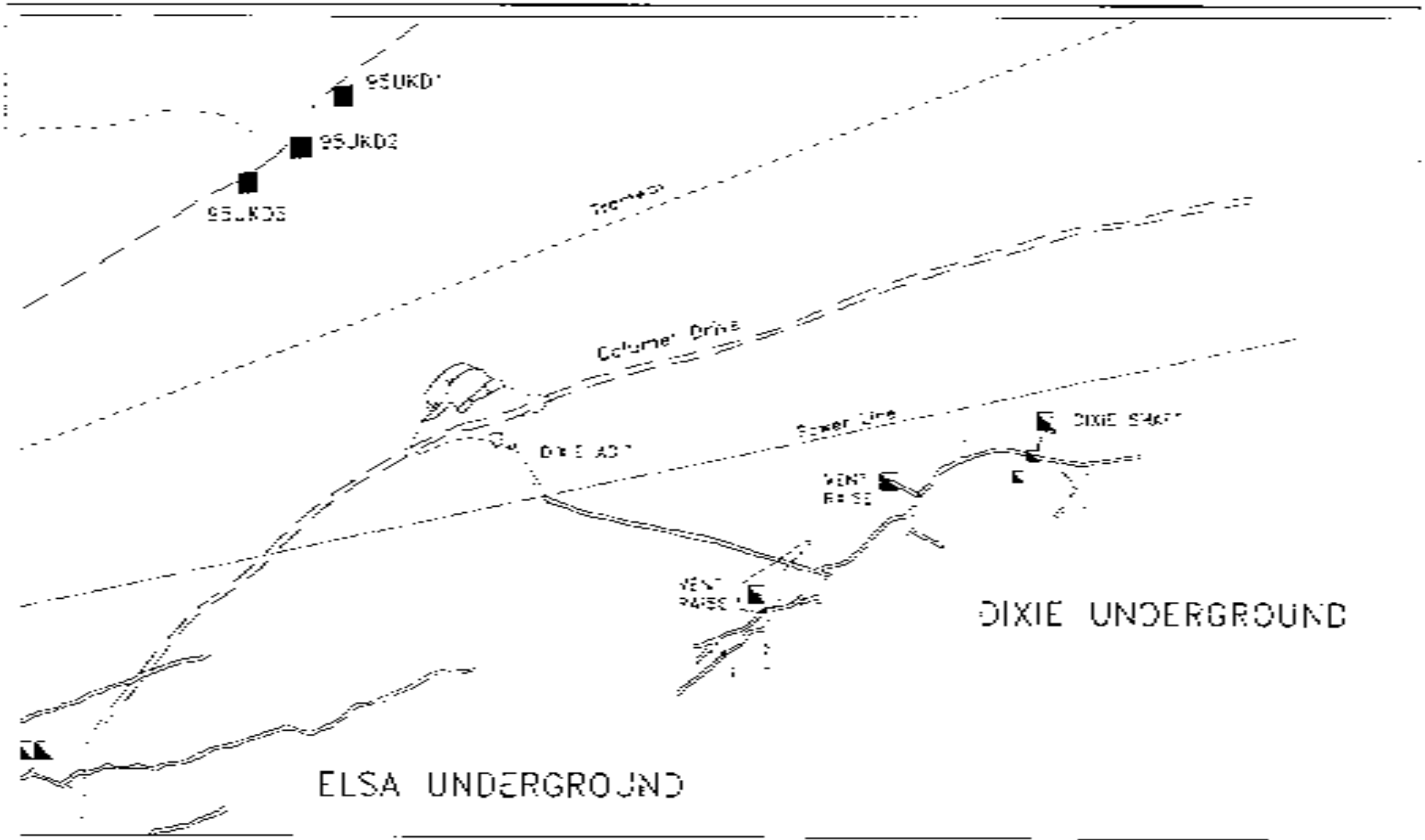
Filename: Site4_Dixie_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007

Approved:

Figure: **19**

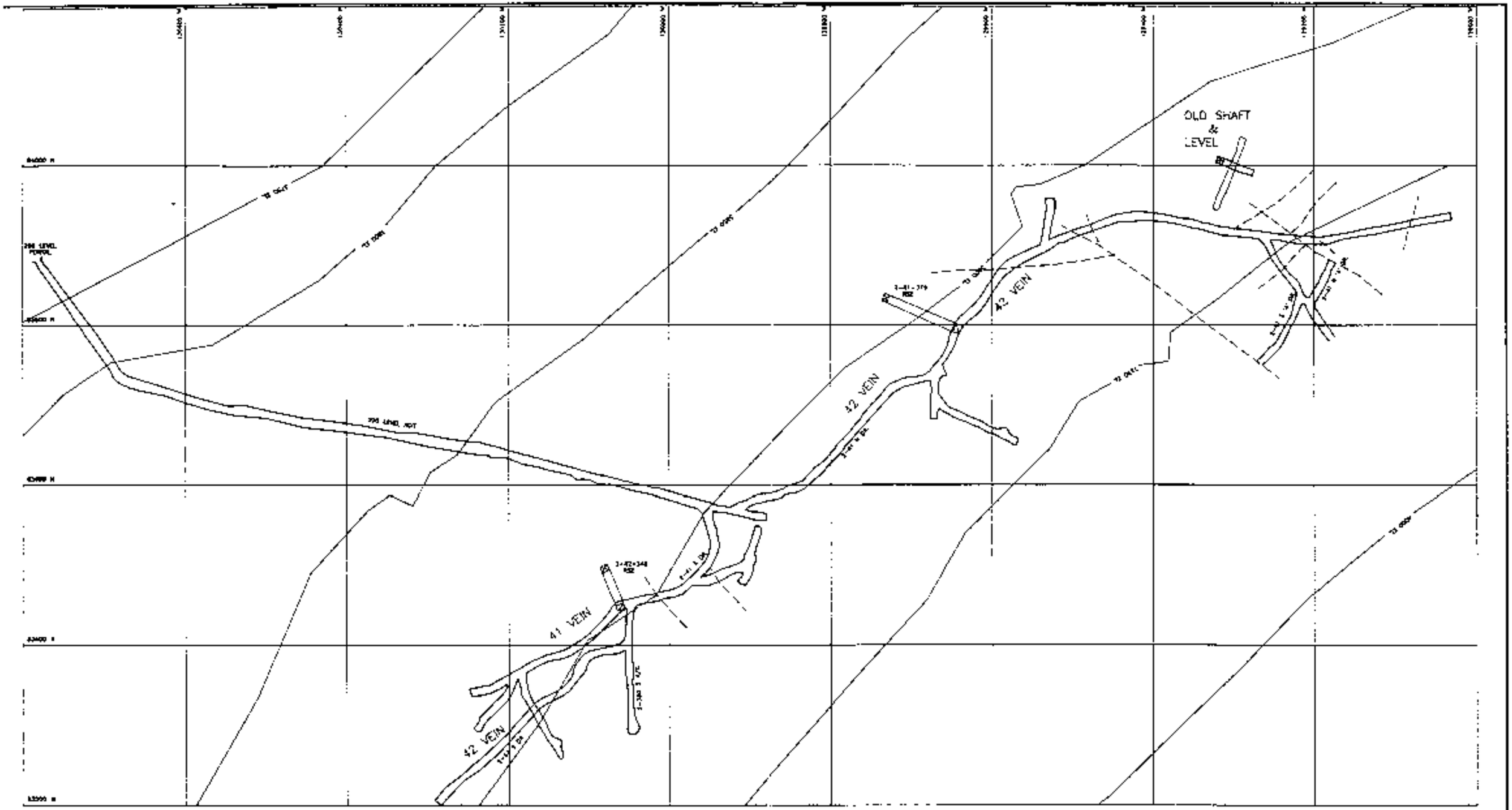


LEGEND

UNITED XENO HILL MINES LIMITED

DIXIE

SITE PLAN



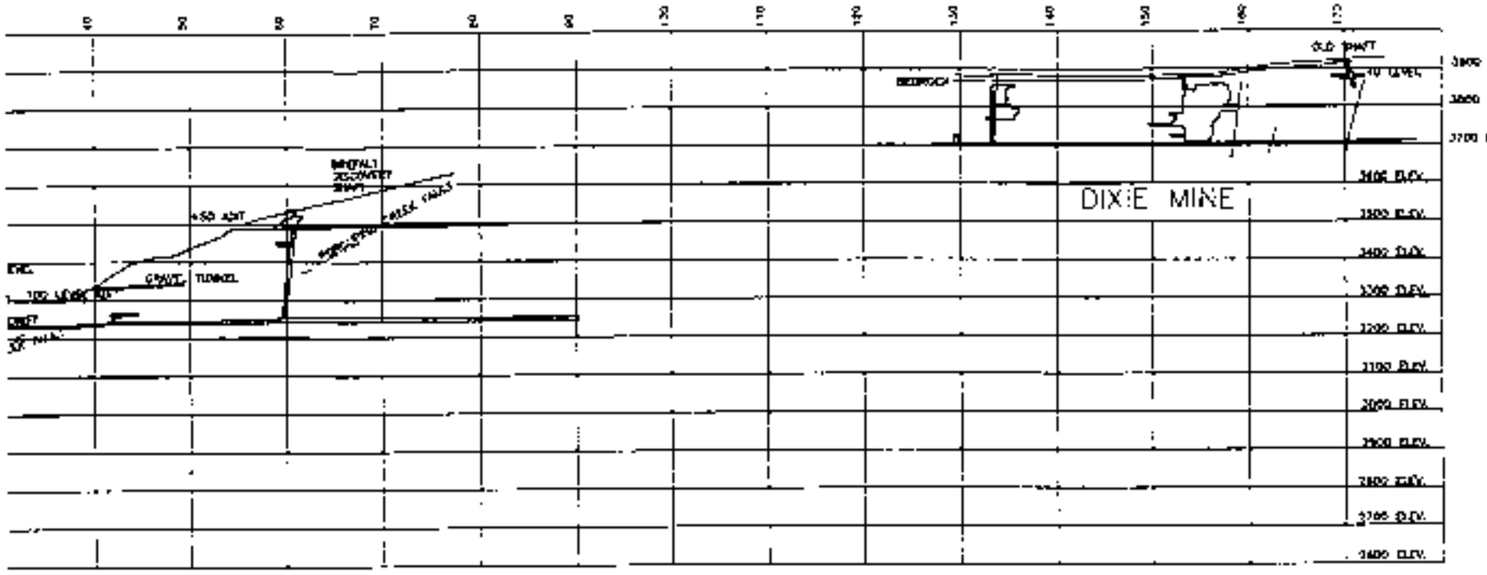
UNITED KENO HILL MINES LIMITED

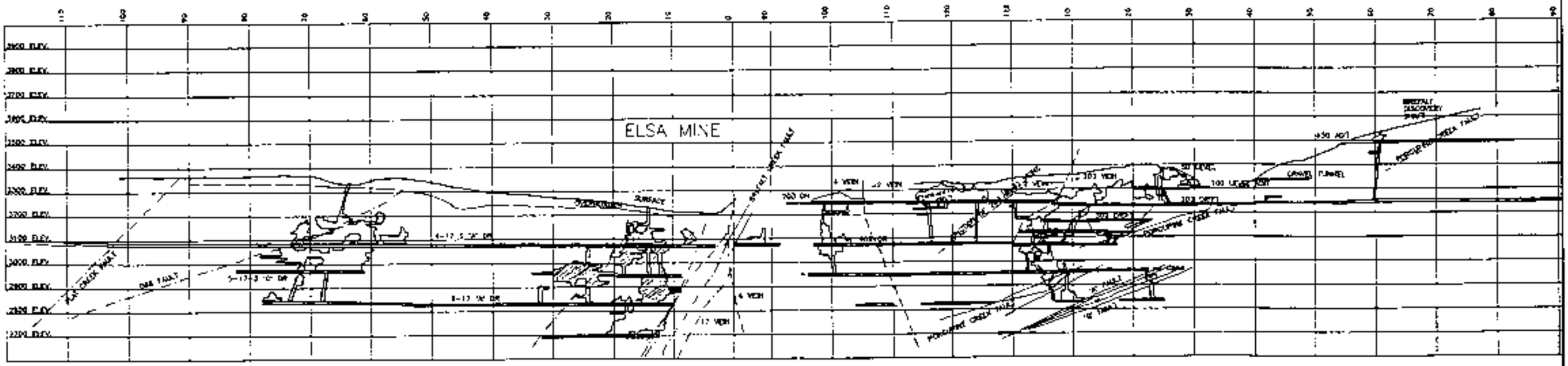
MINE WORKINGS

DIXIE MINE
PLAN

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: DIXIEPLN.DWG	DATE: 28/05/96
PLOTTED: +$\frac{0}{0}$+	DWG: 95DK28	FIGURE: 21





UNITED KENO HILL MINES LIMITED

MINE WORKINGS

ELSA AND DIXIE MINES

VERTICAL LONGITUDINAL SECTION - 203, 2, 4 & 17 VEINS

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: ELSAOOWL.DWG	DATE: 28/05/98
PLOTTED: [illegible]	DWG: 95UK30	FIGURE: 22

3.4.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available.

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

3.5 CORAL AND WIGWAM

3.5.1 Description

Access to the site is from the Elsa Townsite at the junction of Calumet Drive and Wernecke Road. Travel 6.9 km along Calumet Drive to the Hector Portal, switchback to the right (SW) and follow the Bermingham Road. A rough cat trail leads NW for 100 meters to the Coral-Wigwam Site. The Coral Wigwam mine site is at an approximate elevation of 1200m.

The site is on a Northwest facing slope, dipping at -20% overlooking the McQuesten Valley with an elevation of 1220m. It lies at the uppermost portion of Porcupine Gulch and all drainage is into Porcupine Creek. The site consists of an area 300m x 120m were the soils have been stripped off and pushed down-slope. The exposed bedrock has a series of backhoe trenches in it. The stripped material consists of a mixture of glacial till and quartzite & schist colluviurn stripped from the bedrock. The surrounding vegetation consists of stunted black spruce, willows, and alder with a floor covering of mosses, indicative of a permafrost environment.

Staked in 1921, by 1924 three shafts (one -8 m deep with a drift and crosscut off it) had been developed and approximately 7 tonnes of ore shipped. In the 1950's minor bulldozer trenching was done. In the 1980's the area was stripped and seven shallow (1-2 m) backhoe trenches dug and drilled with a percussion drill (PWGSC, 2000).

3.5.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 7.

An ortho-map of the site is provided in Figure 23 while a map created by the PWGSC and appended in the SRK report follows as Figure 24.

Table 7 Coral and Wigwam Closure Issues Matrix

Common Site Name: **Coral & Wigwam**
PWGSC site #: 5

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	477900.00	7086250.00	

General Location Description		Closure Issue Categories					
		Human & Wildlife Health and	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Shaft (west)		✔			✔		
Shaft (east)		✔			✔		
Northeast of Shaft #2					✔		

DRAFT

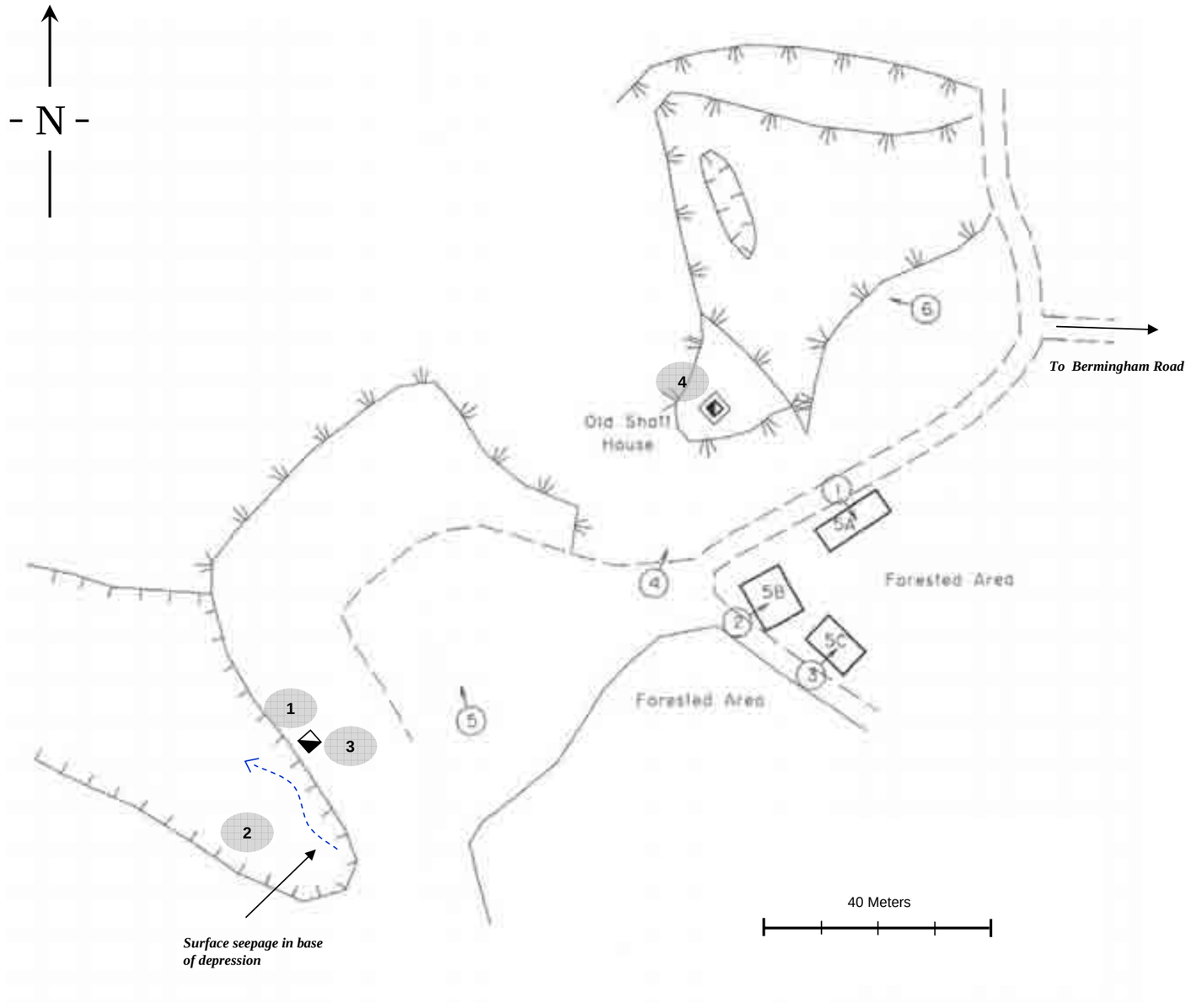
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 23 - CORAL & WIGWAM

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,490
FILE: Untitled.mxd		



#1 ***- Shaft #1 is open at surface, with no barrier to access. Timber cribbing is in good condition, and drift to southeast is clearly visible from top of shaft (Photo 1) and appears to be open. This feature represents a high intrigue risk.***

#2 ***-Stripping to southwest of Shaft #1 has formed a linear depression that appeared approximately parallel to the alignment of the drift, and that is free-draining downslope. No bedrock was observed in the depression.***

-The base of the depression appeared to be topographically lower than the bottom of the shaft. A trickle of seepage was observed at the upper (southeast) end of the linear depression; this seepage infiltrated into the soil in the base of the depression and no surface flow was observed leaving the depression.

#3 ***- A 3m x 5m area of subsidence was observed approximately 4m east southeast of Shaft #1.***

#4 ***-Shaft #2 is collapsed, with no evidence of original ground support. A 3m depression remains, with actively-ravelling walls formed of waste rock at approximately angle of repose (Photo 2). The depression contains a wooden ladder and various pieces of wood and metal debris, and represents a minor intrigue risk.***

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

SRK Consulting
Engineers and Scientists
VANCOUVER

ALEXCO

Job No: ALEX-06-ESP-05

Filename: Site5_Coral_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Coral & Wigwam Site #5

Date: Jan. 2007

Approved:

Figure: **24**

3.5.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available.

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.6 BERMINGHAM

3.6.1 Description

The Bermingham Mine complex is the largest open pit mine and the second to be mined by UKHM in the late 1970's. It comprises two open pits and underground workings.

There is one adit, the Bermingham 200 Adit, which has caved and has a wooden door to block access.

Level plans show that there were eight shafts associated with the Bermingham underground workings. Four of these daylighted within the larger Bermingham pit, and one in the smaller Bermingham Southwest pit. Rock sloughing from the pit walls has filled and covered most of these shafts, with the exception of the No. 1 on the northwest side of the main pit. This shaft is partially collapsed.

Two of the eight shafts are external to the pits. The Bleiler Shaft is located to the east of the main pit and extends about 40 feet in depth to a small underground working isolated from the rest of the underground development. The No. 2 shaft is located at the western edge of the Bermingham SW open pit (AMC, 1996a).

3.6.2 Closure Issues

The Bermingham area includes an open pit mine, relatively large pit rock waste dumps, a free draining adit, and a small associated adit rock waste pile. Chemical stability and dissolved metals in adit drainage appears to be the major closure issue. Also important is access to the pit and the adit. There are no buildings or equipment associated with the Bermingham open pit, but there are buildings at the adit.

There are no physical stability concerns associated with the mines. The only question that has been raised is regarding the tension cracks at the crest of one of the pit dumps as a result of some minor slumping at the toe. The risk of failure is low; these dumps have been in place for over 15 years with no evidence of failure. The consequence of a failure is minor; there are no water courses or public access roads immediately downslope of the dumps (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 8.

An ortho-map of Bermingham is provided in Figure 25. Maps for the Bermingham Pit Area and Ruby 400 Adit sites were created by the PWGSC and appended in the SRK report. These maps follow as Figures 26 and 27 respectively. Diagrams showing the site plan, composite plan and underground workings for the Bermingham Pit area and Ruby 400 Adit areas are presented as Figures 28 through 30.

Table 8 Bermingham Closure Issues Matrix

Common Site Name: **Bermingham**
PWGSC site #: 6

Site coordinates:	easting	northing	
	478701.59	7087187.56	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Bermingham Pit Area						
Bermingham Pit				✔		
Bermingham Pit (southeast bench)				✔		
Bermingham Pit (above southwest bench)			✔			
Bermingham Pit (south bench)				✔		
Creek entering Bermingham Pit from east			✔			
Between E side of Bermingham Pit and trail			✔			
Dump (west of Ruby shaft)				✔		
Dump / pit (north of Bermingham southwest shaft)			✔	✔		
Bermingham Pit (southeast bench)			✔			
Bermingham Pit (southeast wall)				✔		
Ruby shaft (next to shaft)	✔			✔		
Ruby shaft (skip location)	✔			✔		
Ruby shaft (area in front of shaft)	✔			✔		
Bermingham Adit			✔			
Bermingham Pit (northwest bench)	✔			✔		
Explosives magazine and Detonator House	✔					
Water shack	✔					
Residential buildings (2)	✔					
Older dump (northwest slope)				✔		
Ruby 400 Adit Area						
Ruby 400 Adit (near hot water tank on wheels)			✔			
Ruby 400 Adit (area in front of adit)			✔			
Ruby 400 Adit (adit drainage path to west)			✔			

Calumet Drive

Ruby 400 Adit Waste Rock Dump

Ruby 400 Adit

Bermingham Adit Waste Rock Dump

Bermingham Adit

Ruby Shaft

Bermingham Waste Rock Dump

Bermingham SW Open Pit

Bermingham Workings

Bermingham Open Pit

Older Bermingham Waste Rock Dump

DRAFT

EROC

ACCESS

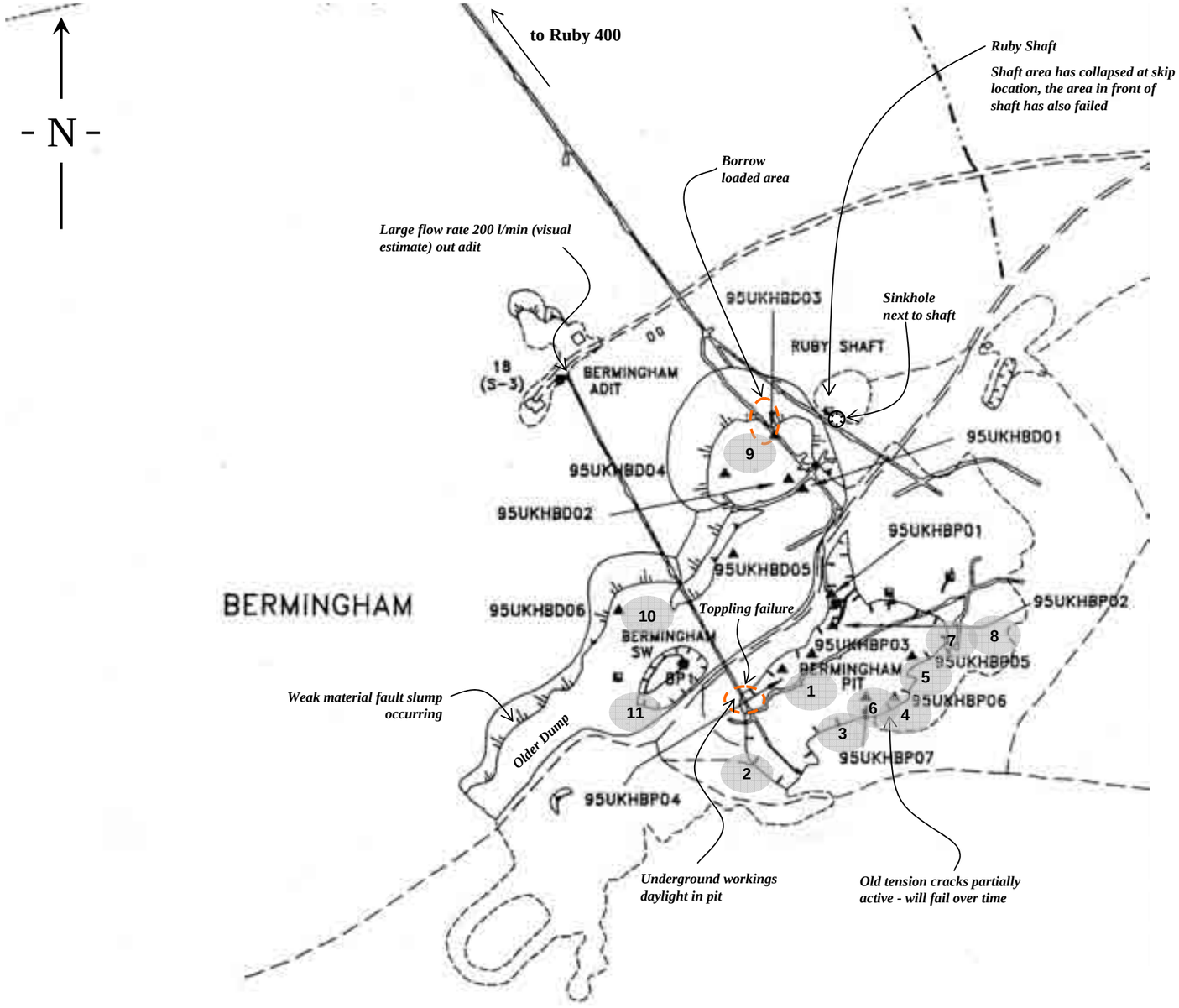
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 25 - BERMINGHAM & RUBY

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:4,852
FILE: Untitled.mxd		



#1 *No water was noted in the bottom of the pit.*

Pre-split blasting techniques were used. The faces look good in the southeast corner, but less so in other areas of the pit.

The SE slope area shows definite weaker rockmass conditions, the slope in this area is unravelling extensively.

#2 *In this area water is draining into the pit - low flow rate observed.*

#3 *The overburden material is creeping towards the pit. This will continue to creep slowly with each progressive freeze and thaw cycle. Some tension cracks are occurring.*

#4 *A larger potential failure is defined by tension cracks. This area is currently showing no signs of movement. This area will potentially fail over the long term.*

#5 *This area of the pit has very weak phyllite material. This material is expected to fail over the medium term.*

#6 *Large , old tension crack, which is showing signs of re-activation. This area will fail over the medium to longer term. This area may have slumped in the past*

#7 *There is a small creek running into the corner of the pit. The flow is fairly low. This water disappears below the failed/ravelled material at the toe of the bench face.*

#8 *This area may have slumped in the past; pools of water observed on surface at time of inspection.*

#9 *This dump does not have any berms along the dump crest*
- *No seeps were noted at the toe of the dump*
- *Old tension cracks exist above borrow dump*
- *The top of the dump profile is all over the place, sloped to both the north and the northeast*

#10 *Water collects all around dump/pit- does not run off to north*
- *Collected water on the dump drains back towards the SW pit*
- *An old tension crack occurs on the dump top*

#11 *The pit bottom is filled with water*
- *The weaker phyllite material around the pit is cracking and creeping (southeast wall).*
- *The pit is generally stable, but the walls in the weaker material are expected to break back over the medium term.*

General Comments

- *Some sections of dumps are a combination of weak and strong material*
- *some sections contain only phyllite waste*
- *For the longer term there is a need to assess the stability of the dumps in more detail*

200 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

SRK Consulting
Engineers and Scientists
VANCOUVER

ALEXCO

Job No: 1CA009.000
Filename: Site 6_Bermingham_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Bermingham Site #6
Bermingham Pit

Date: Jan. 2007
Approved:
Figure: **26**

#1 - Transformers removed

#2 - Kill zone between waste dump and roadway. No impacted vegetation observed below road.

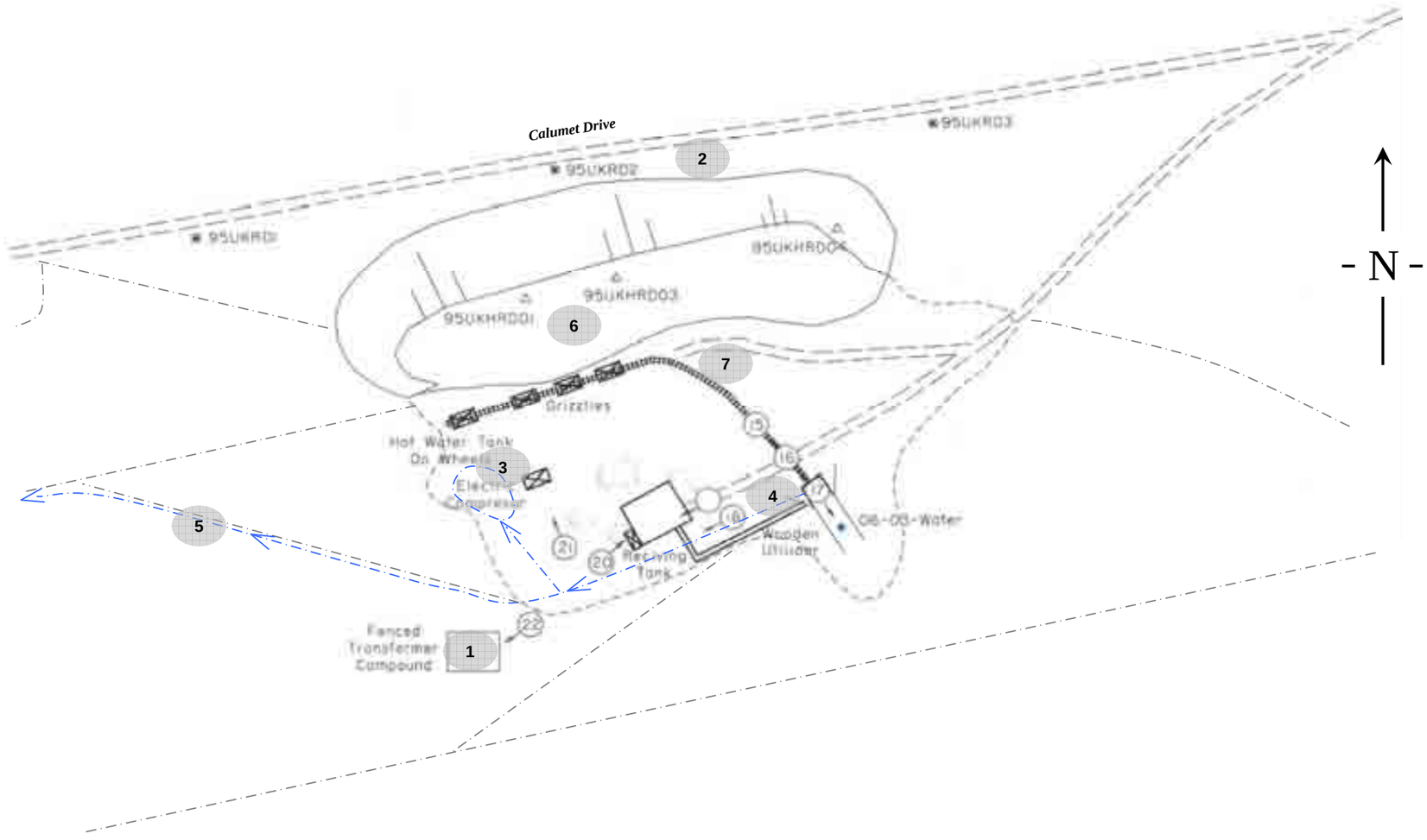
#3 - Adit drainage pooling on surface and infiltrating into waste rock. No surface outflow from pond at time of inspection.

#4 - Drainage from adit pools in front of adit. Infiltration occurs at this location, and surface runoff occurs to southwest along old roadway. Abundant light orange precipitate and minor green algae observed in flow.

#5- Adit drainage channelled along old overgrown trail. Reports to culvert crossing Calumet Drive; tracing flow downgradient indicated that this water probably ultimately reports to No Cash Creek. Flow infiltrates on slope below culvert, and does not report to No Cash Creek as surface flow.

#6- Minor light orange to yellow to rusty brown staining observed along runoff pathways on traffic surfaces

#7- Wooden structures beginning to deteriorate



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

SRK Consulting
Engineers and Scientists
VANCOUVER

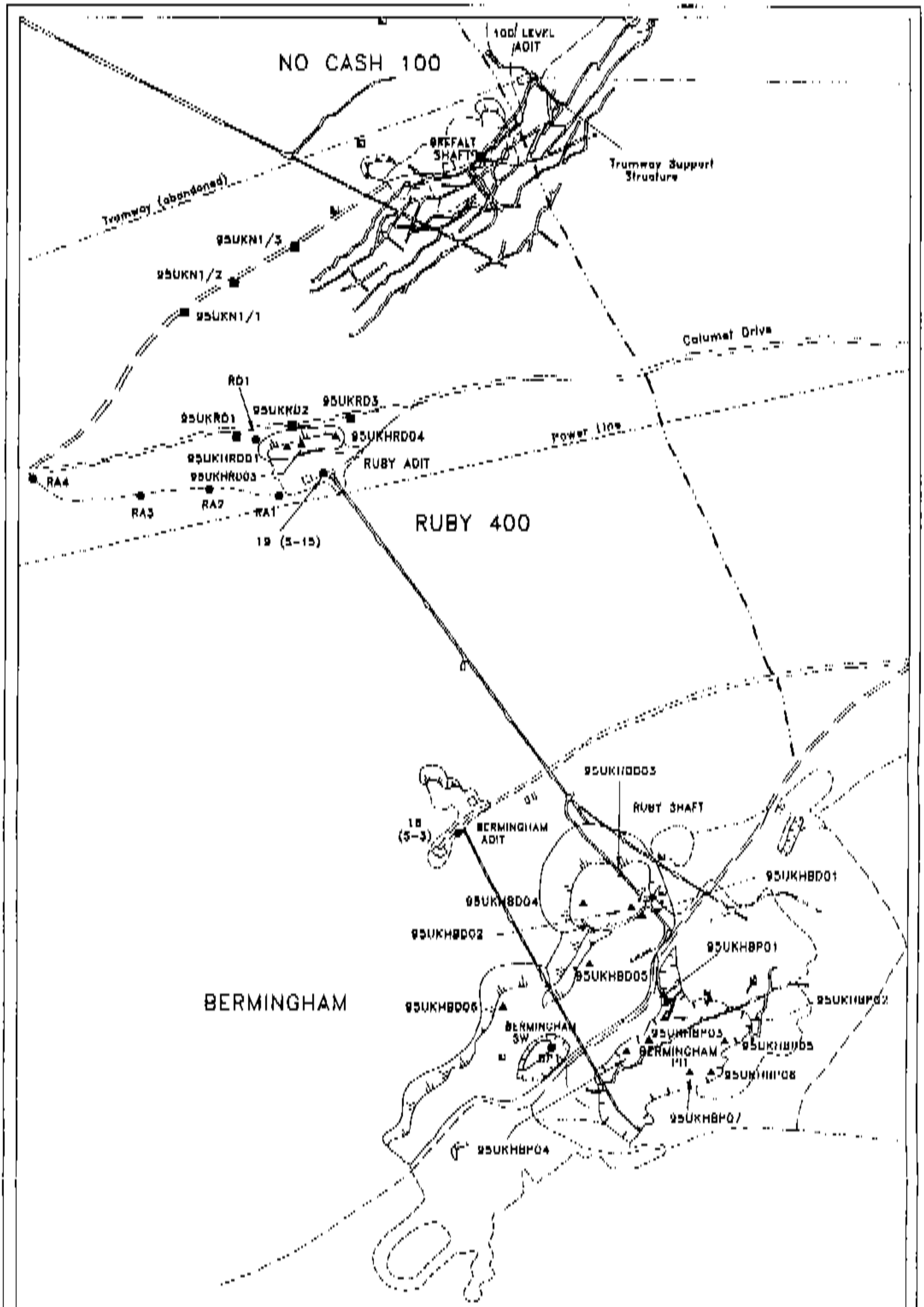
ALEXCO

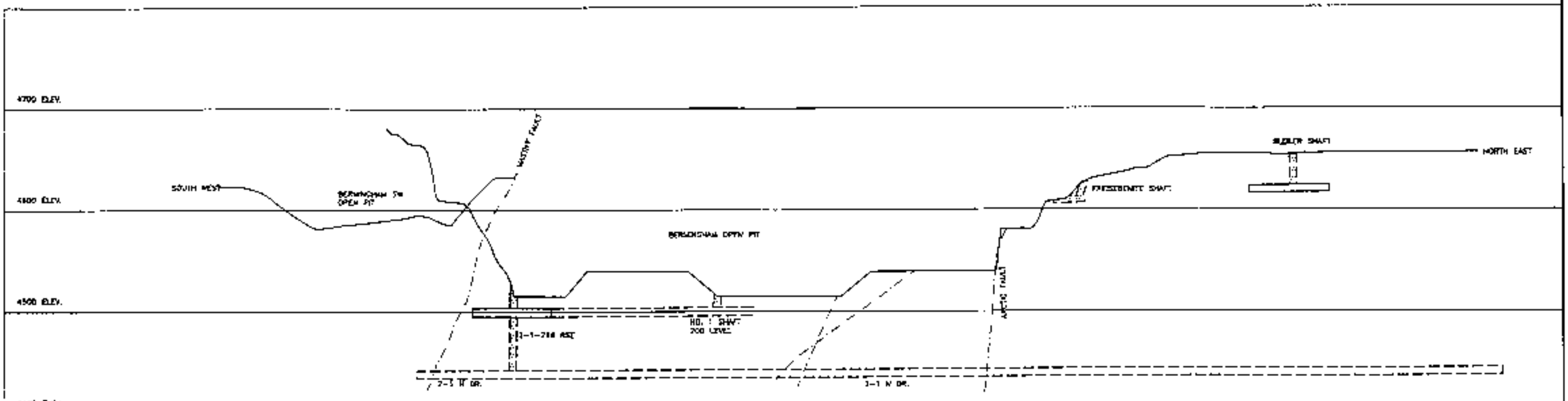
Bermingham &Ruby Site #6
Ruby 400 Adit

Job No: 1CA009.000
Filename: Site 6_Bermingham_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date: Jan. 2007
Approved:
Figure: **27**


NO CASH 100
100' LEVEL ADIT
OFFALT SHAFT
Tramway Support Structure
Tramway (abandoned)
95UKN1/3
95UKN1/2
95UKN1/1
Calumet Drive
RD1
95UKRD3
95UKRD2
95UKRD1
95UKHRD04
Power Line
95UKHRD01
RUBY ADIT
95UKHRD03
RA4
RA3
RA2
RA1
19 (5-15)
RUBY 400
95UKHBD03
RUBY SHAFT
18 (5-3)
BERMINGHAM ADIT
95UKHBD01
95UKHBD04
95UKHBD02
95UKHBP01
95UKHBD05
BERMINGHAM
95UKHBD06
95UKHBP02
BERMINGHAM SW
95UKHBP03
95UKHBD05
BERMINGHAM NW
95UKHBP06
95UKHBP07
95UKHBP04
LEGEND
Soil test pit with pleasometer
Waste rock sample
Water quality sample site
Vegetation area
Building
Power Line
Telephone Line
Highway #11
Road
Trail
Stream or River
Underground Workings
Open pit, trench
Waste rock dump
Tailings area
Adit entrance
Shaft location
UNITED KENO HILL MINES LIMITED
NO CASH, RUBY, and BERMINGHAM
SITE PLAN
Access mining Consultants Ltd.



UNITED KENO HILL MINES LIMITED

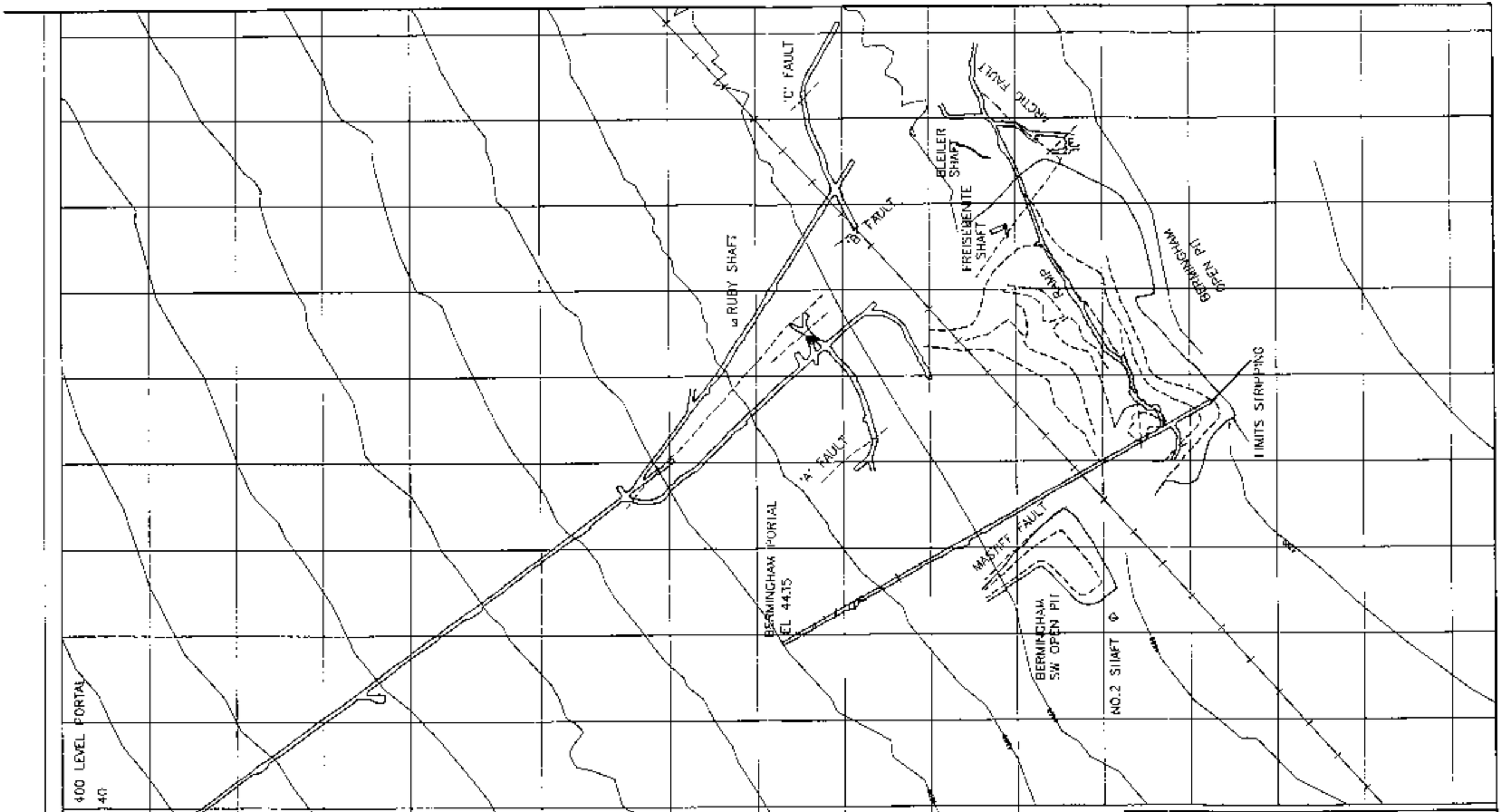
MINE WORKINGS

BERMINGHAM

VERTICAL LONGSECTION (Looking Northwest)

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: RBLONG.DWG	DATE: 28/05/96
PLOTTED:	DWG: 95UK50	FIGURE: 29



UNITED KENO HILL MINES LIMITED		
MINE WORKINGS RUBY - BERMINGHAM COMPOSITE PLAN		
ACCESS MINING CONSULTANTS LTD.		
SCALE: NONE	FILE: RB-BASE.DWG	DATE: 26/05/98
PLOTTED:	DWG: 98UK49	FIGURE: 30

4700 ELEV.

SOUTH EAST

NORTH WEST

BERMINGHAM

PIT

4600 ELEV.

VEIN ZONE

FAULT

4500 ELEV.

NO.1 SHAFT 200 LEVEL

2-1-266 RSE

TO PORTAL

2-1 N DR.

BERMINGHAM 200 ADIT

4400 ELEV.

UNITED KENO HILL MINES LIMITED

MINE WORKINGS

BERMINGHAM MINE

CROSS SECTION (Looking Northeast)

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: 95BXSEC.DWG	DATE: 95/05/95
PLOTTED:	DWG: 95UK51	FIGURE: 31

3.6.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.7 NO CASH

3.7.1 Description

The No Cash underground mine was mined from two levels; initially from the 100 level, and then from the 500 level.

Access to the mine at the 500 level was via the 500 level adit. The portal is blocked by metal doors. The only other opening to surface from the No Cash Mine is a raise near the Brefalt shaft. There are no records of closure of this raise, and it is assumed that some reclamation will be required.

The No Cash Mine is drained at the 500 level. Water from the adit is discharged to No Cash Creek via a culvert through the waste dump at the portal. Recharge to the No Cash Mine is primarily from groundwater, enhanced by connections to other underground workings. It is understood that there is a hydraulic connection to the Calumet Mine via the Jock Fault (AMC, 1996a).

3.7.2 Closure Issues

No Cash 500 adit discharge is the second largest metal load discharging from underground in the district. Despite this, the dissolved zinc load does not appear to be reaching the environment. It appears to be adsorbed or precipitated by surface processes. If this can be shown to present no risk to the environment, then the process

should be allowed to continue as a truly passive treatment. Once established as effective at No Cash, this mechanism can be counted on to provide a buffer between all uphill discharges and the receiving aquatic environments in similar environments (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 9.

An ortho-map of No Cash is provided in Figure 32. Maps for the Level 500 and Level 100 sites created by the PWGSC and appended in the SRK report follow as Figures 33 and 34 respectively. Diagrams showing the site plan, composite plan and underground workings are presented as Figure 35 through 37 respectively.

Table 9 No Cash Closure Issues Matrix

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
500 Level Adit						
Garage	✔					
Bare waste rock area (E side)		✔	✔			
500 Adit			✔	✔		
No Cash 500 Creek square timber culvert	✔		✔	✔		
Waste rock dump			✔			
Area where No Cash 500 Creek flows past waste rock dump			✔	✔		
East side of railway tracks				✔		
Cribed log retaining wall along East side of overburden dump				✔		
500 Adit (along current and former flowpaths of adit discharge)		✔				
100 Level Adit						
Waste Rock pile (upper end of Sandy Creek Drainage)	✔	✔		✔		
100 Level adit portal	✔			✔		
Shaft (south of abandoned tramway, north of Bretall shaft dump)				✔		
Along Star Creek channel at Calumet Drive			✔			

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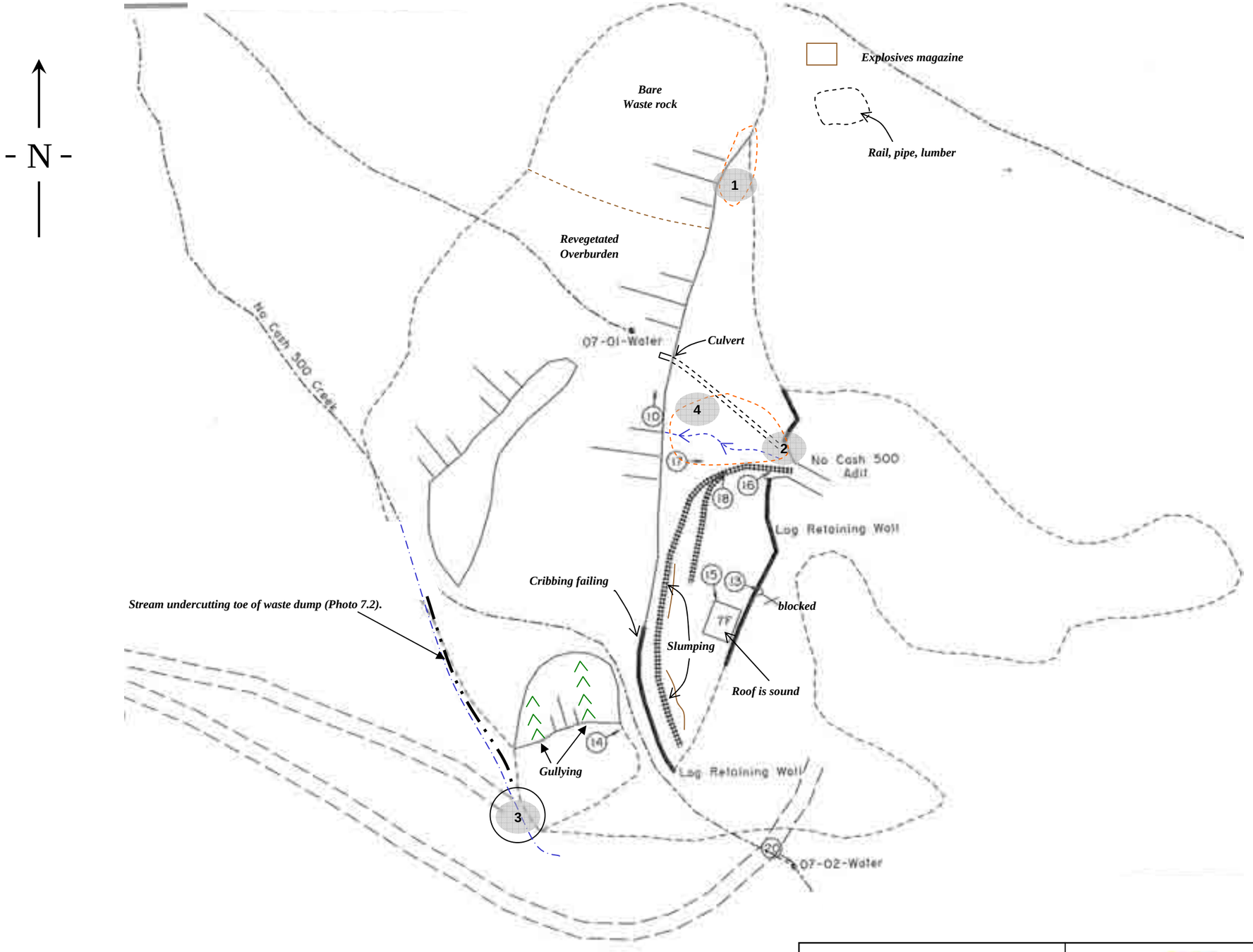
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 32 - NO CASH 100 & NO CA

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:3,839
FILE: Untitled.mxd		



#1 - Pale yellowish and orangey dark brown staining isolated clasts
- Flow path (dry) marked by pale yellow stain

#2 - Blockage inside of adit is causing part of flow to direct away from culvert and flow over crest of dump

#3 - Square timber culvert is partially collapsed, and adjacent mine waste has been partially eroded, leading to reduced lateral support (Photo 7.1).

#4 - Area of orange staining on dump surface along current and former flowpaths of adit discharge

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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ALEXCO

No Cash - 500 #7

Job No: 1CA009.000

Filename: Site 7-No Cash 500_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007

Approved:

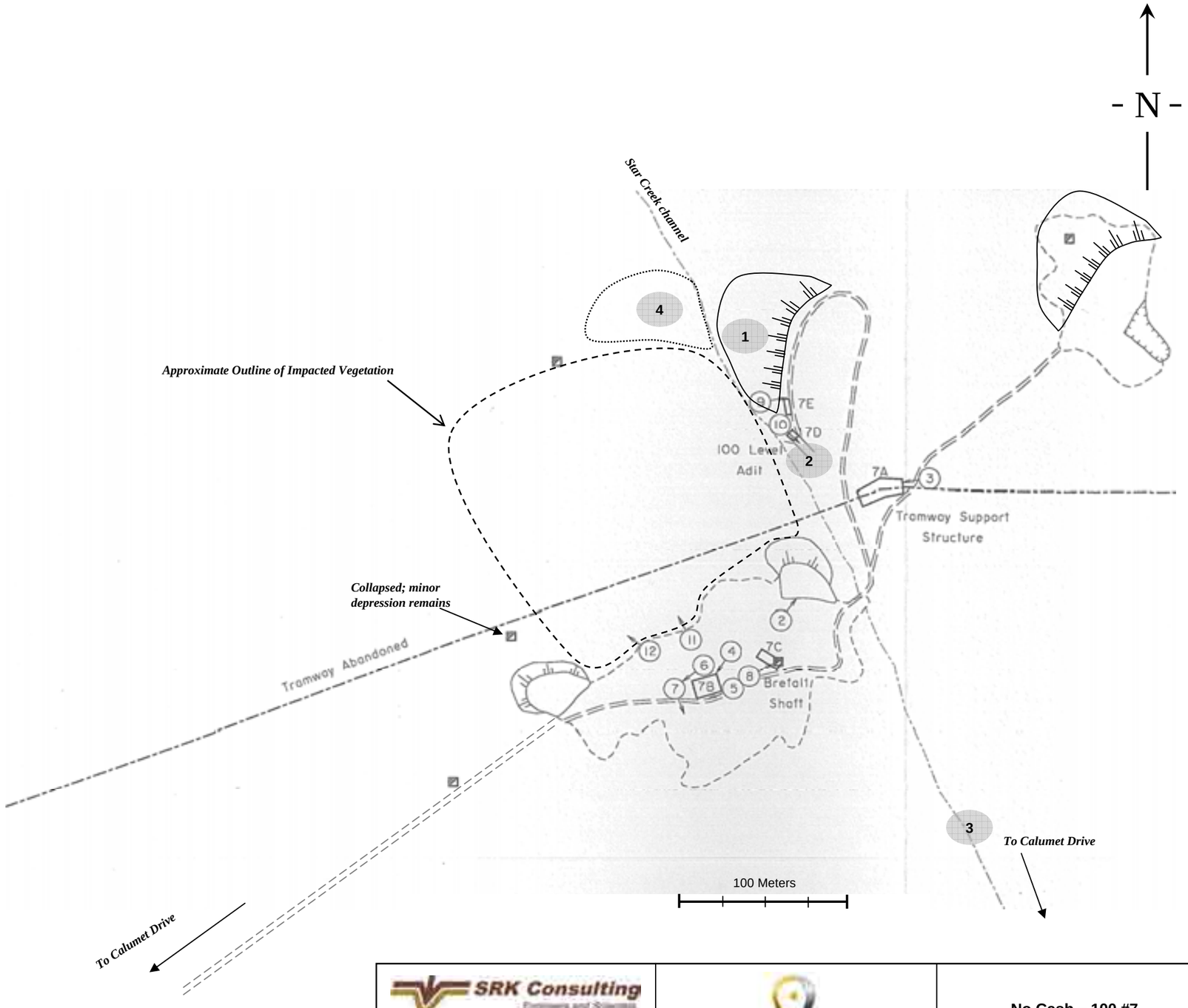
Figure: **33**

#1 - Waste rock pile from No Cash 100 adit not previously noted. Contains remnants of trestle structure- no rails observed in place. Rail and other metal debris observed at toe.
- Waste rock spills into adjacent valley that forms the upper end of the Sandy Creek drainage. No surface water observed in flow path adjacent to 100 adit waste dump at time of inspection (Sept. 2005).
- Waste rock does not block flow path

#2 - 100 level portal not secure. Timber support is failing, but access is not restricted, and structure remains a hazard. Access to workings may be possible.

#3 - Drainage observed along Star Creek channel at Calumet Drive visually estimated at 2 L/second. No surface flow in Star Creek channel was observed upstream of channel crossing at No Cash 100 site or at any location within the site. It is likely that this water enters the workings and reports to No Cash 500 adit.

#3 - Area of additional stripping, minor test pitting/ trenching observed



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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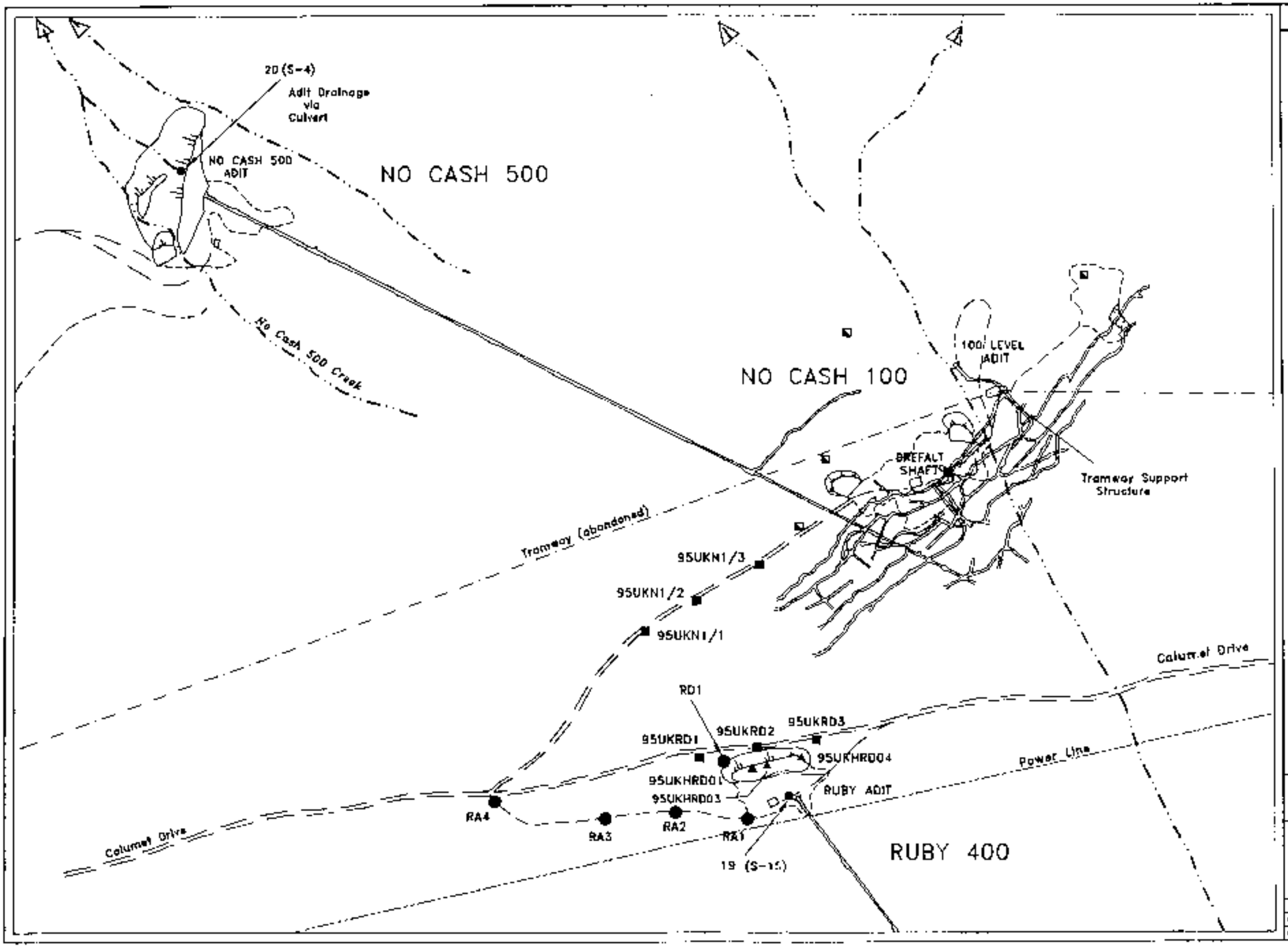
ALEXCO

No Cash – 100 #7

Job No: 1CA009.000	**Baseline Environmental Report, United Keno Hill Mines Property**	Date: Jan. 2007	Approved:	Figure: **34**
Filename: Site 7-No Cash 500_20070131.ppt			



LEGEND

- Soil test pit with piezometer
- Waste rock sample
- Water quality sample site
- Disturbed area
- Building
- Power Line
- Tramway Line
- Highway #11
- Road
- Trail
- Stream or River
- Underground Workings
- Open pit, trench
- Waste rock dump
- Tailings area
- Adit entrance
- Shaft location

UNITED KENO HILL MINES LIMITED

NO CASH and RUBY

SITE PLAN

Agassiz Mining Consultants Ltd.

LEGEND

LEVEL ELEV. -RAIL (IN FEET)

100 LEVEL – 3870
200 LEVEL – 3740
300 LEVEL – 3429
500 LEVEL 3415
FAULT - - - - -

* NO CASH FAULT - CORRELATED WITH JOCK FAULT AT HECLA - CALUMET.

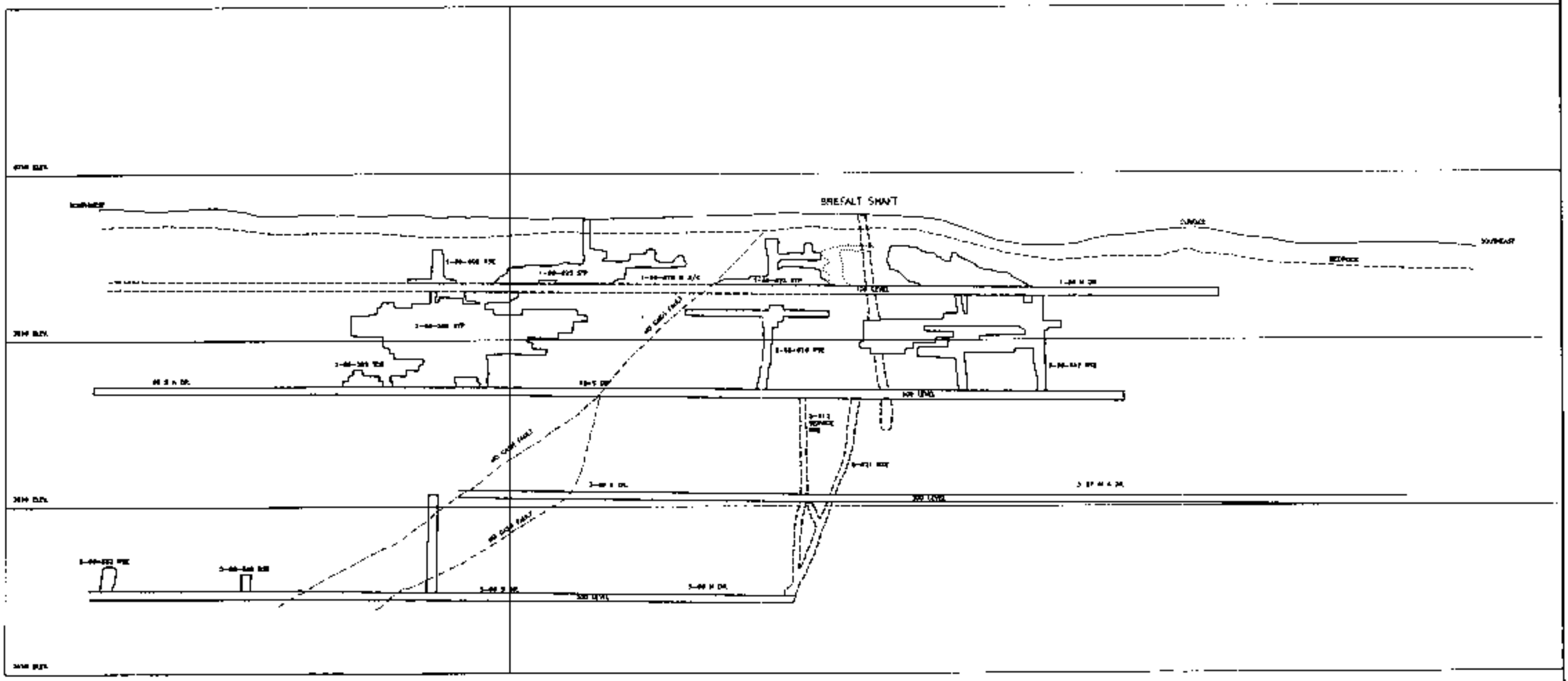
UNITED KENO HILL MINES LIMITED

MINE WORKINGS

NO CASH MINE
COMPOSITE PLAN - 53, 56 & 67 VEINS

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: NCCOMP.DWG	DATE: 28/05/98
PLOTTED:	DWG: 95UK45	FIGURE: 36



UNITED KENO HILL MINES LIMITED		
MINE WORKINGS NO CASH MINE - 86 VEIN VERTICAL LONGITUDINAL SECTION (Looking Northwest)		
ACCESS MINING CONSULTANTS LTD.		
SCALE: NONE	FILE: NC86LONG.DWG	DATE: 28/05/96
PLOTTED: 4:4	DWG: 95UK46	FIGURE: 37

3.7.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.8 BETTY

3.8.1 Description

Access to the site is from the Elsa village, along Calmut Road, crossing over porcupine gulch and taking a left turn onto the No Cash 100 Road. Old trailheads extend northeast from the No Cash mine towards the Betty mine site.

The Betty mine is located on the upper northwest slope of Galena Hill at an elevation of approximately 1200 metres above sea level. The claim is located just east of Sandy Creek, which flows towards the wetlands northeast of the Elsa Tailings.

Vegetation in the area consists of stunted black spruce, willows, and alder with a floor covering of mosses, indicative of a permafrost environment.

The Betty mine site was in operation in the 1920's and 1930's. The trench and shafts were hand shovelled, indicating that heavy equipment was not used. Very little information is available on the history of [the] Betty mine site (PWGSC, 2000).

3.8.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 10.

An ortho-map of Betty is provided in Figure 38. A map for this site created by the PWGSC and appended in the SRK report follows as Figure 39.

Table 10 Betty Closure Issues Matrix

Common Site Name: **Betty**
PWGSC site #: 8

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	479152.00	7088707.00	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Collapsed cabin and shed	✔			✔		
Trench (S of collapsed cabin and shed)	✔		✔			
Shaft - one of two				✔		
Pits dug in muskeg near shaft area (on trail leading to No Cash 100 mining area)				✔		

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KENO HILL SILVER DISTRICT

CLOSURE ISSUES

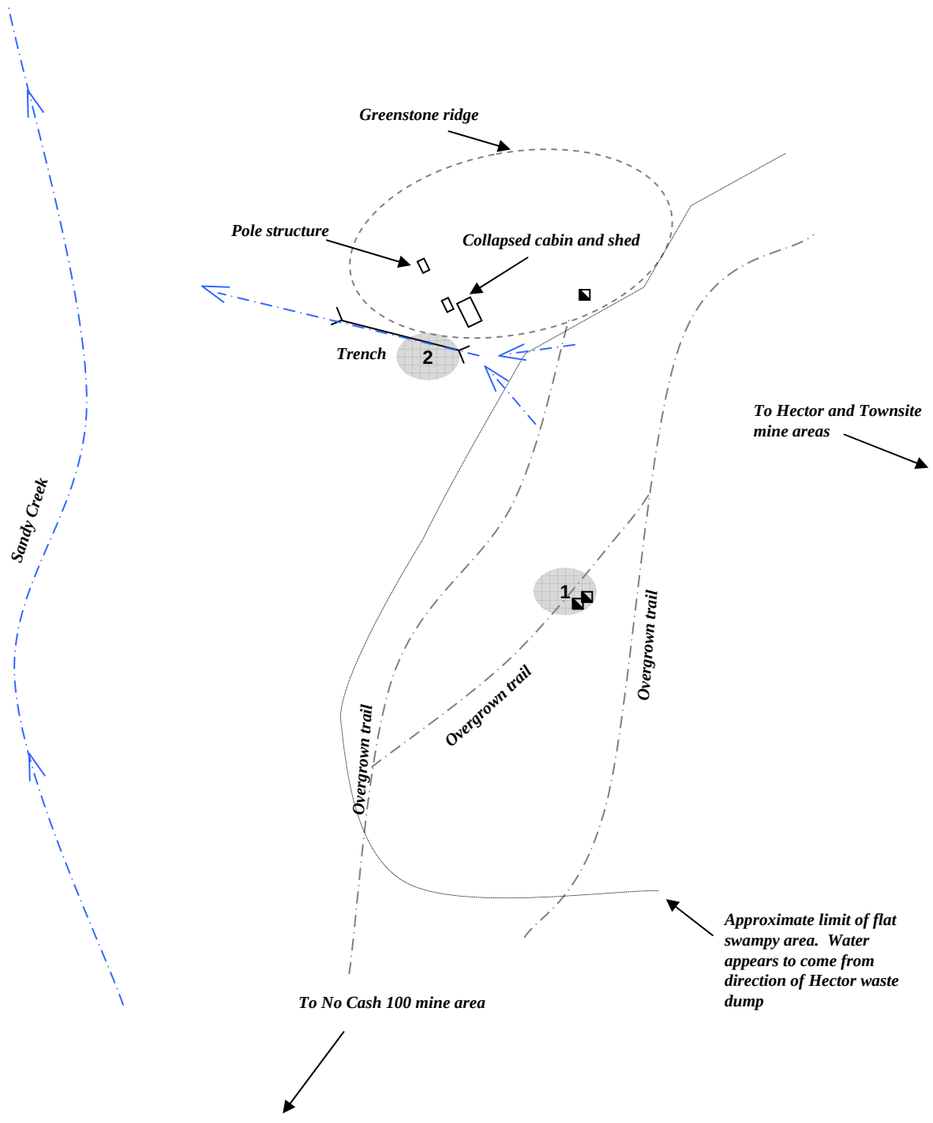
FIGURE 38 - BETTY

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,305
FILE: Untitled.mxd		

#1 - Two 3 m x 3 m openings in muskeg, 1.5 m deep, with exposed mineral soil on margins. Waste rock pile adjacent to SW shaft approximately 0.5 m high x 5 m x 8m; composed of dark grey quartzite and minor quartzite breccia with siderite veining, with minor orange to dark rusty brown staining.
- Little vegetation growing on waste pile- 10% coverage.
- Size of openings may be due to be regressive thawing of permafrost. Standing water (0.3 m) present in both holes, and bottoms felt solid when probed with a stick.

#2 - Trench contains greenstone rubble, with water flowing through the rubble. Appears to collect water from flat swampy area to southeast and channel the water towards Sandy Creek.
- Trench is overgrown with willows and is difficult to identify.



0 50 100 150

approximate scale (metres)

Aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

SRK Consulting
Engineers and Scientists
VANCOUVER

ALEXCO

Betty Site #8

Job No: ALEX-06-ESP-05
Filename: Site8_Betty_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date: Jan. 2007
Approved:
Figure: **39**

3.8.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.9 HECTOR CALUMET

3.9.1 Description

The Hector-Calumet mine workings are probably the most extensive workings on Galena Hill, and include three open pits mined in the mid 1980's and the older Hector-Calumet underground workings. Just over half of the Company's total silver production has come from the Hector-Calumet mine.

The Hector Calumet workings are clearly very extensive and close to surface, it is reported that there was considerable backfilling, using waste rock generated underground, and thus subsidence to surface is not a concern.

There is one portal, at the 400 level, which remains open. The portal is supported by timber and concrete and appears stable. Access is limited by doors at the portal.

There is a significant amount of waste rock at the 400 portal; estimated at about 200,000 tons. Some of this was used as fill and road construction around Calumet, and for foundations for the aerial tramway terminus. The remainder is deposited at the portal. The tramway was used to transport ore from Hector-Calumet to the mill. Most of the Calumet tramway station has been demolished or burned, although some wood and debris remains, as does the cribbing for the foundations.

There are two shafts at the Calumet workings. Both are reported collapsed, but this must be confirmed. It appears from old drawings and plans that there may be additional shafts and raises to surface associated with the older workings, which will be investigated.

The Calumet 1-15 is the second largest pit mined by UKHM, and was mined to recover the crown pillars of the No.1 and No.15 veins. There are two waste dumps associated with the open pit, comprising about 1,000,000 tons of waste rock. The Hector Pit (also called the No. 1 Vein pit) and the 4-11 pit are smaller, with the 4-11 “pit” being a large stripped area and a series of trenches adjacent to the Hector pit, about 600 feet to the west south-west. The 4-11 area was stripped to sample veins, and then a backhoe was used to mine a short, narrow section of ore material. The open pits are connected to the underground workings through either old raises or fault structures and thus are not expected to flood.

The composite plan also shows the very small Calumet “C” pit which was mined in 1981. The pit is, in fact, a small shallow slot which is filled with water.

There was a significant amount of infrastructure at the Hector-Calumet during the peak years of operation, that is, from 1948 through to 1972. A townsite was built, although all of the buildings and structures have since been removed. There was also a steam power plant operating at the 400 level, which explains the residual coal and ash evident in the lower section of the waste dump.

During operation, the mine was dewatered from the 400 level adit. The water discharged on to the hillside downslope from the adit, flooding the area with water and silt, and resulting in the dead trees still evident today. There has been no drainage from the Hector 400 adit since mining ceased in October of 1972. It is understood that the underground water reports to the Galkeno workings. Review of the operations reports from the shaft development period (1953/54) shows that the Hector shaft was essentially dry with the exception of two areas:

- At about 940 ft. depth, the Hector fault was encountered resulting in "...water problems";
- Between the 1165 and 1300 levels heavy water inflows were encountered (Aug. 2, 1954), with recorded flows of up to 100 gallons per minute.

Development was finished in October of 1954 and it was reported that "water flow continues undiminished." It is expected that, after the mining of the Hector underground was finished in 1972, the drainage from underground may have reported ultimately to the Galkeno 900 Adit (AMC, 1996a).

3.9.2 Closure Issues

Hector-Calumet was a large mine with extensive underground workings and several pits and rock waste dumps. The underground does not discharge to surface and thus the major potential chemical issue appears to be the rock dump at the portal. There is some vein material in the waste rock, albeit a small percentage of the total mass, which could be a contaminant source. However, since there are no surface waters immediately downstream of the dump which show an adverse impact, the shallow groundwater monitoring data will be required, in conjunction with the kinetic testing results, to determine if there is a contaminant loading concern from the dump.

There are several unresolved potential safety issues regarding underground openings. Considerable site clean up is necessary (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 11.

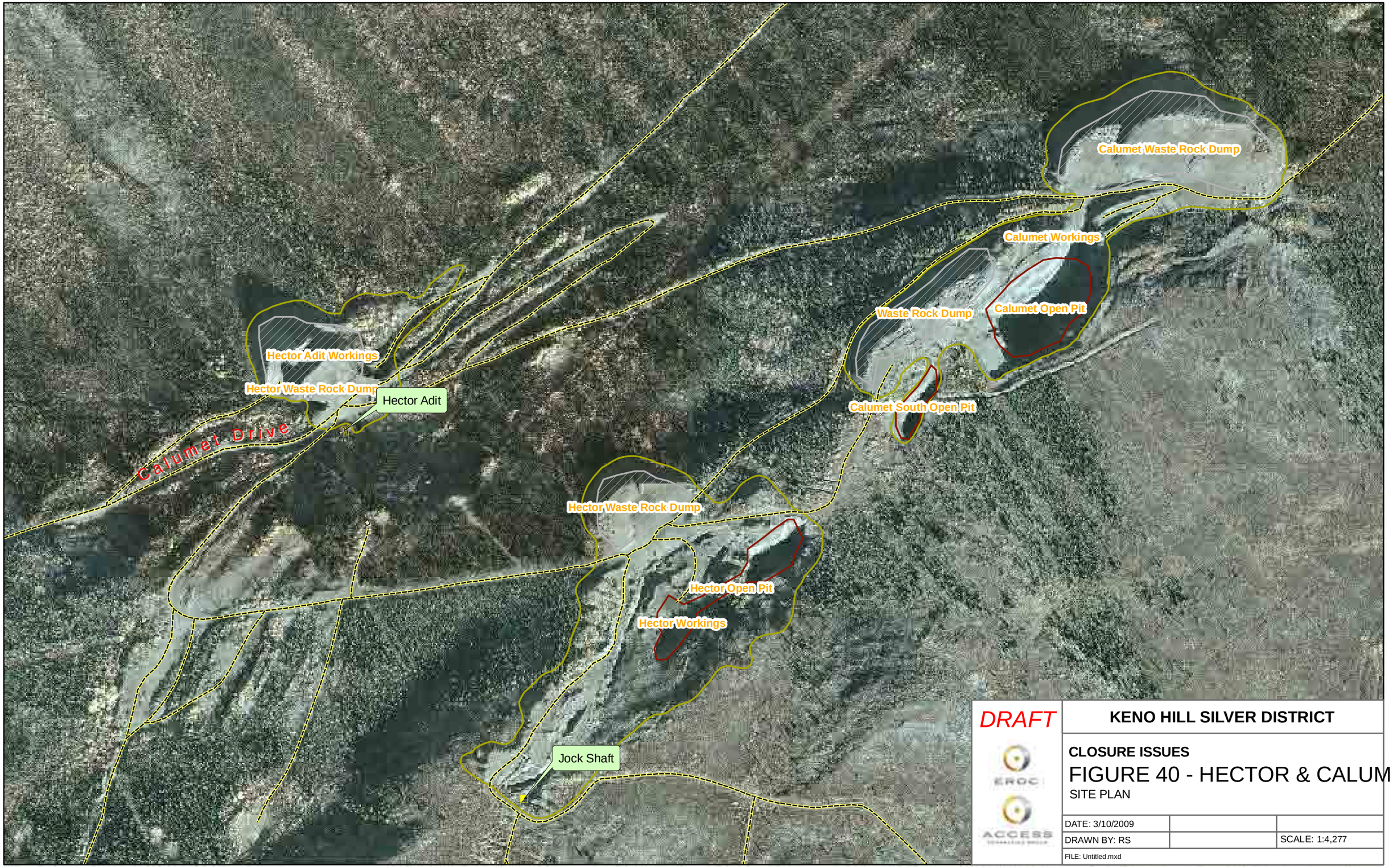
An ortho-map for Hector-Calumet is provided in Figure 40. A map for this site created by the PWGSC and appended in the SRK report follows as Figure 41. Diagrams showing the site plan, underground workings, and cross-section are presented as Figures 42 through 45.

Table 11 Hector-Calumet Closure Issues Matrix

Common Site Name: **Hector Calumet**
PWGSC site #: 9

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	480900.00	7088300.00	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Calumet Pit (intersection of footwall and vent)				✔		
Calumet South Pit				✔		
South of Calumet South Pit				✔		
Hector Pit (upper sides - N end)				✔		
Hector Pit (upper sides - S end)	✔			✔		
<100m E of Jock Shaft	✔		✔	✔		
Hector Pit dump site			✔	✔		
Hill S of Hector Pit dump site			✔	✔		
General site Issue - rain water influence		✔	✔			



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KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 40 - HECTOR & CALUMET

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:4,277
FILE: Untitled.mxd		

#1 *This dump appears to be stable*
- *No tension cracks observed*
- *This is a high dump but the topography below the dump face is fairly flat*

#2 *Pit has intersected old workings*
- *Footwall side of the vein seems to be finer grained and weaker; at the intersection of the footwall and the vent raises, this material is unravelling extensively*
- *Subsidence is occurring in the material in the bottom of the pit*
- *There are a number of tension cracks around this pit, these do not fully delineate failures. These are not currently active but these areas are expected to continue unravelling.*
- *Large slabs coming off the bench faces*

#3 *This is a small excavation*
- *No water was noted in the bottom of the pit.*
- *The western slope of the pit is unravelling substantially.*

#4 *A new sinkhole has formed since the previous review. The dimensions are 4 m x 3 m and 2 to 3 m deep.*

#5 *Upper sides are steep, these are slabbing and unravelling. This is expected to break back on the order of 10-15°*
- *no water was noted at the bottom of the pit*
- *no large failures are anticipated*

#6 *Crack 4 m back from the pit crest*
- *this is an early feature and is not currently active*
- *the bottom of the pit has an open excavation to the underground*

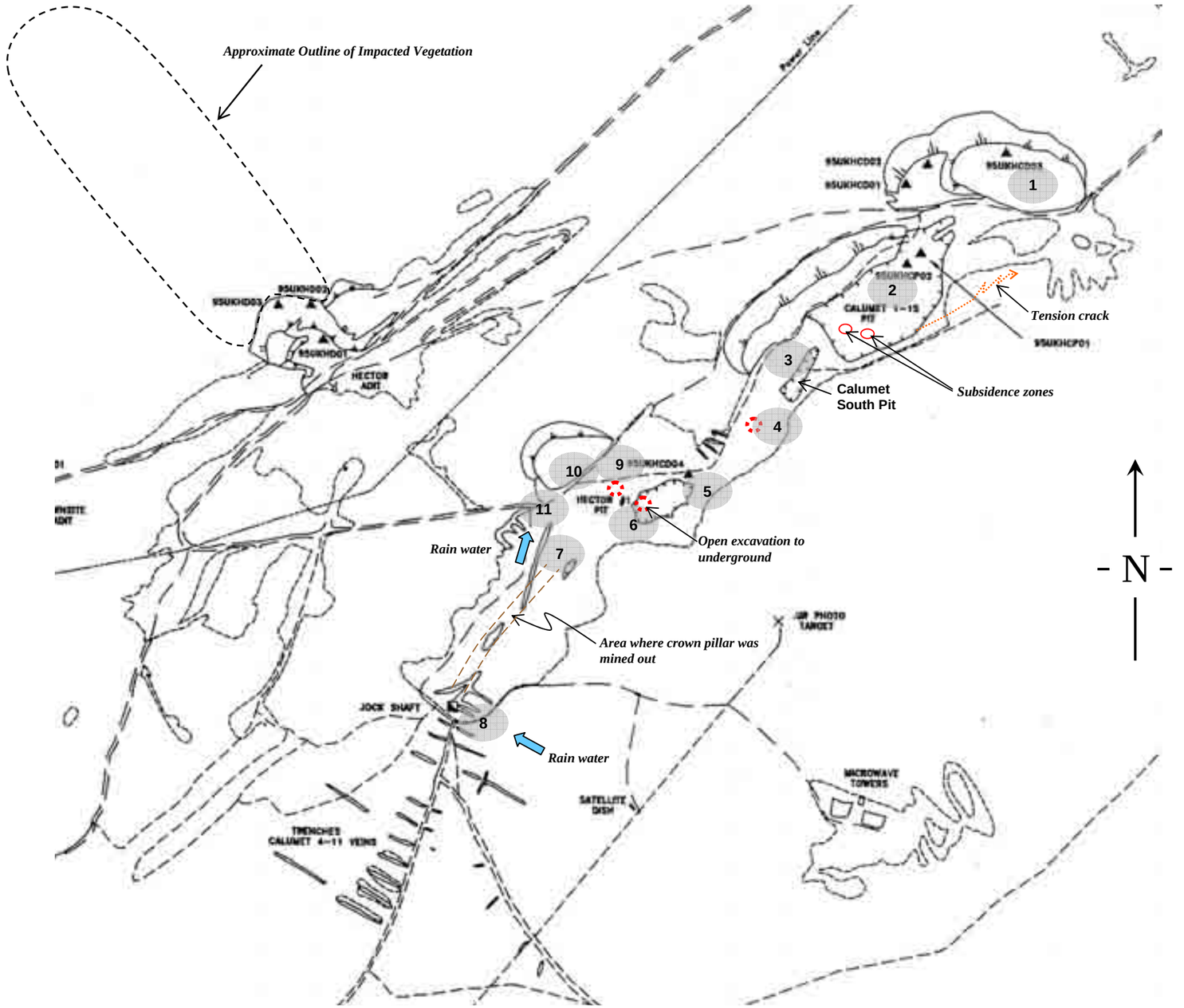
#7 *Trenching and ore extraction along the previous crown pillar intersected a number of raises as indicated by large quantity of timber in the trenches.*

#8 *No sign of shaft; crown pillar mined out.*
- *All the water from top of hill is channelled by a vein exploration trench into main crown pillar mining trench. The majority of this water likely ends up underground.*

#9 *Possible raise to surface.*

#10 *Old tension-cracks back from face*
- *on dump crest new some fairly recent tension cracks were observed, this dump appears to consist of a combination of fine and coarse material, which makes this dump less stable.*
- *the face is eroding and steepening up – <u>this is a higher risk dump</u>*
- *the dump has a poor upper profile and pools of water are occurring on the top of the dump*

#11 *All the water from the hill drains down and is channelled over the dump. Erosion is cutting a wide v-trench in the fine material on the dump face. This dump will become unstable over the longer term.*



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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VANCOUVER

ALEXCO

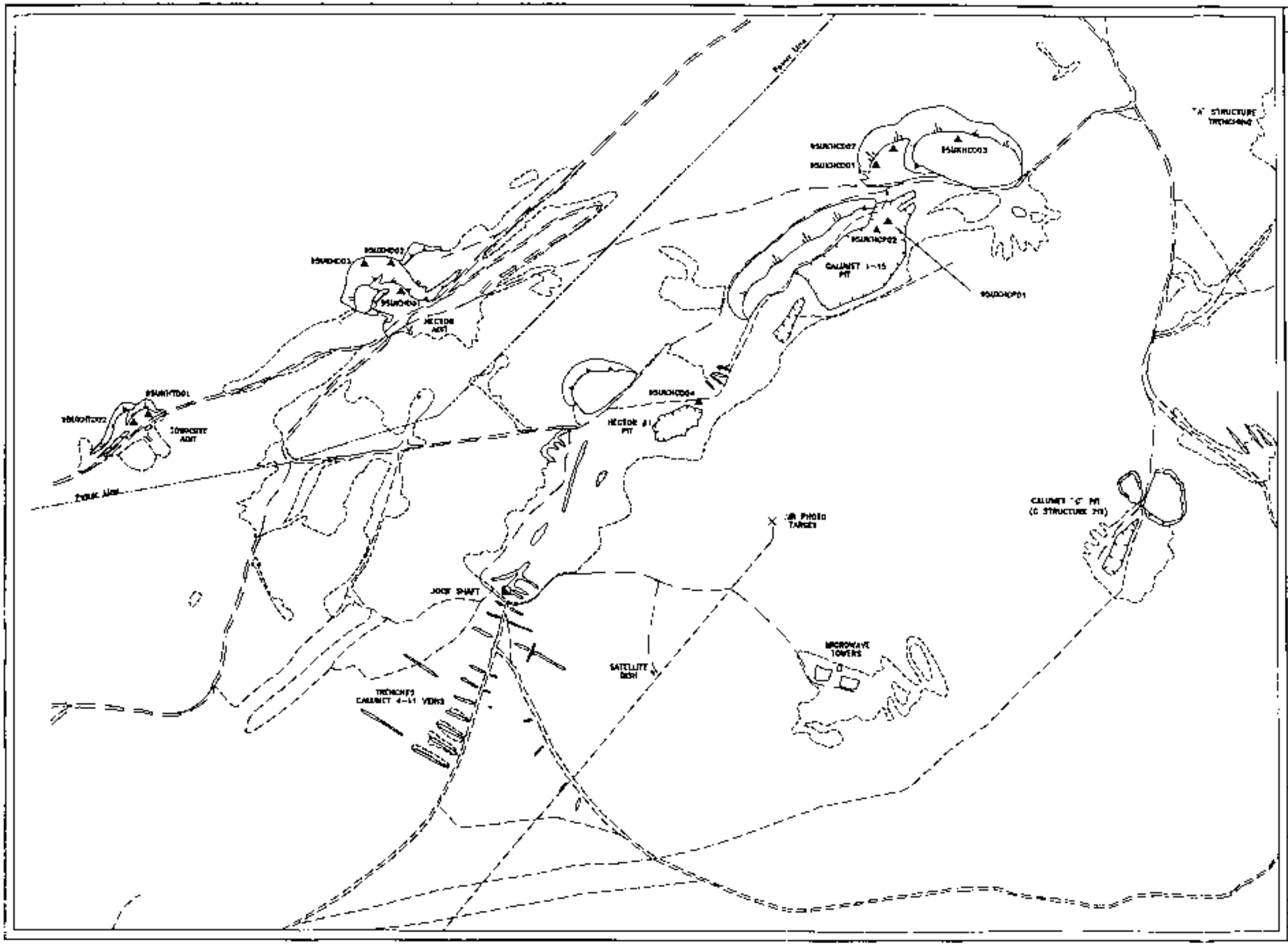
Hector Calumet Site #9

Job No: 1CA009.000

Filename: Site 9_Hector_Calumet_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007 | Approved: | Figure: **41**



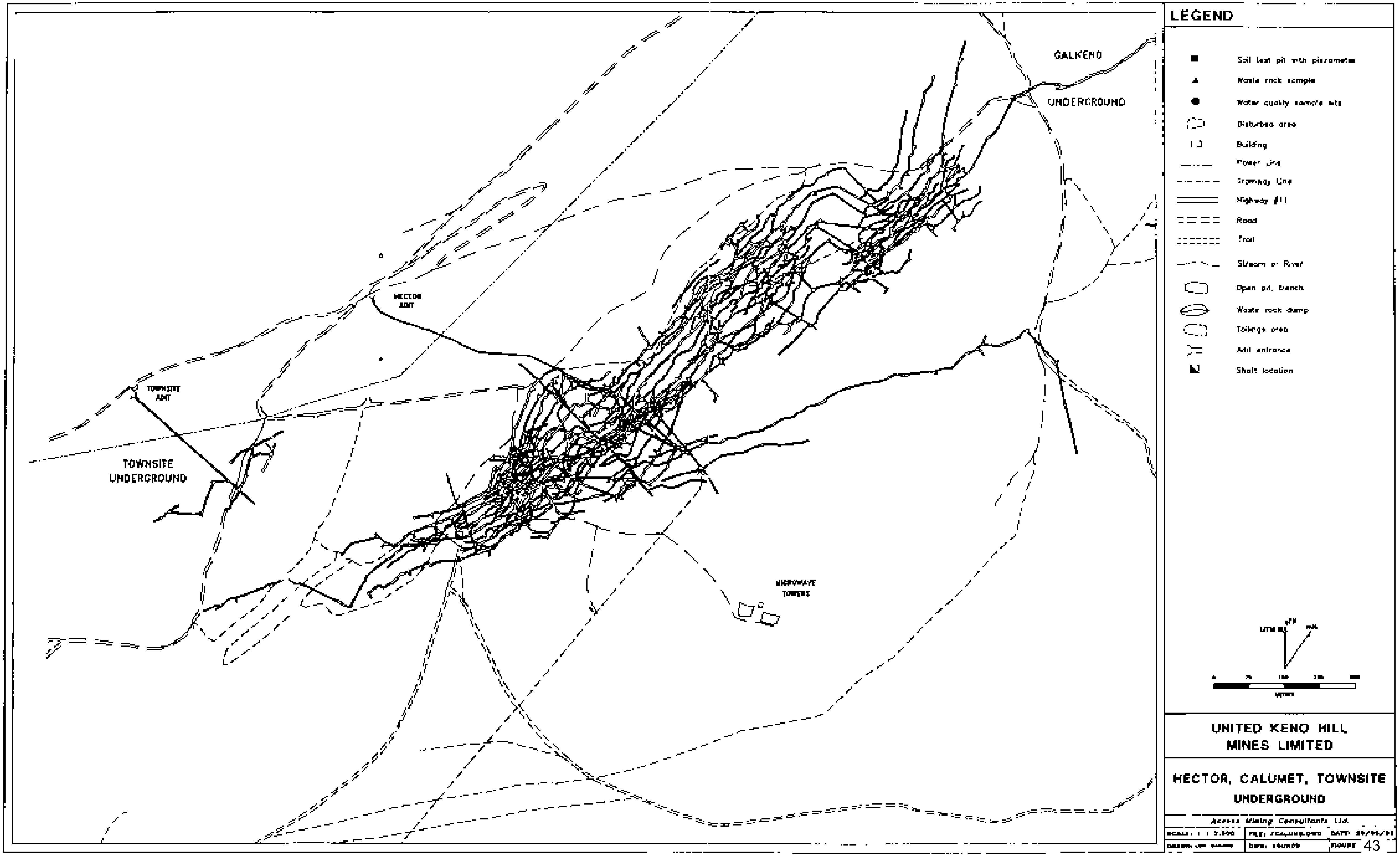
LEGEND

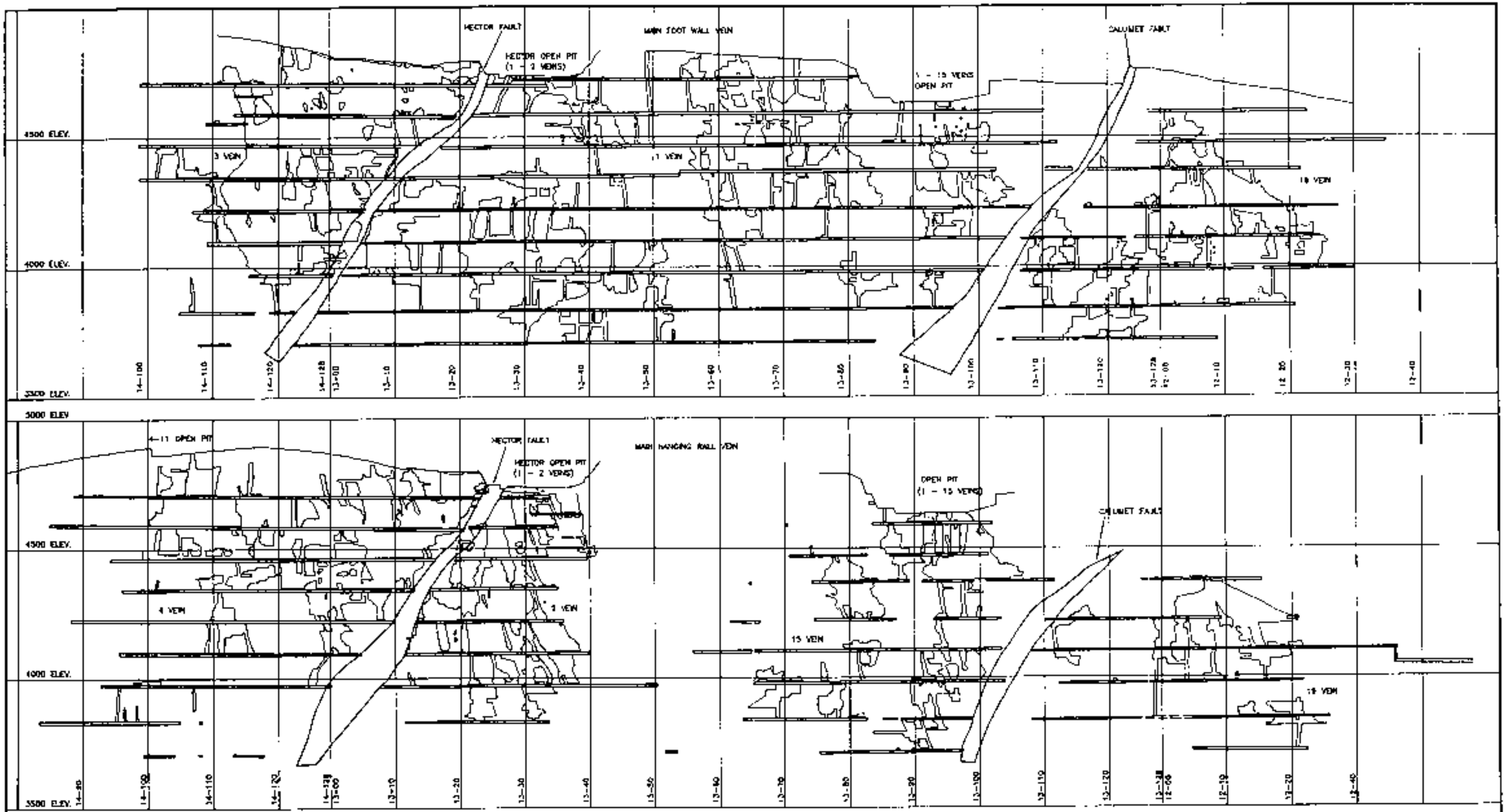
- Soil test pit with piezometer
- Waste rock sample
- Water quality sample site
- Disturbed area
- Building
- Power Line
- Tramway Line
- Highway #11
- Road
- Trail
- Stream or River
- Open pit, trench
- Waste rock dump
- Tailings area
- Adit entrance
- Shaft location

UNITED KENO HILL MINES LIMITED

HECTOR, CALUMET, TOWNSITE SITE PLAN

Access Mining Consultants Ltd.


CALKENO
UNDERGROUND
TOWNSITE ADIT
TOWNSITE
UNDERGROUND
HECTOR ADIT
MICROWAVE TOWERS
LEGEND
Soil test pit with piezometer
Waste rock sample
Water quality sample site
Disturbed area
Building
Power Line
Highway #11
Road
Stream or River
Open pit, bench
Waste rock dump
Tailings area
Adit entrance
Shaft location
UNITED KENO HILL
MINES LIMITED
HECTOR, CALUMET, TOWNSITE
UNDERGROUND
Access Mining Consultants Ltd.



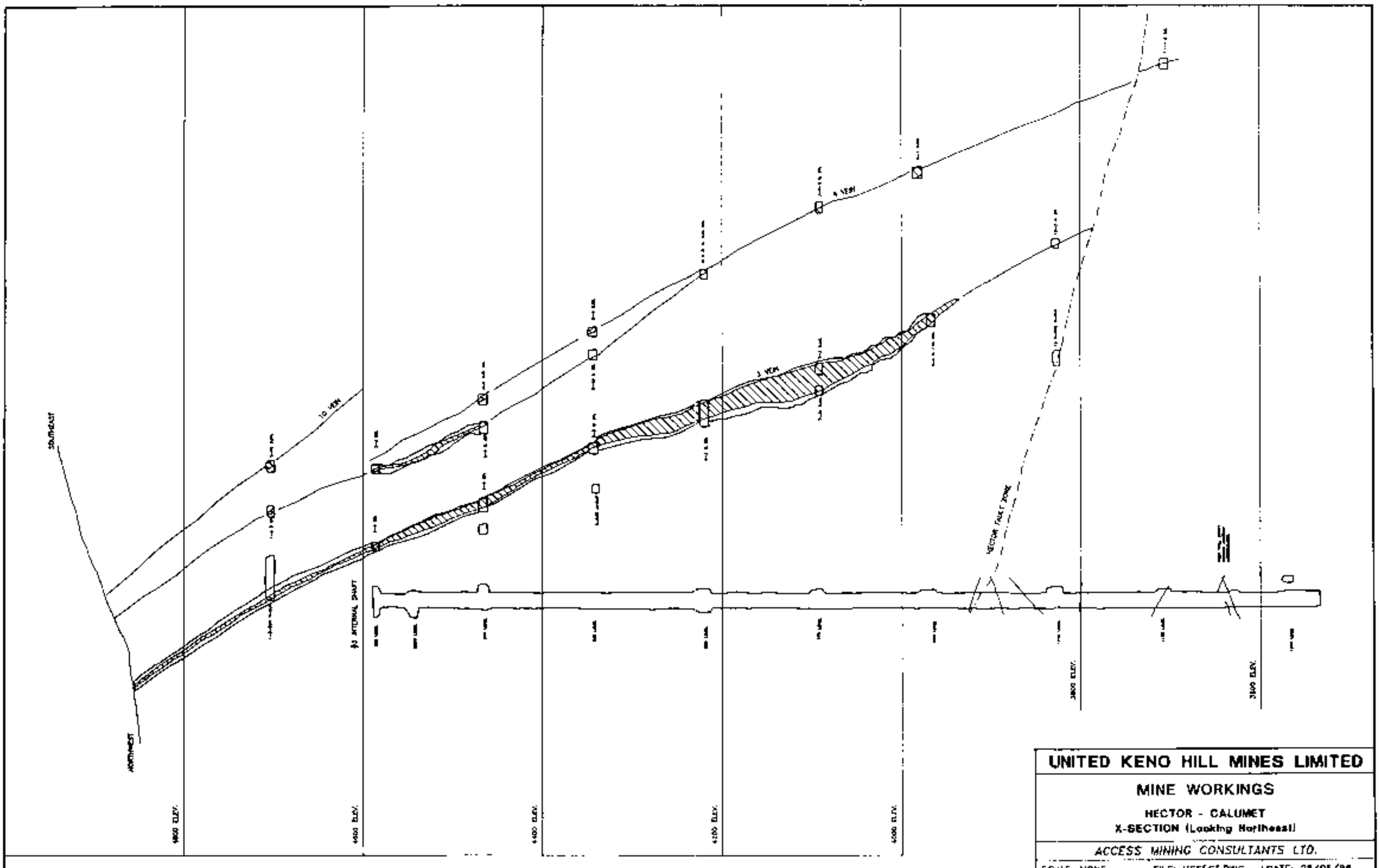
UNITED KENO HILL MINES LIMITED

MINE WORKINGS

HECTOR - CALUMET
VERTICAL LONGITUDINAL SECTION

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: HCLONG.DWG	DATE: 28/05/98
PLOTTED:	DWG: 95UX35	FIGURE: 44



UNITED KENO HILL MINES LIMITED

MINE WORKINGS

HECTOR - CALUMET

X-SECTION (Looking Northeast)

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: HCSECT.DWG	DATE: 28/05/98
PLOTTED:	DWG: 95UK56	FIGURE: 45

3.9.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available.

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.10 DRAGON (UN) AND MILLER

3.10.1 Description

The UN adit and associated limited underground workings were developed in the 1950's but no ore was mined here. There is a small waste dump and an adit. The adit does drain, although flows are relatively low. The portal is timbered but not secured for closure. There are no remaining buildings or equipment (AMC, 1996b).

The Miller pit is a relatively small development. Initially mined from a 35' shaft and 135' of drifting, it was subsequently mined by open pit. The open pit mined to the bottom of the old underground workings. All that remains in the area is the shallow open pit, and some associated waste rock within the pit. The pit has not accumulated water (AMC, 1996a).

3.10.2 Closure Issues

The UN adit drainage does not present a significant environmental risk. Other than general cleanup and adit blockage there is little to do here (AMC, 1996b).

Other than access to the Miller pit, there is little concern for closure issues (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 12.

An ortho-map of the Dragon (UN) and Miller is provided in Figure 46. A map for this site created by the PWGSC and appended in the SRK report follows as Figure 47. The UN and Miller Underground Working Diagram is presented as Figure 48.

Table 12 Dragon (UN) & Miller Closure Issues Matrix

Common Site Name: **Dragon (UN) & Miller**
PWGSC site #: 10

Site coordinates:	easting	northing	
	481500.00	7088800.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Miller Pit waste rock dump		✔	✔	✔		
Miller Pit		✔	✔	✔		
UN waste rock dump		✔	✔	✔		
UN Adit	✔	✔	✔			✔

Calumet Drive

Un Adit

Waste Rock Dump

Miller Waste Rock Dump

Miller Workings

Miller Open Pit

100 Le

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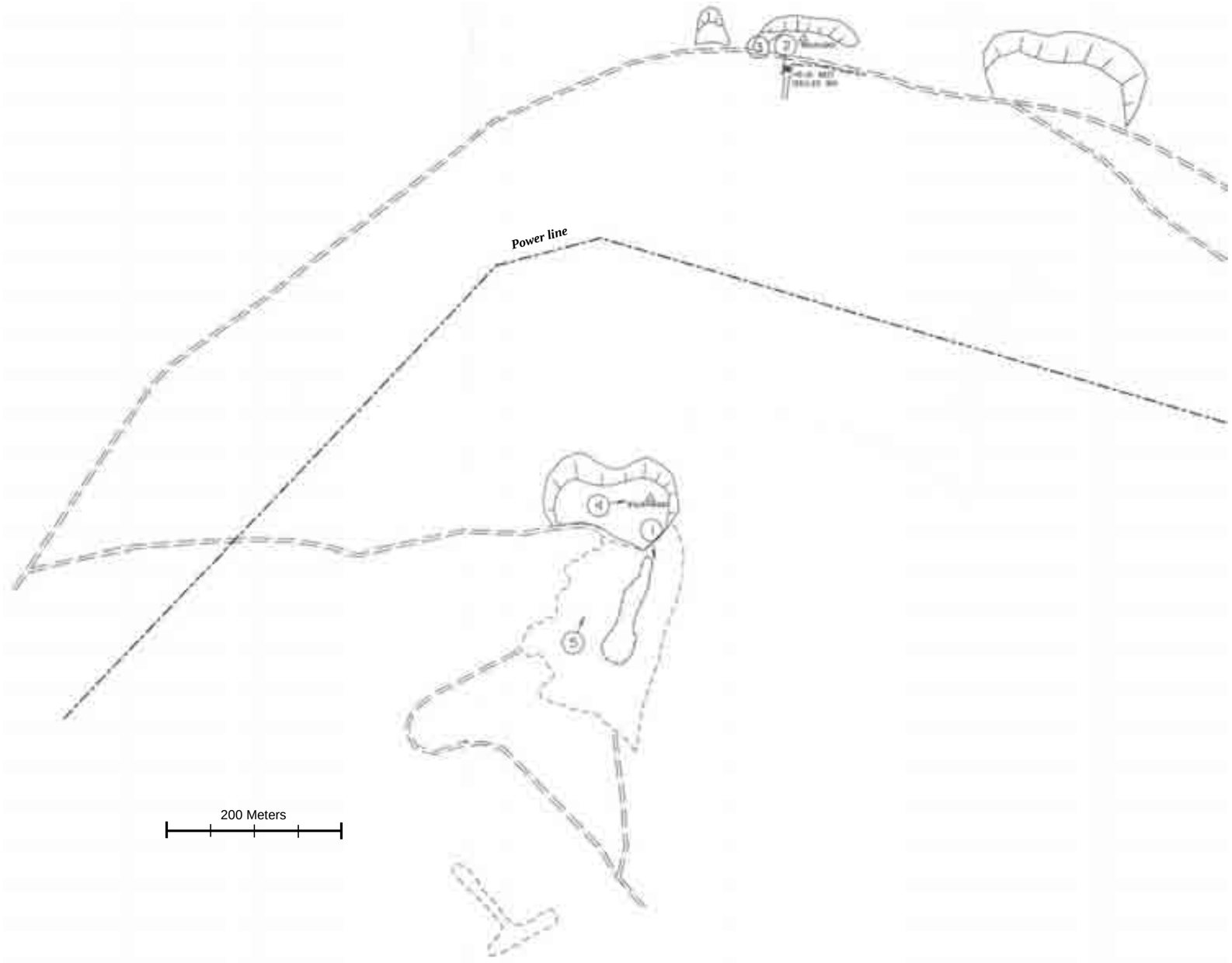
CLOSURE ISSUES

FIGURE 46 - MILLER & DRAGON (U

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,699
FILE: Untitled.mxd		



- N -

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

SRK Consulting
Engineers and Scientists
VANCOUVER

ALEXCO

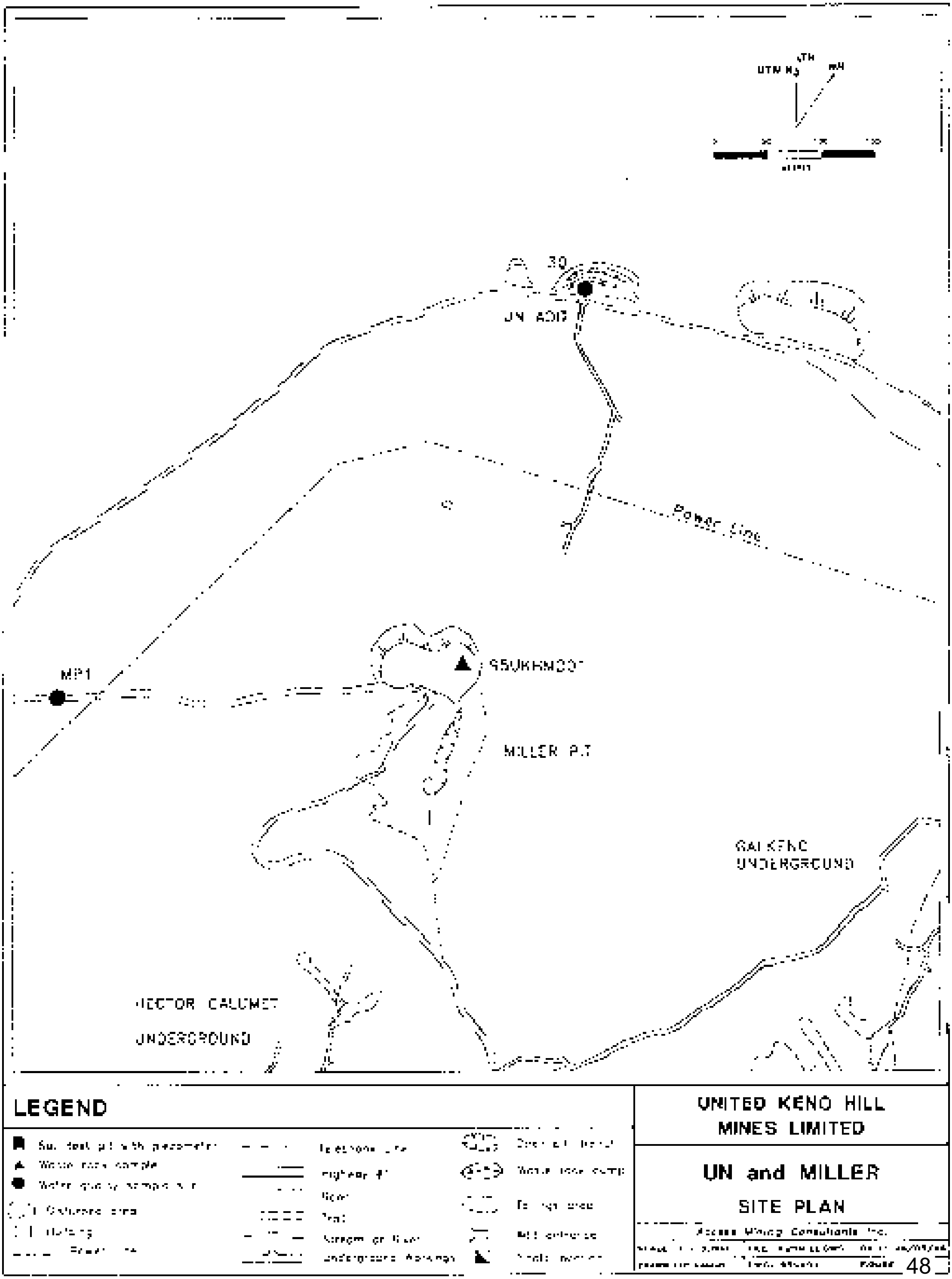
Job No: 1CA009.000

Filename: Site10_Dragon&Miller_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Dragon (UN) and Miller Site #10

Date:	Approved:	Figure:
Jan. 2007		**47**


UN ADIT
30
Power Line
MP1
95UKHM001
MILLER PIT
GALKENO
UNDERGROUND
HECTOR CALUMET
UNDERGROUND
LEGEND
UNITED KENO HILL
MINES LIMITED
UN and MILLER
SITE PLAN
Access Mining Consultants Inc.

3.10.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

3.11 GALKENO (GALKENO 900 AND GALKENO 300)

3.11.1 Description

Galkeno mine is primarily an underground mining area, mining two veins; the McLeod Vein and the Sime Vein. The area was mined in the 1950's and 60's. UKHM did not mine from any of the McLeod workings, but did development work on the Sime 400 and 500 levels.

The McLeod Vein was mined from underground, with workings from the 100 to 500 levels, and an adit at the 900 level. The 900 level adit was driven to dewater the McLeod Vein workings below the 500 level, but apparently was not used for production.

The adits at the 100 and 200 levels have both caved, preventing access to the underground.

The adit at the 300 level is open, blocked by a wooden door but not locked. The 300 level adit connects the McLeod and Sime workings. There was also a shaft on the McLeod vein connecting surface with the 100 level. It is reported that this shaft has caved, which will be confirmed.

In the fall of 1993, an hydraulic plug was installed by UKHM in the Galkeno 900 level adit, in response to concerns from Environment Canada that this adit was a major source of contaminant loading to the receiving environment. The objective of the installation was to cause flooding of the underground workings which would limit oxidation and dissolution of metals into the drainage water.

It has been recognised, given the geology of the hillside and extent of development above the 900 level, that:

- The workings would not entirely flood and the source of soluble metals could continue; and,
- As water accumulated behind the plug, the increasing hydraulic head would force the water to seep from the rock mass beyond the plug and surrounding grout curtain, and to daylight elsewhere in the hillside.

Therefore, a temporary active water treatment system has been established at the Galkeno 900 adit, comprising lime addition and two settling ponds. Investigations into passive treatment systems are in progress, based on observations of in-situ sulphate reduction downstream of the Galkeno 900 adit drainage.

The Sime Vein was mined both from a series of three open pits, and from underground. Access to underground was through two adits at the 200 and 300 levels, with an internal

shaft connecting the 300 level to the 400 and 500 levels. The 300 level is partly caved, and connects to the Hector-Calumet 775 level. The status of the 200 level adit must be checked. It is assumed that some closure measures will be required.

The Sime open pits have some waste rock associated with them, but appear to have been mined in sequence, with waste deposited in and around the open pits. While no shafts are located within the pits, it appears that some stopes broke through to the pit floor, keeping the pits drained. The floors and lower benches of the upper two pits, called Sime 6 and Sime 4, are covered with broken rock.

The McLeod and Sime underground workings are also connected by a cross-cut at the 500 level. Prior to the development of this cross-cut, there was no hydraulic connection between the workings below the 400 level, as evidenced by the water level recorded in March 1965.

Also associated with the Galkeno area is the former Galkeno mill and tailings. This mill was operated by Mackeno Mines in the 1950's, with some custom milling. UKHM did not use this mill, or the tailings facilities. All of the buildings were removed from the area, and some contouring done. While anecdotal evidence indicates that the tailings were deposited in the lake, at least during winter months, old air photos show what appears to be a tailings impoundment adjacent to the mill and upstream of the mouth of Christal Lake. It is likely that the custom milling operations resulted in tailings deposition in different areas, that is, both on-land and underwater disposal (AMC, 1996a).

3.11.2 Closure Issues

The most significant closure issue for Galkeno is drainage from the 900 adit. An engineered hydraulic bulkhead has been installed to attempt to recharge groundwater in the hill and reduce loadings in the long term. In the short term it appears that high zinc loads will continue, thus treatment is underway and contingencies for longer term passive management have been explored. In addition to the Galkeno adit, there is a small tailings impoundment across Christal Lake. Current evidence suggests that this does not represent a physical or geochemical concern. The Sime pits appear to pose no

risk of chemical impacts to the environment. Pit high walls and entrances may require blockage to reduce safety risk (AMC, 1996b).

Current closure issues for Galkeno 900 and 300 Adits noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Tables 13 and 14 respectively.

Ortho-maps for Galkeno 900 and 300 are provided in Figures 49 and 50. Maps for the Galkeno 900 and 300 sites were created by the PWGSC and appended in the SRK report. These maps are shown in Figures 51 through 53.

The Galkeno site plan, Galkeno 900 Adit site plan, cross-sectional diagrams looking northeast, 330^{o} and west, and a composite plan showing the Galkeno sites spatial relationship to the nearby Jock, Hector and Calumet mine are presented as Figures 54 to 59 respectively.

Table 13 Galkeno 900 Closure Issues Matrix

Common Site Name: **Galkeno 900**
PWGSC site #: 12

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	483407.26	7087890.05	

General Location Description	SRK BEA Report Map Reference Number	Closure Issue Categories					
		Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Discharge point from pipe - corrugated sections	*1*				✔		
Discharge area - after corrugated section	*3*		✔	✔	✔		
Settling pond - southeast corner	*4*			✔	✔		

Table 14 Galkeno 300 Closure Issues Matrix

Common Site Name: **Galkeno 300**
PWGSC site #: 11

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	482544.76	7088754.67	

General Location Description	SRK BEA Report Map Reference Number	Closure Issue Categories					
		Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Sinkhole - south Bench, #35 Vein Pit	*1*	✔			✔		
Dumps 1 - 7	*3*	✔					
Dump - east of unnamed adit (minor issue)				✔			
Sime #6 pit	*5*				✔		
Sime #4 pit - NE side	*6*				✔		
11-1 Adit dump	*9*			✔			
100 Level	*10*	✔					
Effluent pipe discharge point - riprap area					✔		
Galkeno 300 Adit southeast corner of pond				✔	✔		

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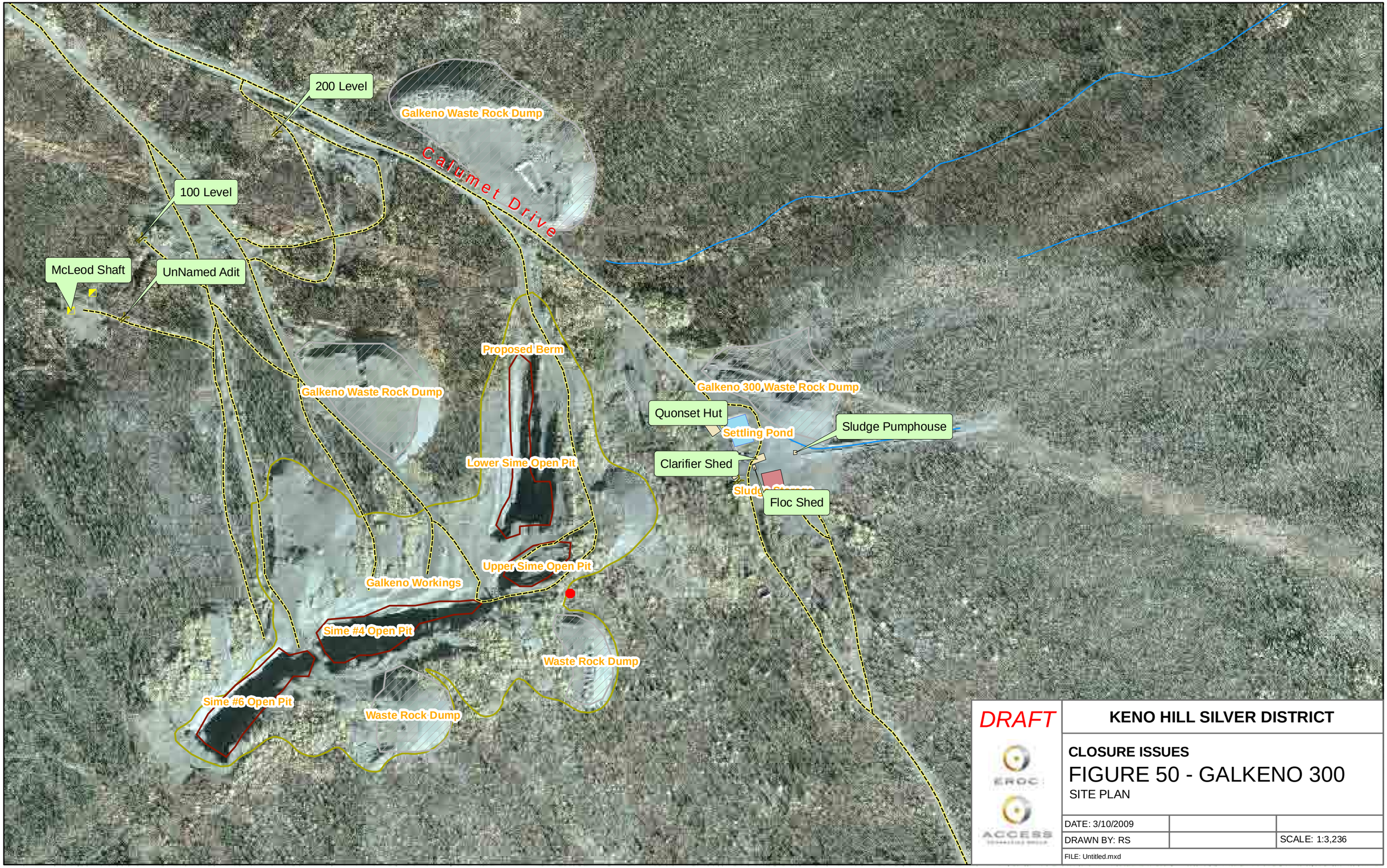
CLOSURE ISSUES

FIGURE 49 - GALKENO 900

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,486
FILE: Untitled.mxd		



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KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 50 - GALKENO 300

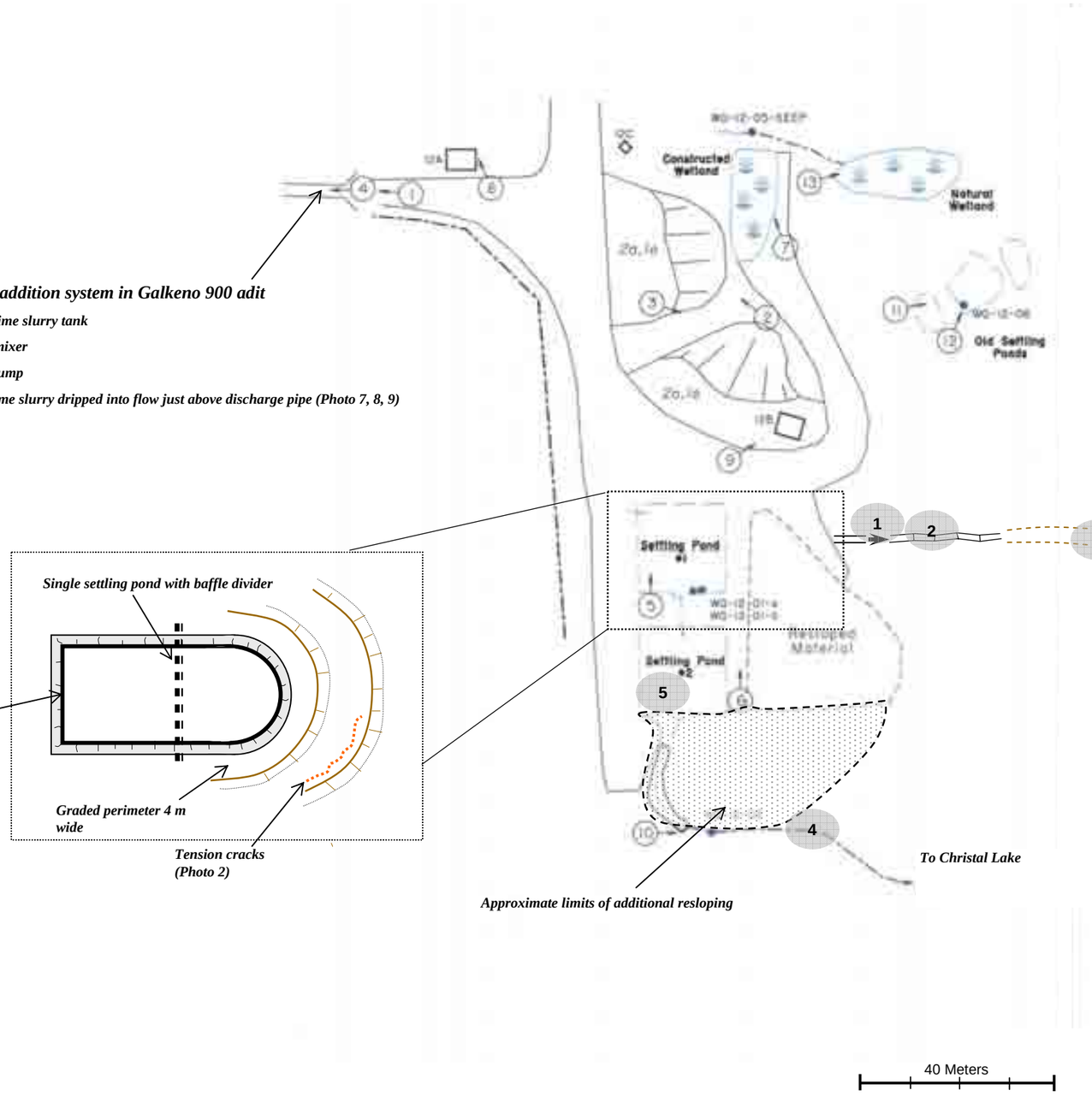
SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:3,236
FILE: Untitled.mxd		

- N -

Lime addition system in Galkeno 900 adit

- *lime slurry tank*
- *mixer*
- *pump*
- *lime slurry dripped into flow just above discharge pipe (Photo 7, 8, 9)*



#1 Discharge from pipe into unbraced corrugated sections (Photo3)

#2 Corrugated sections are twisted and flow escapes over side (Photo 4) and under lower sections

#3 Discharge path shows whitish precipitates, heavy iron-staining and permafrost thaw features (Photo 5)

#4 Permafrost degradation and erosion along former discharge channel

#5 Settling Pond #2 decommissioned and recontoured

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

SRK Consulting
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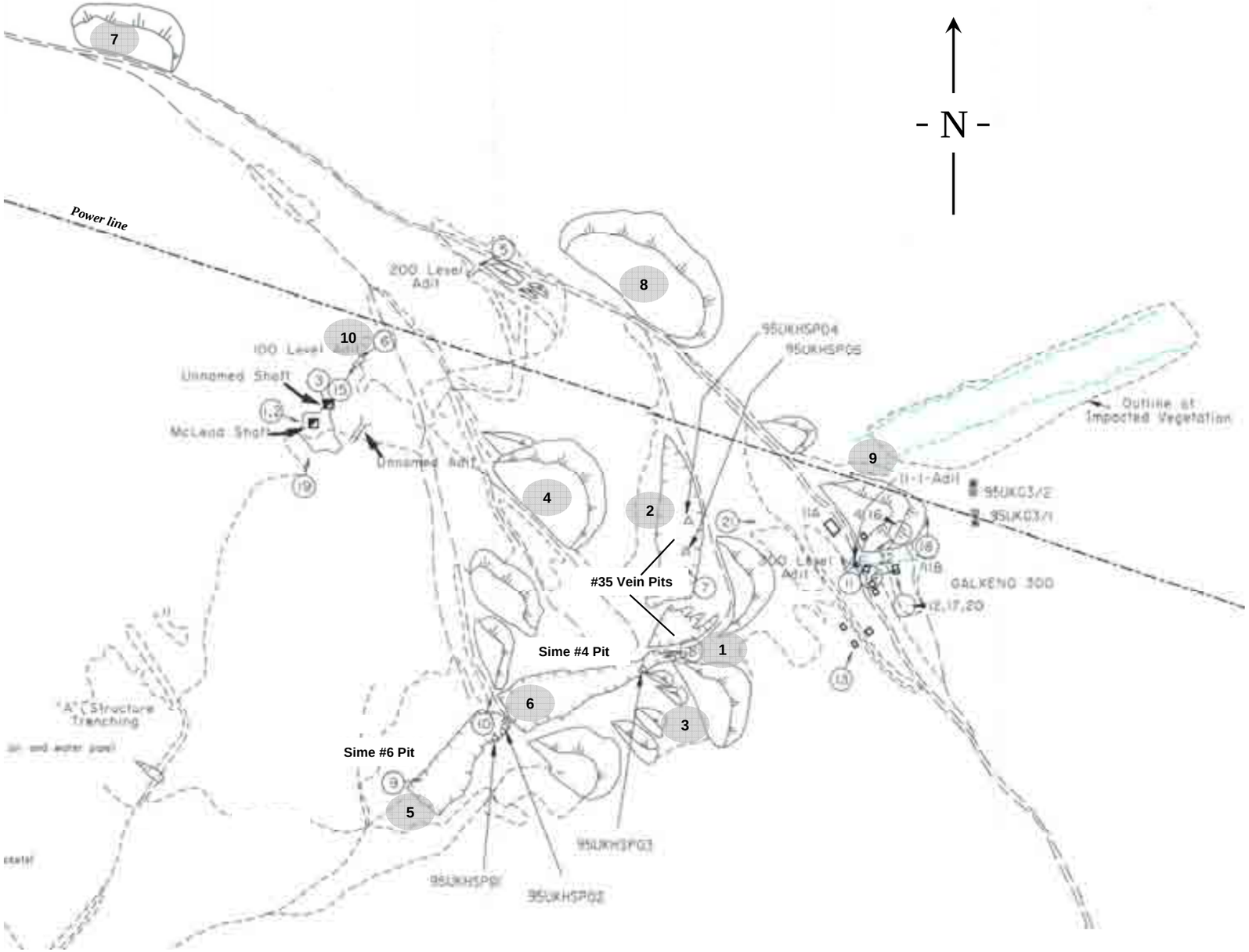
VANCOUVER

ALEXCO

Galkeno 900 Site #12

Job No: 1CA009.000	**Baseline Environmental Report, United Keno Hill Mines Property**	Date: Jan. 2007	Approved:
Filename: Site 12_Galkeno 900_20070131.ppt		Figure: **51**	



#1 - Subsidence/Sinkhole, no timber was noted within the hole. This is a previously-unidentified hole, with 2 – 3m of fill over the area

#2 - The #35 Vein pits are stable with no tension cracks observed around the pit perimeter.
- Some unravelling of the slope face is occurring, but this is to be expected.
- No water observed at the bottom of either pits.

#3 - Dumps 1 – 7 show no indication of instability.
- Only 40% of these dumps have berms on the crest. The roads do not have berms.

#4 - 50% of this dump has a berm along the dump crest. The dump is graded towards the road, except on the east side.
- Some water pools occur on the top of the dump.
- No tension cracks or deformation along the toe of the slope was noted.
- This dump is considered to be stable.

#5 - This pit shows no signs of the development of large failures.
- The pit walls show a high level of unravelling and this is expected to continue.
- No water was observed in the bottom of the pit.

#6 - This pit is considered stable- no large tension cracks were noted.
- Limited unravelling of the slopes is occurring and this is mainly on the NE side.
- No water was noted in the pit bottom.

#7 - No berms were placed on the crest of this dump.
- No tension cracks were observed on the top of the dump.
- No significant displacement of the toe is noted, though minor displacement may have occurred.
- Some localised zones of oversteepening in the dump.
- This dump is considered to be stable.

#8 - Dump stability appears good, with no tension cracks or heave of the slope toe observed.
- 80 % of the dump crests are guarded with a berm.

#9 - The stability of this dump is considered to be fair.
- The dump consists of a finer-grained, more mixed material.
- East side of dump has been recontoured as part of improvements to the water treatment discharge.
- A well developed erosion gulley was observed on this dump face.

#10 - The timbers in the collar of the adit have collapsed making access difficult, but still possible.

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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Galkeno 300 Site #11 (Part 1)

Job No: 1CA009.000
Filename: Site 11_Galkeno 300_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007 | Approved: | Figure: **52**

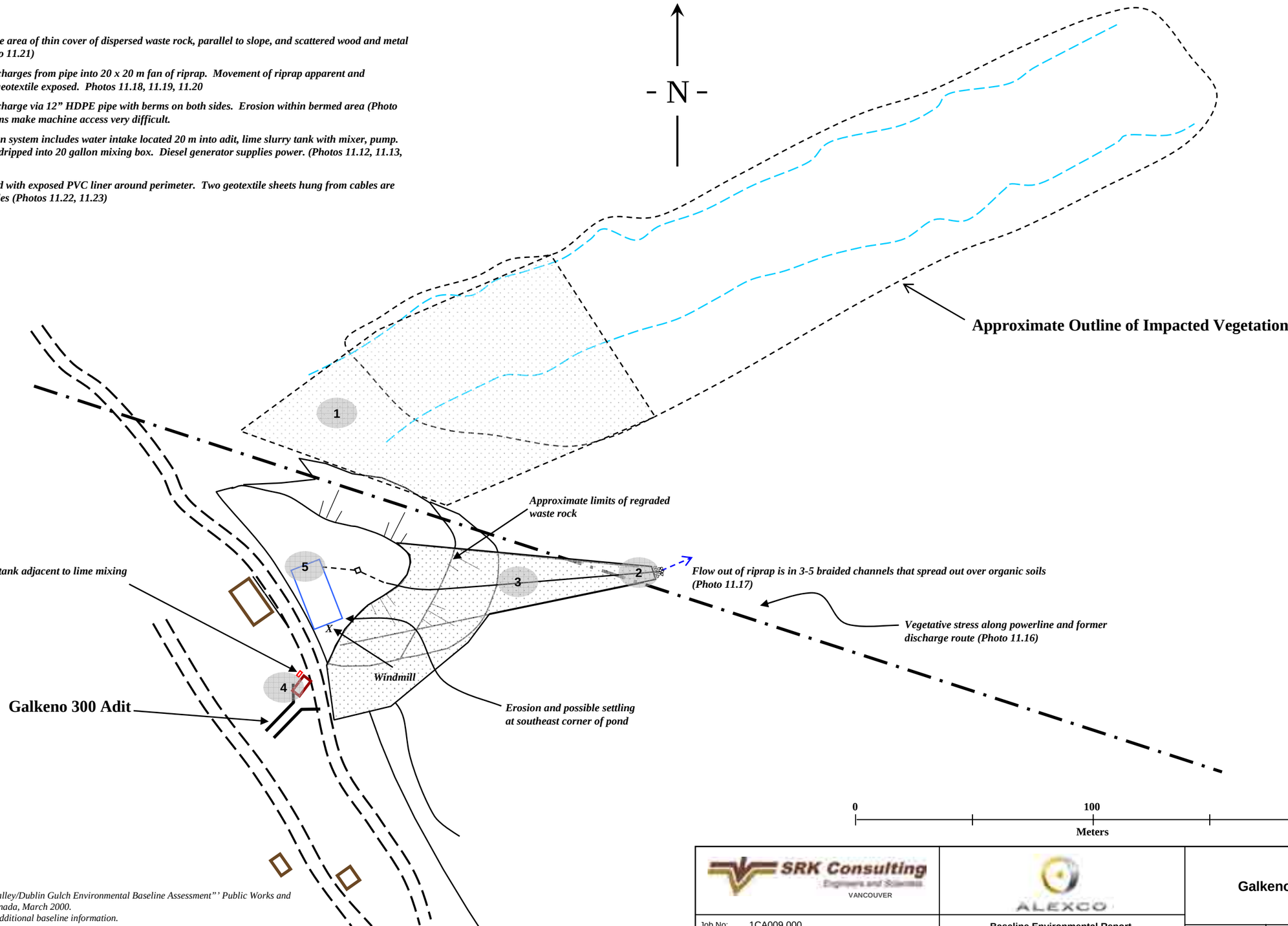
#1 Approximate area of thin cover of dispersed waste rock, parallel to slope, and scattered wood and metal debris (Photo 11.21)

#2 Effluent discharges from pipe into 20 x 20 m fan of riprap. Movement of riprap apparent and underlying geotextile exposed. Photos 11.18, 11.19, 11.20

#3 Effluent discharge via 12" HDPE pipe with berms on both sides. Erosion within bermed area (Photo 11.15). Berms make machine access very difficult.

#4 Lime addition system includes water intake located 20 m into adit, lime slurry tank with mixer, pump. Lime slurry dripped into 20 gallon mixing box. Diesel generator supplies power. (Photos 11.12, 11.13, 11.14)

#5 Settling pond with exposed PVC liner around perimeter. Two geotextile sheets hung from cables are used as baffles (Photos 11.22, 11.23)



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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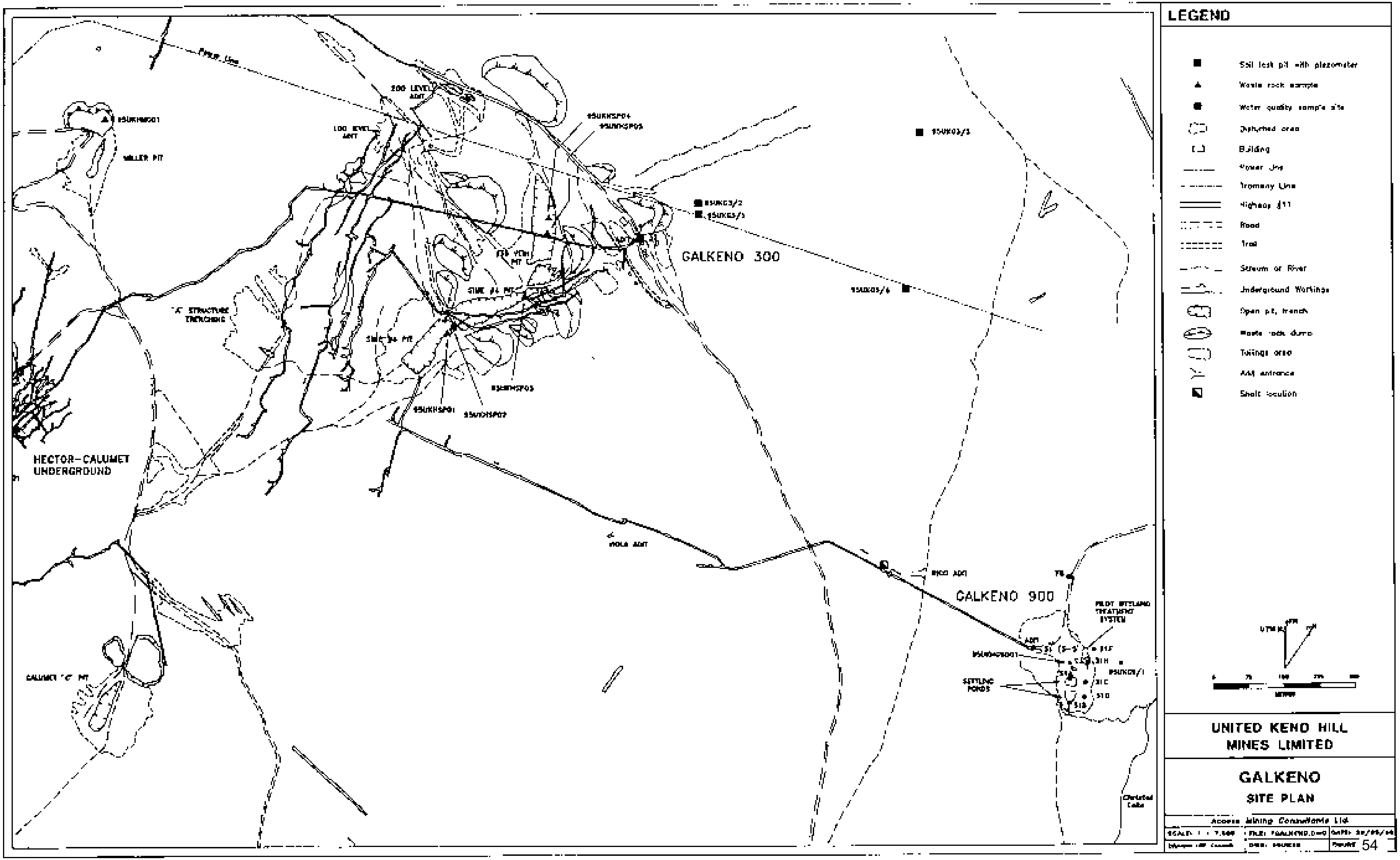
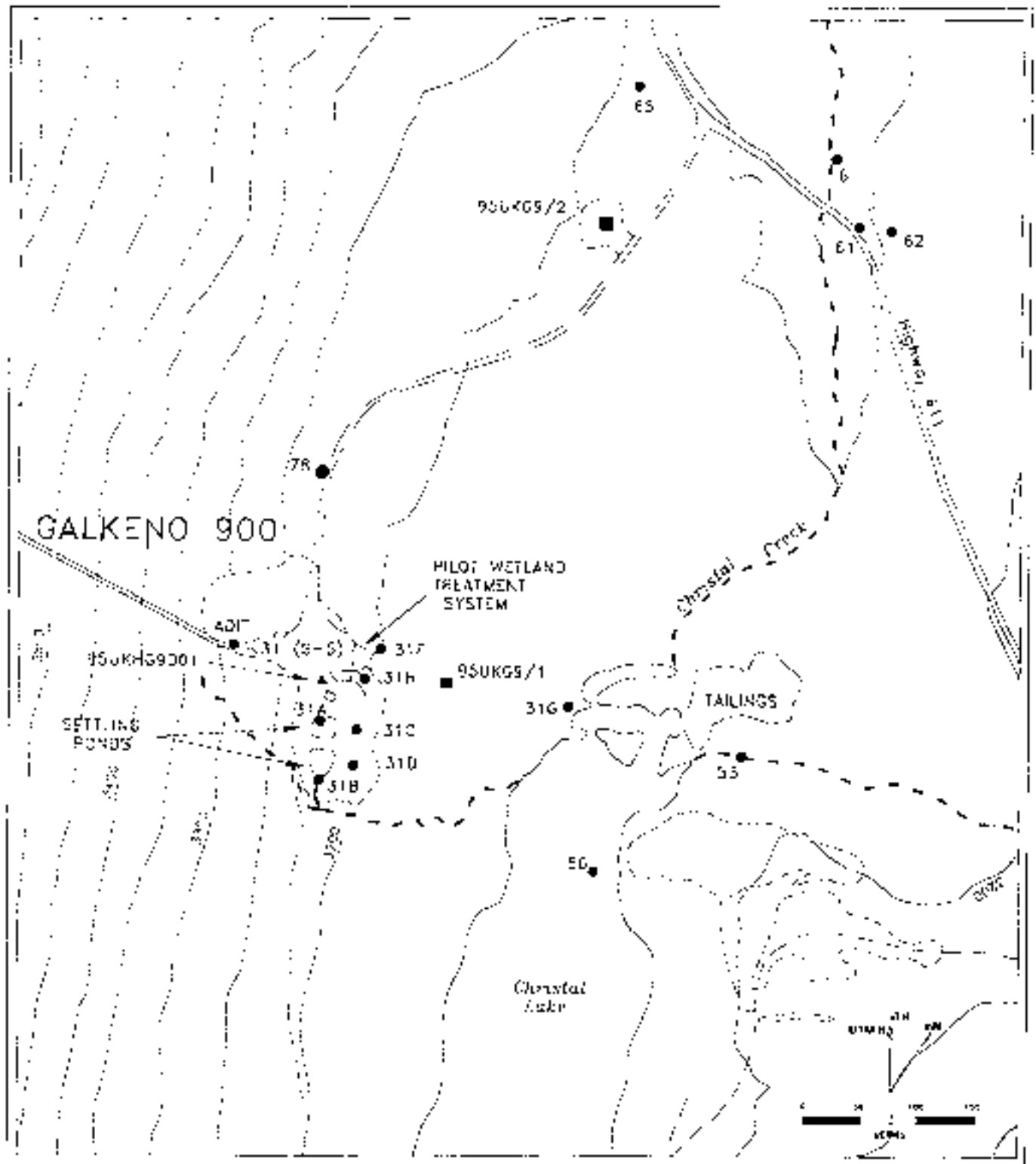
VANCOUVER

ALEXCO

Galkeno 300 Site #11 (Part 2)

Job No: 1CA009.000	**Baseline Environmental Report, United Keno Hill Mines Property**	Date: Jan. 2007	Approved:
Filename: Site 11_Galkeno 300_20070131.ppt			Figure: **53**


LEGEND
Soil test pit with piezometer
Waste rock sample
Water quality sample site
Disturbed area
Building
Power Line
Highway #11
Road
Trail
Stream or River
Underground Workings
Open pit, trench
Waste rock dump
Tailings area
Adit entrance
Shaft location
GALKENO 300
GALKENO 900
HECTOR-CALUMET UNDERGROUND
MILLER PIT
200 LEVEL ADIT
100 LEVEL ADIT
"A" STRUCTURE TRENCHING
SIME #4 PIT
ADIT
SETTLING PONDS
PILOT WETLAND TREATMENT SYSTEM
UNITED KENO HILL MINES LIMITED
GALKENO
SITE PLAN
Access Mining Consultants Ltd
54



LEGEND

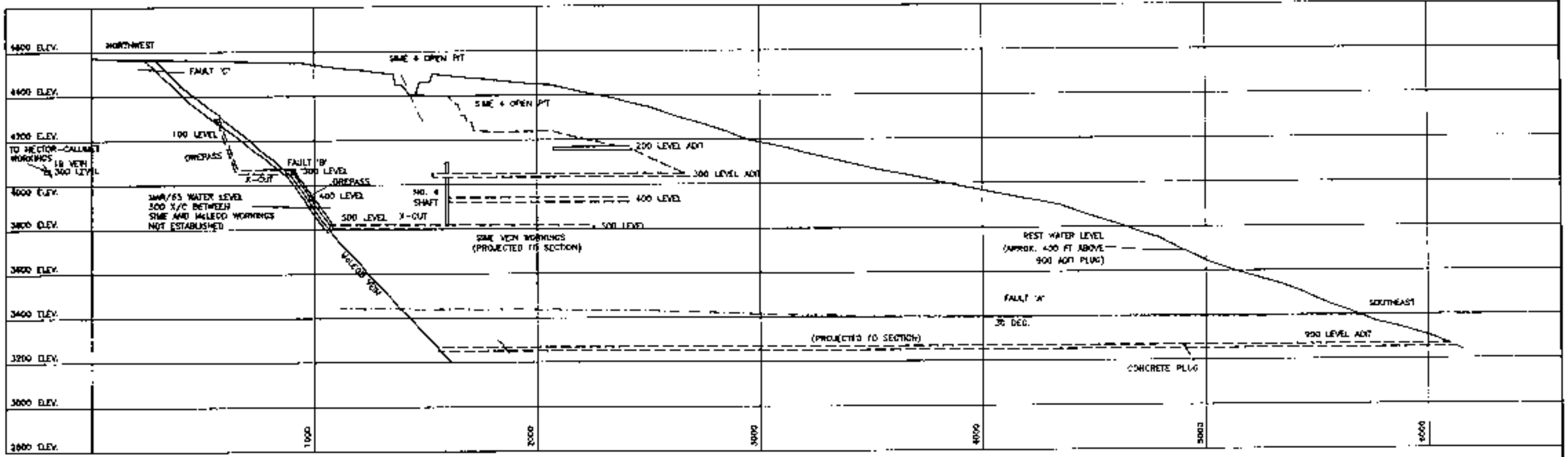
- Soil and grab sample location
- Rock sample
- Water quality sample site
- Disturbed area
- Building
- Power line
- Telephone line
- Highway #11
- Road
- Trail
- Stream or River
- Underground Workings
- Open pit trench
- Waste rock dump
- Tailings area
- Adit entrance
- Shaft location

UNITED KENO HILL MINES LIMITED

GALKENO 900

SITE PLAN

Access Mining Consultants Inc.



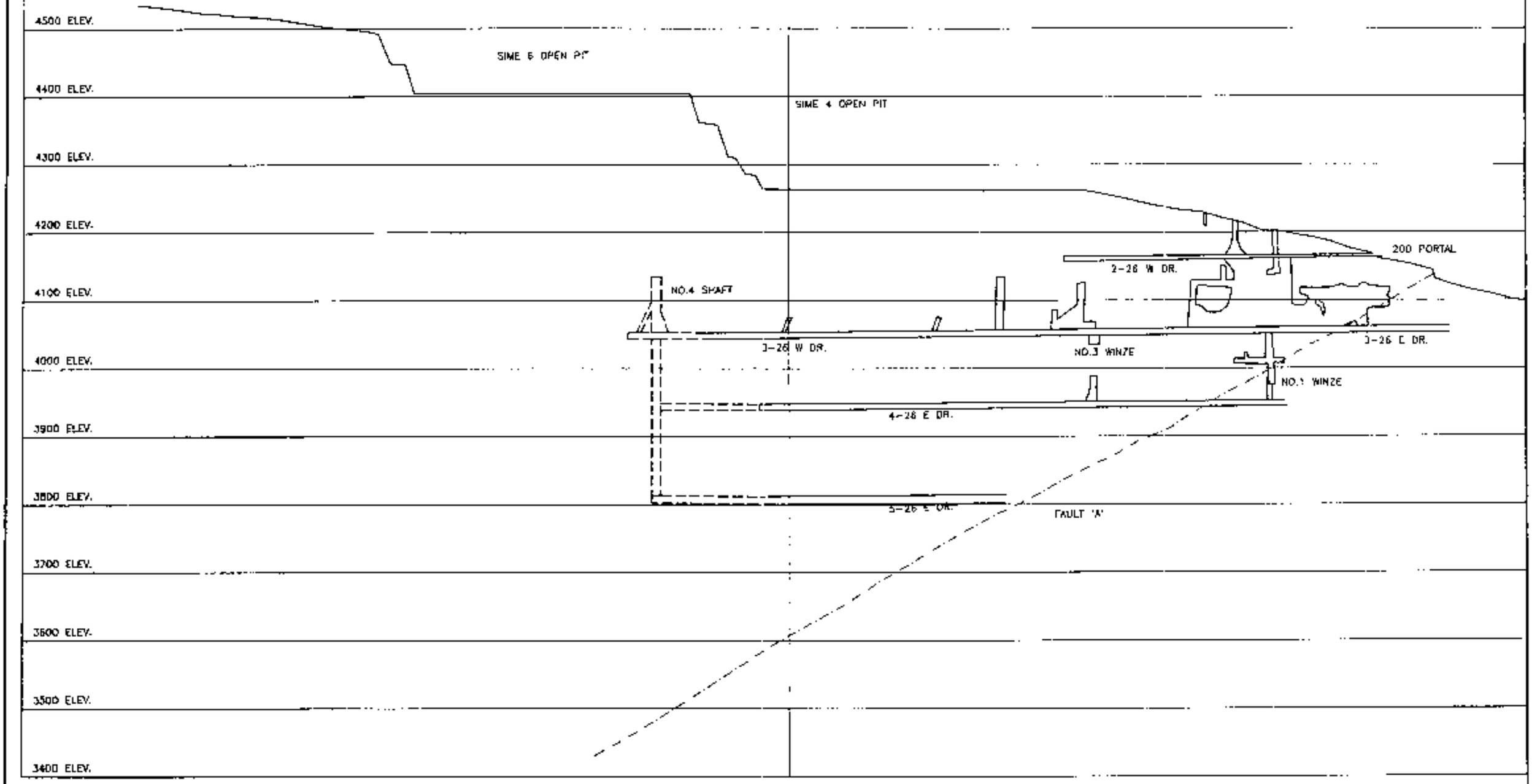
UNITED KENO HILL MINES LIMITED

MINE WORKINGS

X-SECTION SHOWING McCLEOD, SIME WORKINGS & 900 LEVEL ADIT (Looking Northeast)

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: GALSIME_DWG	DATE: 28/05/98
PLOTTED: 4.5"	DWG: 98UK33	FIGURE: 56



UNITED KENO HILL MINES LIMITED

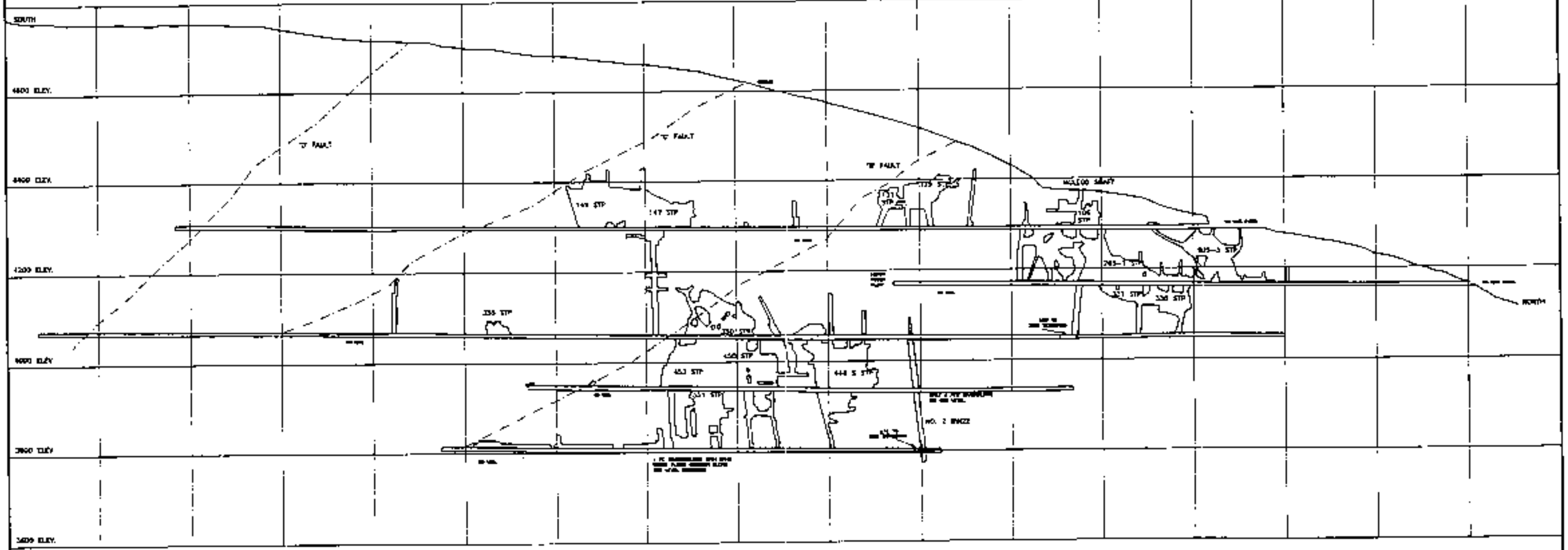
MINE WORKINGS

GALKENO MINE

VERTICAL LONGITUDINAL SECTION (Looking Azimuth 330°)

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: GALVERT.DWG	DATE: 28/05/98
PLOTTED: 4:1	DWG: 95UX34	FIGURE: 57



UNITED KENO HILL MINES LIMITED		
MINE WORKINGS		
GALKENO McCLEOD VEIN		
VERTICAL LONGITUDINAL SECTION (Looking West)		
ACCESS MINING CONSULTANTS LTD.		
SCALE: NONE	FILE: GLONGSEC.DWG	DATE: 28/05/96
PLOTTED:	DWG: 95UK80	FIGURE: 58

HECTOR - CALUMET
LEVEL ELEVATIONS (MAX. IN FT)

LEVEL	HECTOR FAULT	BETWEEN HECTOR & CALUMET FAULTS	CALUMET FAULT	VEIN LEVEL COLOUR
100	4705	4795	–	GREEN
300	4585	4585	4585	WHITE
400	4485	4485	4475	MAGENTA
500	4340	4340	4370	RED
650	4215	4215	4225	BLUE
775	4080	4085	4110	CYAN
900	3965	3970	3965	BROWN
1045	3825	3830	3815	GREY
1185	3700	3705	3715	DARK GREEN
FAULTS	–	–	–	

GALKENO
LEVEL ELEVATIONS (MAX. IN FT)

LEVEL	MCLEOD VEIN WORKINGS	SAME VEIN WORKINGS	VEIN LEVEL COLOUR
100	4280	–	ORANGE
320	4185	4153	MAGENTA
300	4060	4040	BLUE
400	3935	3940	CYAN
500	3800	3800	GREEN
800	3335	–	DARK GREEN
OPEN PIT	–	–	WHITE
OPEN PIT VEIN	–	–	
FAULTS	–	–	

* INFORMATION ON THE GALKENO 200 LEVEL ADIT PROVIDED BY A.R. ARCHER, P.ENG.-GEOLOGIST AT UKHM WHEN THE ADIT WAS DRIVEN. UP TO THIS POINT THE ADIT WAS FAIRLY DRY. AT THIS POINT, THE ADIT INTERSECTED A LARGE WATER FLOW WHICH COVERED THE ADIT FLOOR TO A DEPTH OF ABOUT 3 FEET. WORK ON THE ADIT COULD NOT CONTINUE UNTIL JULY, 1982 BECAUSE OF THE WATER FLOW FOR A PERIOD OF 22 MONTHS.

UNITED KENO HILL MINES LIMITED

MINE WORKINGS

JOCK, HECTOR, CALUMET & GALKENO MINES
COMPOSITE PLAN

ACCESS MINING CONSULTANTS LTD.

SCALE: NONE	FILE: HCCOMP.DWG	DATE: 28/05/96
PLOTTED: 4:5:4	DWG: 95UK59	FIGURE: 59

3.11.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available.

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.12 BLUEBIRD

3.12.1 Description

Bluebird site is located on the lower northeast slope of Galena Hill, approximately 4 km northwest along Highway 11 from the village of Keno Hill. The site is located roughly 70 m upslope to the northeast from the Highway at an elevation of 945 m. Access from the highway is only possible on foot through thick alder growth.

The site is found on a moderate to gentle northeast slope, averaging about 12 degrees toward azimuth 050. A moderately sloping hill underlain by greenstone occurs immediately to the northwest of the shafts. The area is thought to have permafrost. No surface water or channels were observed draining from the site that is situated roughly 550 m southwest of Christal Creek.

Mining took place between 1925 and 1930. Two of the four shafts were reported to be 12.2 and 7 metres deep (Stockwell, 1930). Several shallow test pits are also present in the area, and appear to be of the same vintage. Bulldozer stripping of shallow overburden on the top of the hill is likely pre-1980, and exposed an area of bedrock about 25 by 10 metres. A cabin was built circa 1980, and appears to have been a residential structure.

There are four shallow shafts and an area of overburden stripping/trenching on the Bluebird site.

No ore was processed on the site and there are no tailings or tailings impoundment structures on the site. There are also no wastewater treatment facilities on the site.

3.12.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 15.

An ortho-map for this site is provided in Figure 60, while a map created by the PWGSC follows as Figure 61.

Table 15 Bluebird Closure Issues Matrix

Common Site Name: **Bluebird**
PWGSC site #: 14

	easting	northing	
Site coordinates:	483031.00	7089792.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
building	✔			✔		

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FIGURE 60 - BLUEBIRD

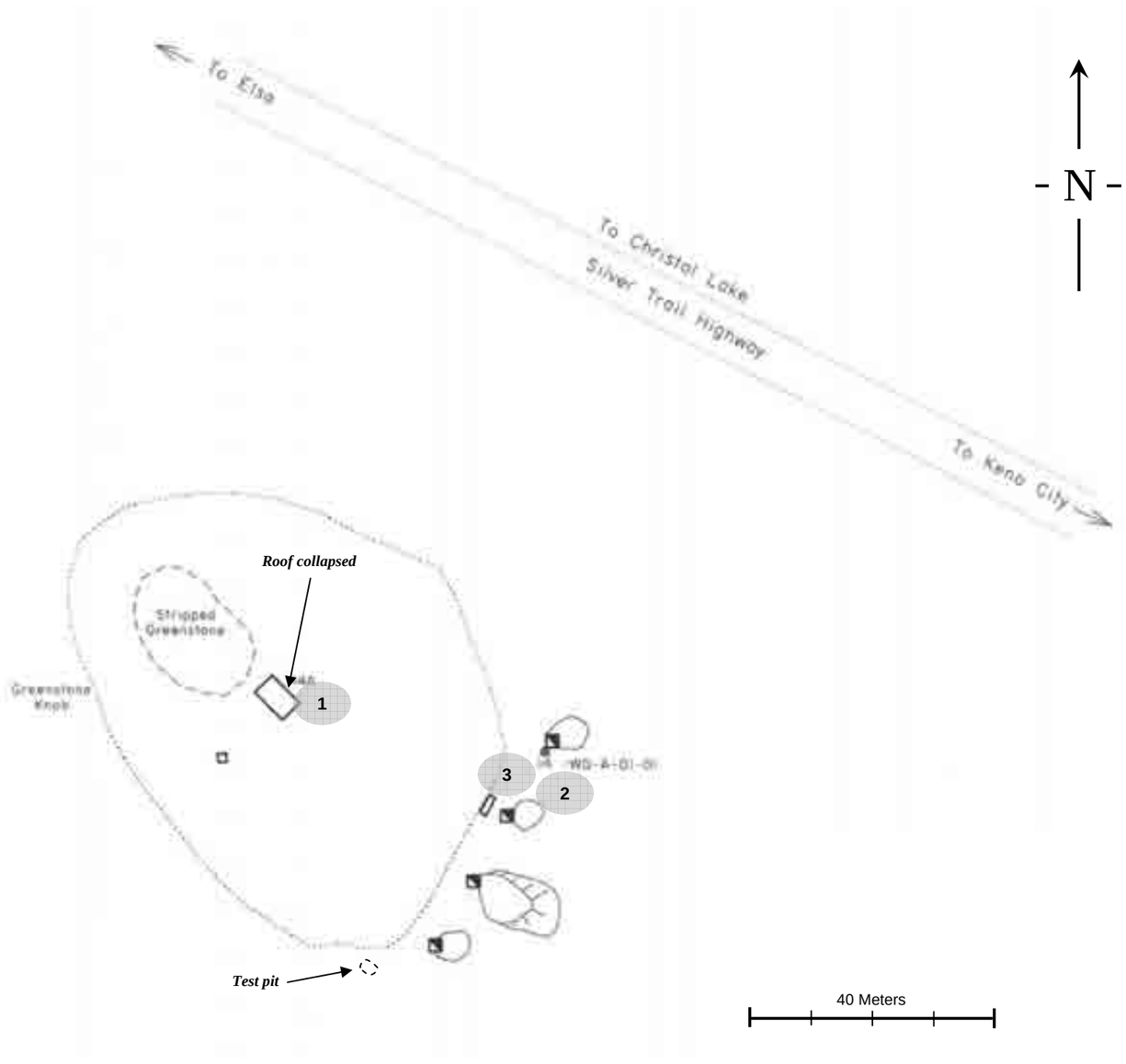
SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,294
FILE: Untitled.mxd		

#1 - 2 sheets of approximately 1.2 m by 1.2 m asbestos fibreboard in NE corner of cabin- fixed to wall as heat shield for wood stove.

#2 - Minor unvegetated oxidized greenstone and vein material.

#3 - 3 m x 2 m x 2 m rock cut into base of outcrop with greenstone waste rock adjacent to east.



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Bluebird Site #14

Job No:	ALEX-06-ESP-05
Filename:	Site14_Bluebird_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**61**

3.12.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.13 TIN CAN

3.13.1 Description

There is no access road into this site, although there is some evidence of a very old track running uphill south of the site, possibly from near the Galkeno 900 adit. The nearest access road is Highway 2 located approximately 250 meters downhill to the east of shaft #1.

Shaft #1 is located at 630 55' 31.6" N; 1350 19' 53.3" W and shaft #2 is located approximately 25 meters north east of the first shaft. The shallow test pits are located approximately 100 meters uphill (west) of shaft #l. The shafts are at an approximate elevation of 960 m and the test pits at 980 m.

Site drainage is down the steep valley slope east toward Christal Creek. A seasonal stream is located south of the site running parallel to the two shafts approximately 100 m south of the site. No surface drainage was noted from the site. The shafts are located in a relatively level area of open muskeg forest. The test pits are located on a slope immediately uphill (west) of the shafts in rocky terrain. Drainage from the pit area is probably towards a second seasonal channel to the northwest; however, this was dry at the time of the site visit.

Two shafts, 9.8 m and 4.6 m deep were dug pre-1926. It is unknown which of the two shafts located is the deeper. Ground sluicing is also reported, and a narrow ditch was located that channeled water from a flat marshy area to a steep slope, with little disturbance evident at this time. This ground sluice is located about 30 m west of the

shafts. Several shallow (0.5m deep) test pits were dug on the ridge to the west in the same era. All workings are overgrown.

There is no evidence of more recent work; however a trail crosses the area that may be a winter skid road from exploration since the 1960's.

Mine development was limited to two shallow timber-lined shafts as well as four identifiable small test pits uphill from the shafts (PWGSC, 2000).

3.13.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 16.

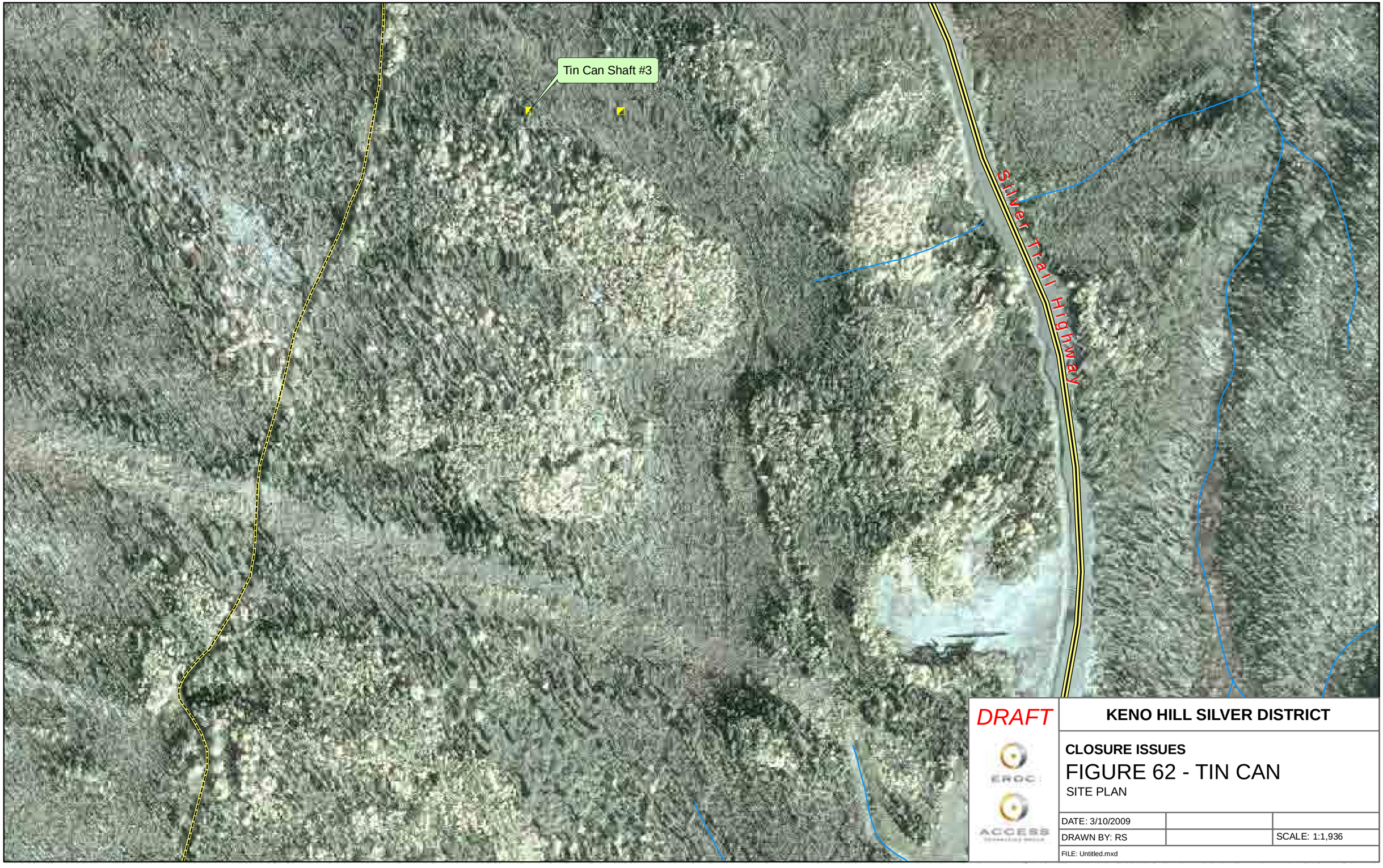
An ortho-map for this site is shown in Figure 62, while a map created by the PWGSC follows as Figure 63.

Table 16 Tin Can Closure Issues Matrix

Common Site Name: **Tin Can**
PWGSC site #: 15

Site coordinates:	easting	northing	
	483402.00	7088663.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Shaft #3	✔			✔		
Shaft #4	✔			✔		
Shaft # and #4 area	✔					
Waste pile at Shaft #4		✔				



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CLOSURE ISSUES

FIGURE 62 - TIN CAN

SITE PLAN

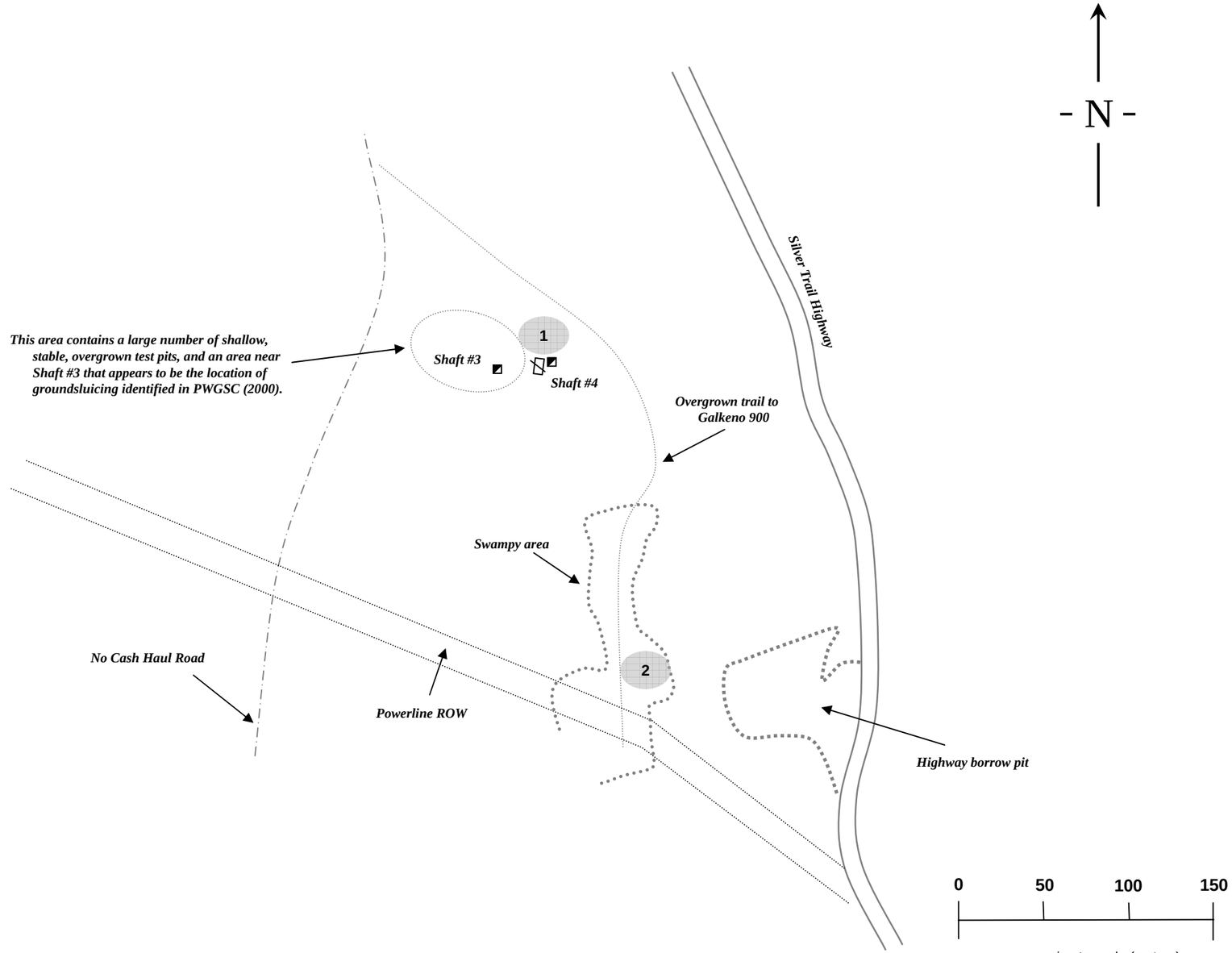
DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,936
FILE: Untitled.mxd		

#1 - Shafts #1 and #2 described in PWGSC 2000 not located.
- Two previously-unidentified shafts were located.

- Shaft #3: NAD 83 483470 E, 7088650 N. 1.7 m x 1.7 m collapsed timber-cribbed shaft, with subsidence around the shaft opening forming a 2 to 3 m deep 3 m x 5 m depression (Photo 15.-1). Area to east and southeast appears to have been groundsluiced (4 m x 30 m x up to 1 m deep)- presently covered by dense growth of alders.

- Shaft #4: NAD 83 483522 E, 7088649 N. 1.5 m x 1.5 m timber lined shaft, open to depth of 2.5 m, minor subsidence around shaft collar (up to 1 m, extending up to 2 m away from shaft collar).
- Waste pile at Shaft #4 forms a flat 7 m wide bench across hillside at elevation of collar. Pile extends downslope for 6 m. Margins of exposed pile are composed of greenstone, with surface of central portion of pile extending from shaft to toe composed of orange-stained greenstone with purplish-black stained clasts and minor limonite.
-Orange staining extends to depth of 0.3 m. Rinse pH of sample of near-surface fines was 6.2, with a rinse conductivity of 0.9 mS/cm.
- Unoxidized greenstone observed below veneer of oxidized waste in shallow test pit.

#1 - Swampy area to southeast of shafts #3 and #4 is location of Shaft #1 and Shaft #2 described in PWGSC (2000). Vegetation consists of saturated moss and small shrubs, along with isolated black spruce and willows.



2006 aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Tin Can Site #15

Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site15_TinCan_20070131.ppt		Figure: **63**	

3.13.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.14 RICO

3.14.1 Description

Rico is on the lower northeast slope of Galena Hill, 450 m upslope of the Galkeno 900 site at an elevation of 1025 m. Four wheel drive access is possible via an old dirt road that branches off the Calumet Back Road roughly 2.2 km north of the junction with Duncan Creek Road. The site is on the western side of the dirt road and 610 m from the turnoff.

The Rico site is located on a moderately steep, east facing slope, possibly underlain by permafrost. The site and surrounding area is thickly vegetated with willows, birch and spruce trees as well as shrubs. The ground is covered with a blanket of moss and decaying leaves. The site is within the Christal Creek catchment area, at an elevation roughly 150 m higher than Christal Lake. No surface water was encountered at or near the site.

The single adit and shaft on this site were developed between 1924 and 1962 (PWGSC, 2000).

3.14.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 17.

An ortho-map for the site is shown in Figure 64, while another map created by the PWGSC follows as Figure 65. The Rico site was shown in relation to the Galkeno workings previously in Figure 54.

Table 17 Rico Closure Issues Matrix

Common Site Name: **Rico**
PWGSC site #: 16

Site coordinates:	easting	northing	
	483171.00	7088044.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
No Cash haul road - north of building		✔				
Collapsed shaft - northeast of building	✔					

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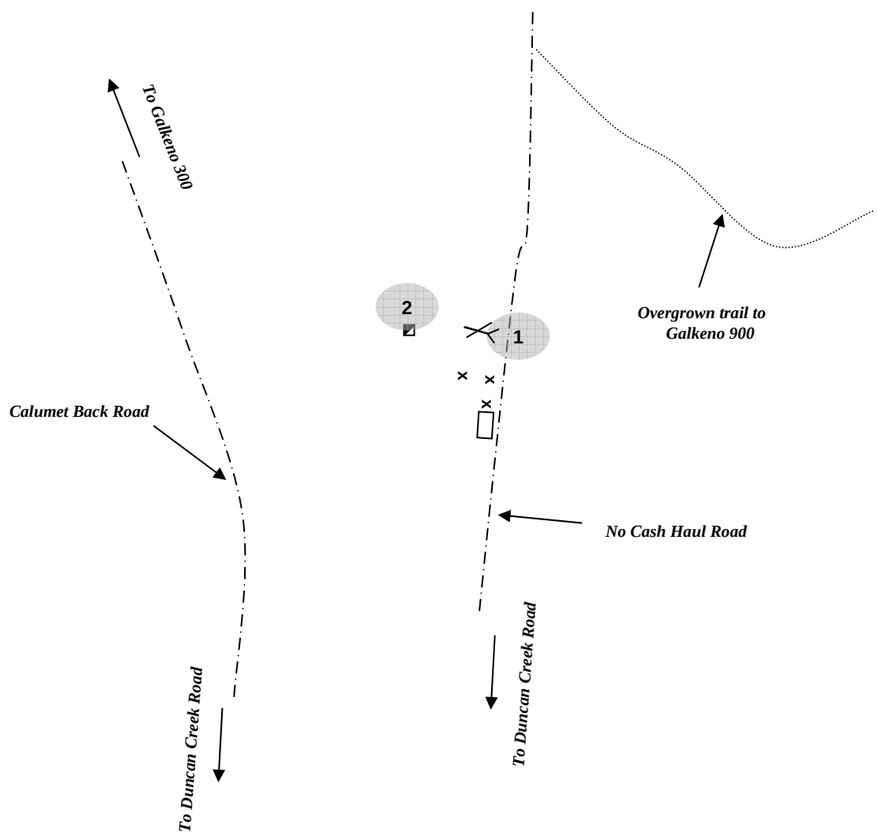
FIGURE 64 - RICO

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,712
FILE: Untitled.mxd		

#1 - There appeared to be insufficient volume of waste rock for a 37 m adit. Waste may have been used as road material.
- Linear subsidence above adit extends for ~30 m, up to 2.5 m deep with stable sides and complete revegetation.

#2 - Shaft waste pile 70% overgrown with moss, lichen, heather, and isolated birch.
- Composed of weathered quartzite breccia, siderite vein material, minor oxidized carbonaceous phyllite.
- Abundant black manganese oxide staining observed, lesser orange to dark rusty brown staining.
- Shaft remains open; water and debris observed at 4m depth. Timber support remained intact.



2006 aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Rico Site #16

Job No:	ALEX-06-ESP-05
Filename:	Site16_Rico_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		65

3.14.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy.

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.15 DUNCAN CREEK

3.15.1 Description

The Duncan Creek site is located southwest of Keno City just east of the confluence of Duncan Creek with Lightning Creek at an elevation of roughly 910m. Four-wheel drive access is possible via the Duncan Creek Track, a dirt road that branches off to the east from the Duncan Creek road 3.8 km south of Keno City. The site can be reached by foot via an overgrown cat track oriented NNW that intersects with the Duncan Creek Track approximately 800 m from the Duncan Creek Road. About 50 m along this cat track is the beginning of the trenching that comprises the activity at this site (PWGSC, 2000).

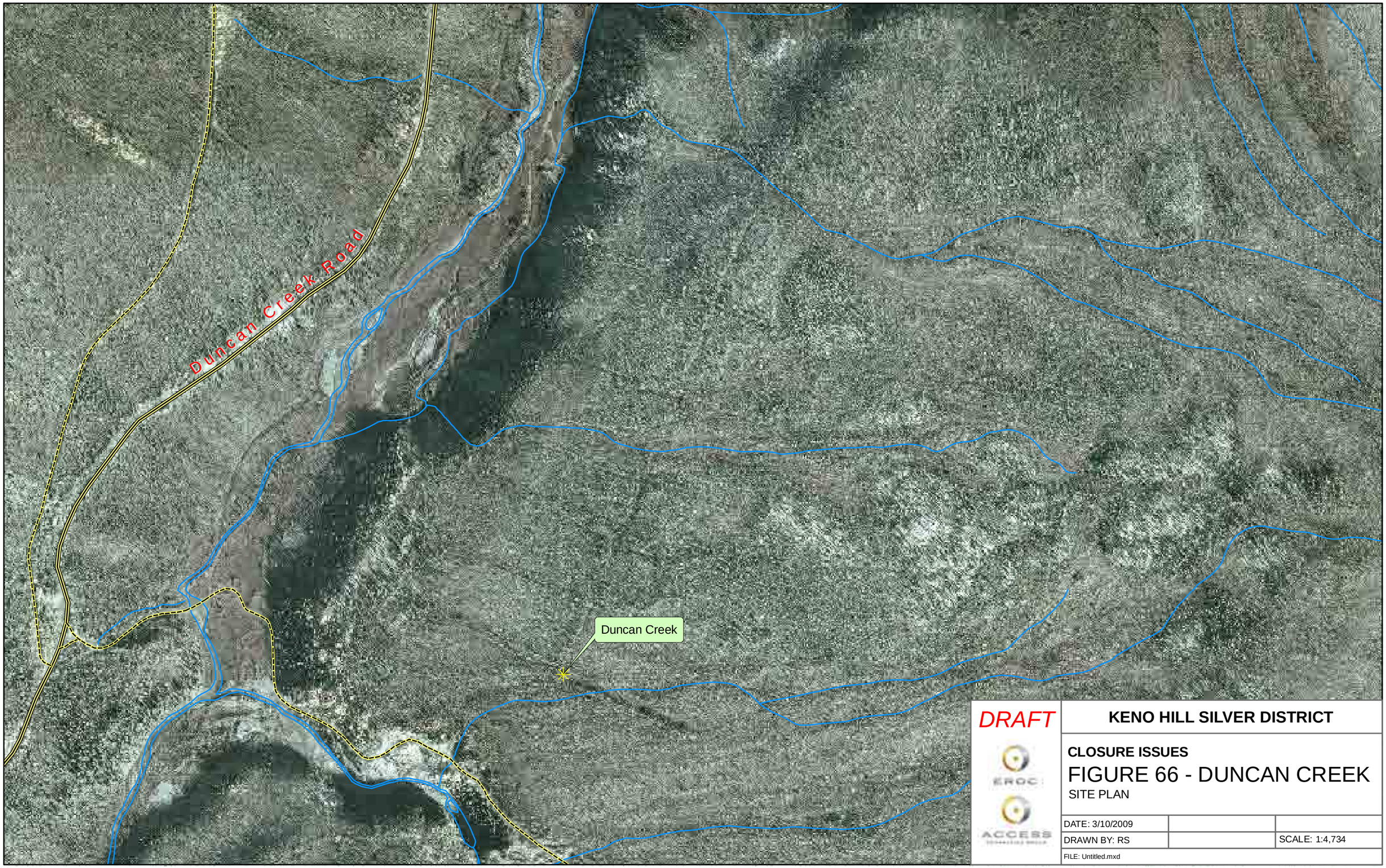
3.15.2 Closure Issues

No new closure issues were noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting. Current closure conditions are described in Table 18 below.

An ortho-map for the site is shown in Figure 66, while a map created by the PWGSC and appended by SRK is presented as Figure 67.

Table 18 Duncan Creek Closure Issues Matrix

Common Site Name: **Duncan Creek** PWGSC site #: 17						
Site coordinates:	easting 483291.00	northing 7085124.00	*coordinates are projected to UTM zone 8 N, Nad 1983			
General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
cutlines	✔					



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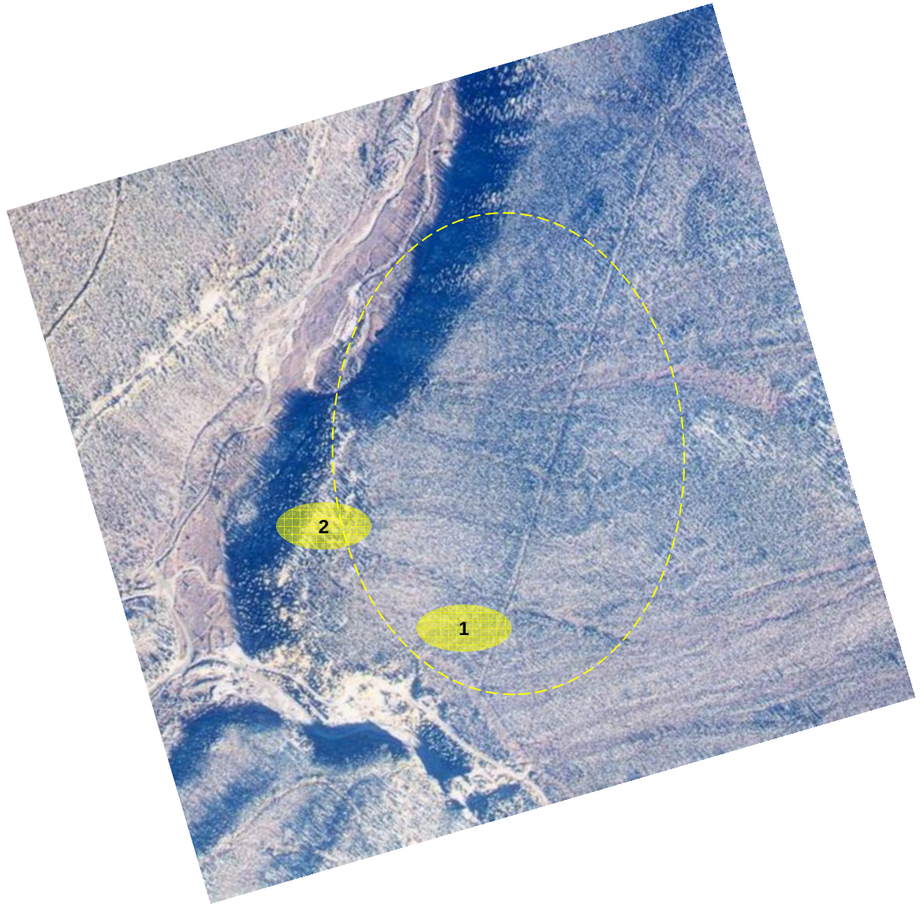
CLOSURE ISSUES

FIGURE 66 - DUNCAN CREEK

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:4,734
FILE: Untitled.mxd		



- N -

#1 - Area of trenches identified in PWGSC 2000 east of confluence of Lightning Creek and Upper Duncan Creek.

- At the time of inspection in 2006, no trenches were located. There are several cutlines in the area indicated on the aerial photograph, and there are areas where melting of permafrost along the cutlines has resulted in subsidence and the formation of linear depressions.

- Complete or nearly complete vegetative coverage was observed on all cutlines inspected in 2006.

#2 - Test pitting in gravel observed in this area. It is suspected that this disturbance is related to placer exploration.

0 150 300 450

approximate scale (metres)

2006 aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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VANCOUVER

ALEXCO

Job No:	ALEX-06-ESP-05
Filename:	Site17_Duncan_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Duncan Creek Site #17

Date:	Approved:	Figure:
Jan. 2007		67

3.15.3 Information Gaps

No information gaps were identified for this site.

3.16 FLAME AND MOTH

3.16.1 Description

The Flame and Moth was originally a small underground development comprising a shaft and 75 foot level drift on vein. It was developed initially in 1923, but mined primarily in the 1950's. Only 1600 tons of ore are reported to have been extracted in total from this area.

In the late 1980's open pit mining to recover the crown pillar from the old underground was started by UKHM, and the site was still in production at closure. The open pit still contains ore reserves.

The mine is reported to be on the Onek vein, and more closely resembles the Keno Hill mineralogy with higher calcite content and higher, according to Lynch, pyrrhotite and arsenopyrite than is typical of Galena Hill.

There is a small waste dump associated with the open pit. The shaft is located within the open pit, but has been partially mined out.

There is no apparent discharge of water from the pit or dumps; however there may be shallow ground water flow from the area. Any drainage would ultimately report to Christal Lake (AMC, 1996a).

3.16.2 Closure Issues

There has been relatively little surface disturbance at the Flame and Moth pit. Only 1500 tons has been mined from the pit and additional reserves remain. The ore is noted to be pyrrhotite rich, thus acid generation could be a concern, particularly if there is further production from this area. More work is needed on this issue (AMC, 1996b).

Site components for this location are noted in Table 19. No new closure issues were noted in the SRK report.

An ortho-map for this site is shown in Figure 68, while maps created by the PWGSC and appended by SRK follow as Figures 69 and 70.

Table 19 Flame and Moth Closure Issues Matrix

Common Site Name: **Flame and Moth**
PWGSC site #: 18

	easting	northing	
Site coordinates:	483967.00	7086852.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Trenches						
Active Keno City Dump Site						
Pit						

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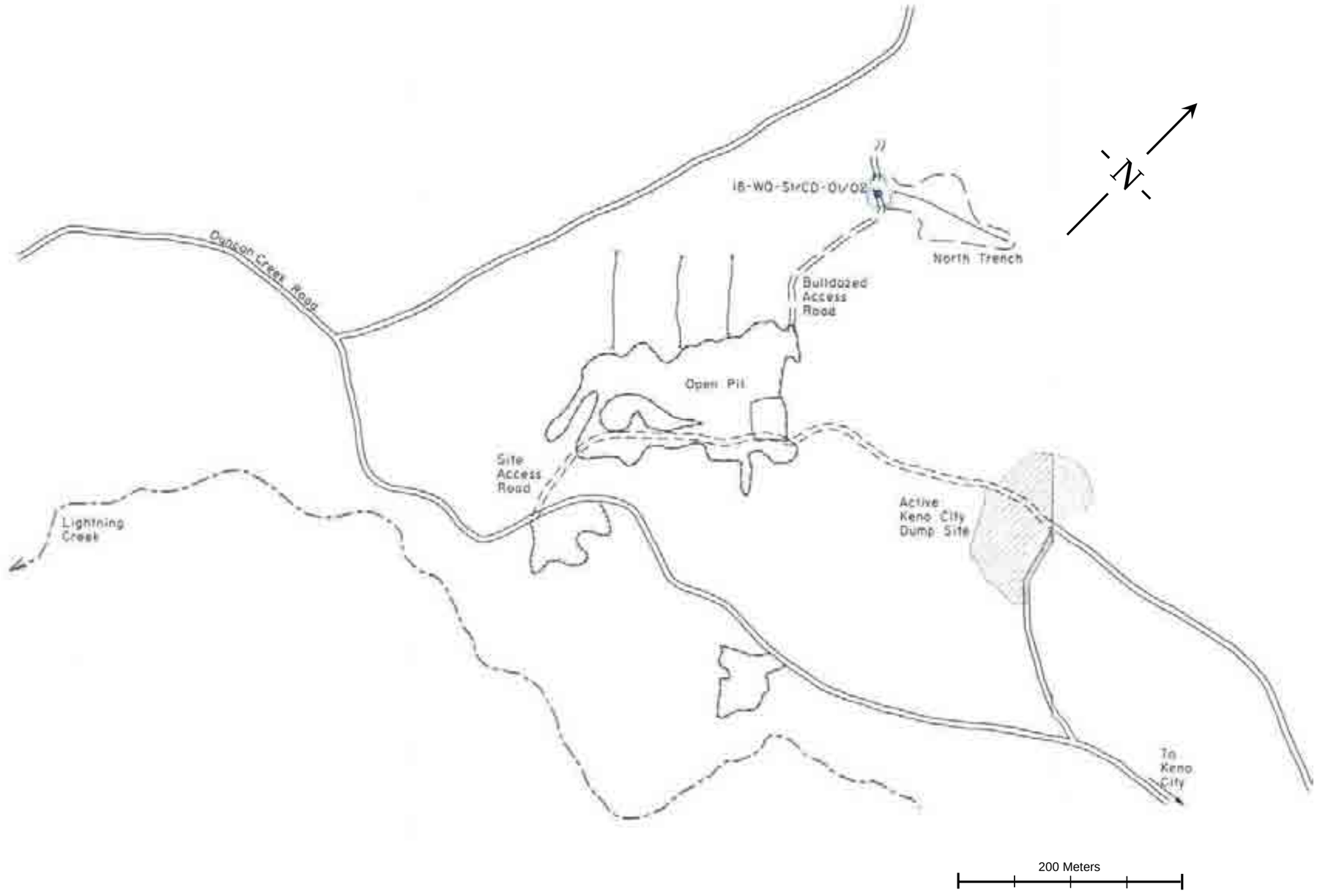
CLOSURE ISSUES

FIGURE 68 - FLAME & MOTH

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,784
FILE: Untitled.mxd		



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Job No: ALEX-06-ESP-05

Filename: Site18_FlameMoth_20070131.ppt

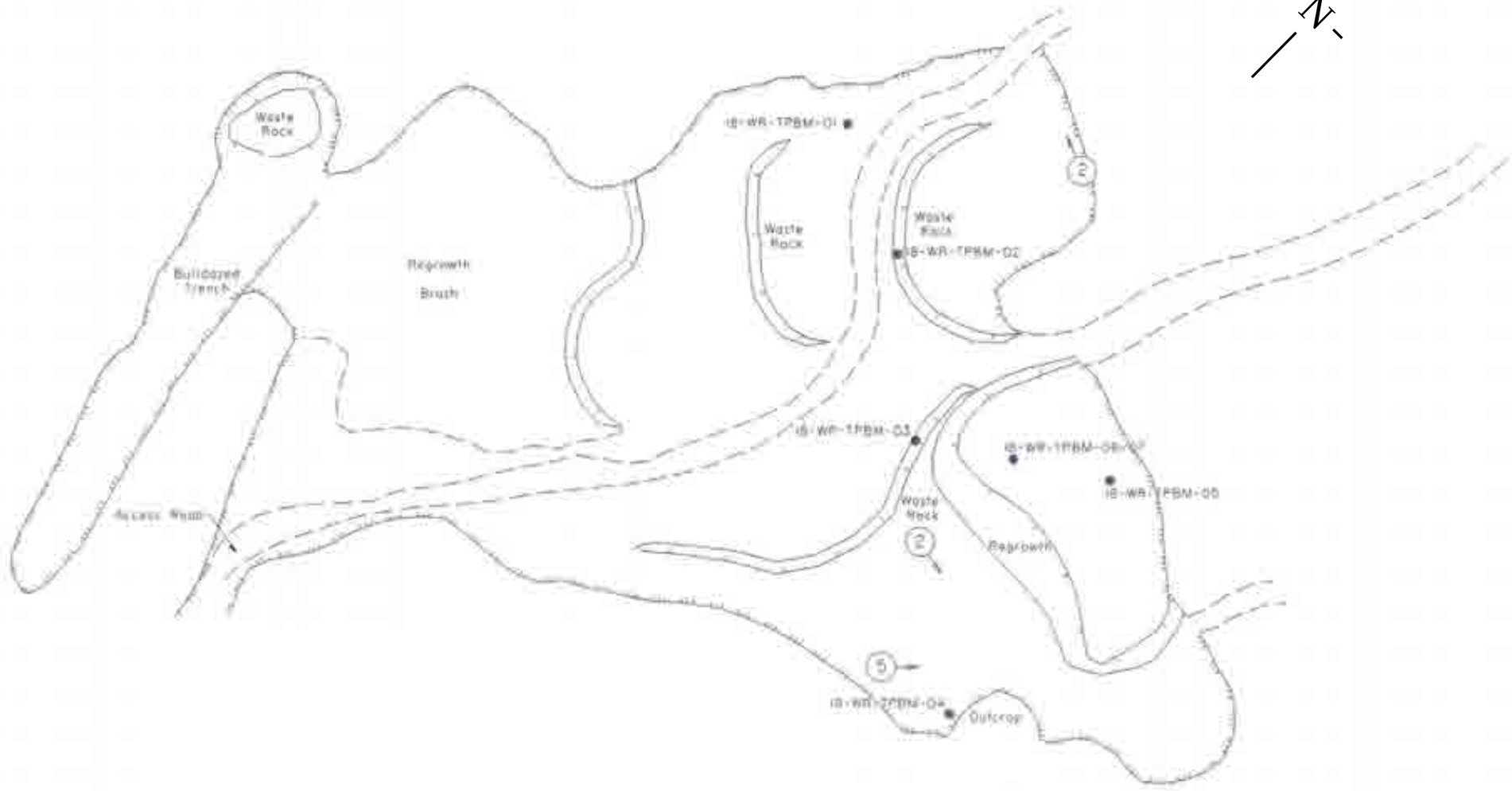
Baseline Environmental Report,
United Keno Hill Mines Property

Flame & Moth Site #18

Date: Jan. 2007

Approved:

Figure: **69**



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Flame & Moth Site #18

Job No:	ALEX-06-ESP-05
Filename:	Site18_FlameMoth_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		70

3.16.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

3.17 ONEK

3.17.1 Description

Onek was mined originally from underground, and subsequently from the open pit. There is one adit, located at the 400 level, in Keno City. The Fisher shaft daylights within the Onek open pit (also called the Fisher Pit); the pit bottom being about 25 feet above the 100 level. The second shaft developed at Onek is located about 650 feet SW of the Fisher shaft.

There is clearly a hydraulic connection between the pit and the underground workings, primarily through the Fisher shaft. This hydraulic connection is of particular interest at Onek, due to the history of ice damming in the adit, and subsequent sudden release of stored water as the ice plug was displaced. This ceased to occur when the open pit was developed in the mid 1980's. However, the adit continues to drain water from the underground workings.

There are no remaining buildings or equipment remaining associated with the Onek development. The adit is open and, being located within Keno City, requires long-term control of access (AMC, 1996a).

3.17.2 Closure Issues

The Onek development consists of a small underground whose crown pillar was mined in a fairly large pit. Other than blocking access and shafts that enter the pit, there is little to do there. The underground is free draining, part of the year, with very low flow but high zinc and cadmium levels. Drainage seeps in to the ground, but there is no evidence of groundwater contamination. More groundwater investigation work is needed due to proximity to town. Bursting of the ice dam in the adit no longer occurs since the pit was developed thus this is not a closure issue (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 20.

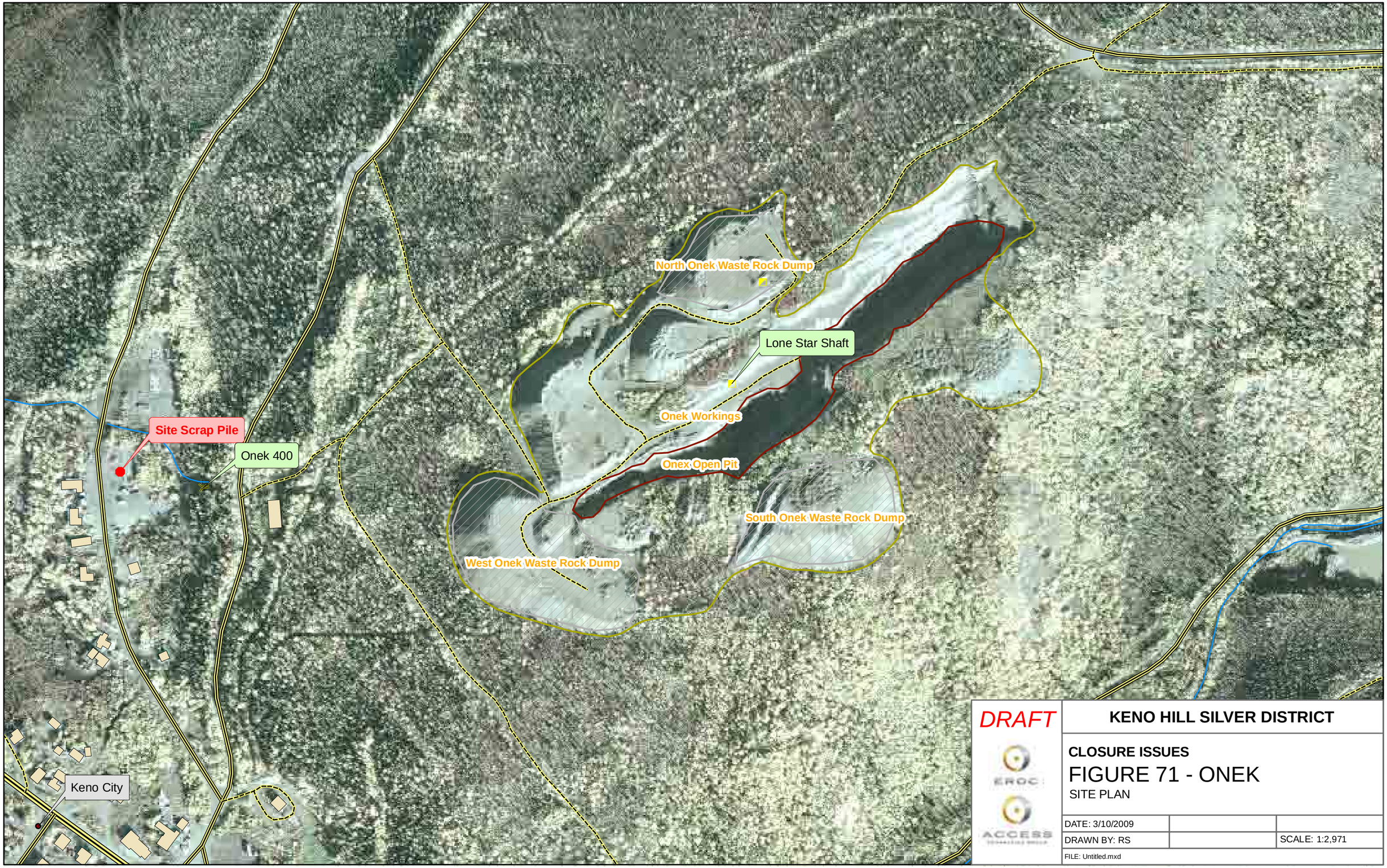
An ortho-map for Onek is shown in Figure 71, while maps for the pit and waste dump, and 400 Portal created by the PWGSC follow as Figures 72 and 73 respectively. The Onek site plan, composite plan, and vertical longitudinal cross-section are presented as Figures 74 to 76 respectively.

Table 20 Onek Closure Issues Matrix

Common Site Name: **Onek**
PWGSC site #: 19

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	479577.00	7090692.00	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Onek Pit and Waste Dumps						
Dump - north and west areas				✔		
crest of waste dumps - north of Lone Star Shaft						
Buldings - north of Lone Star Shaft	✔	✔		✔		
south waste dump				✔		
pit edge				✔		
benches				✔		
Onek 400 Portal						
400 Level portal			✔	✔		
400 Level portal - area above				✔		
site buildings	✔					



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EROC

ACCESS

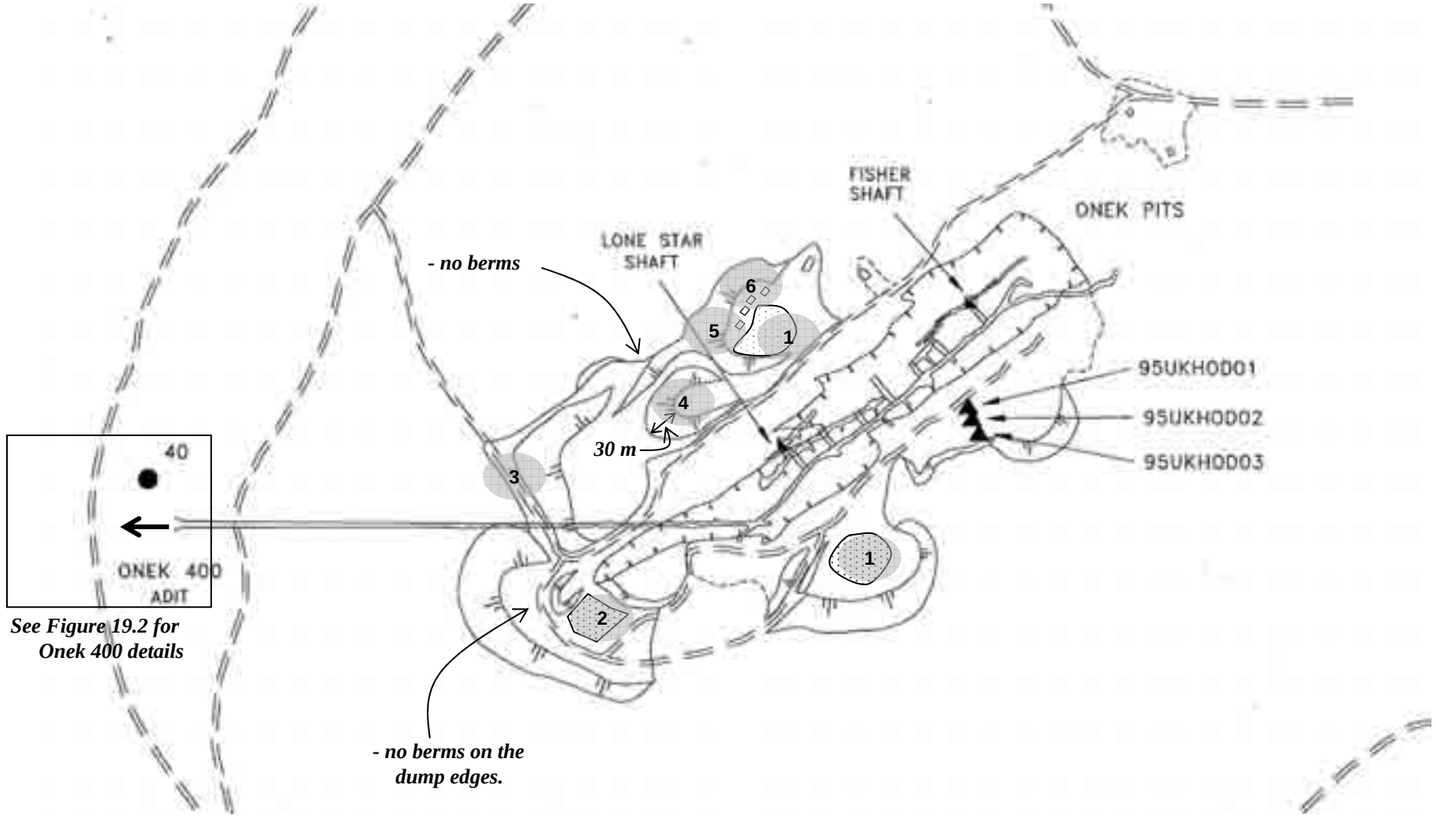
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 71 - ONEK

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,971
FILE: Untitled.mxd		



#1 - Free dumps and traffic surfaces of oxidized dark orangey brown to black ore

#2 - Free dumps of oxidized dark orangey brown to black ore
- Approximately 40 dump loads, each 2 m x 4.5 m x 4.5 m

#3 - North & west areas have berms
- South area – high, no berms and very steep

#4 - East slope berm – 30 m wide
- Berms smaller

#5 - No berms along the crest of the waste dumps

#6 -Minor hydrocarbon staining near buildings. Buildings in poor repair. One lead/ acid battery noted.

General Notes:

- No large pit failures are expected

- No water in pit

- Dumps reviewed; berms noted on some dumps

- Berms are lacking on the south waste dumps

- The benches will continue to unravel with each subsequent freeze and thaw cycle and slowly break back.

-The pit edge does not have protective berms in many areas

200 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

SRK Consulting
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VANCOUVER

ALEXCO

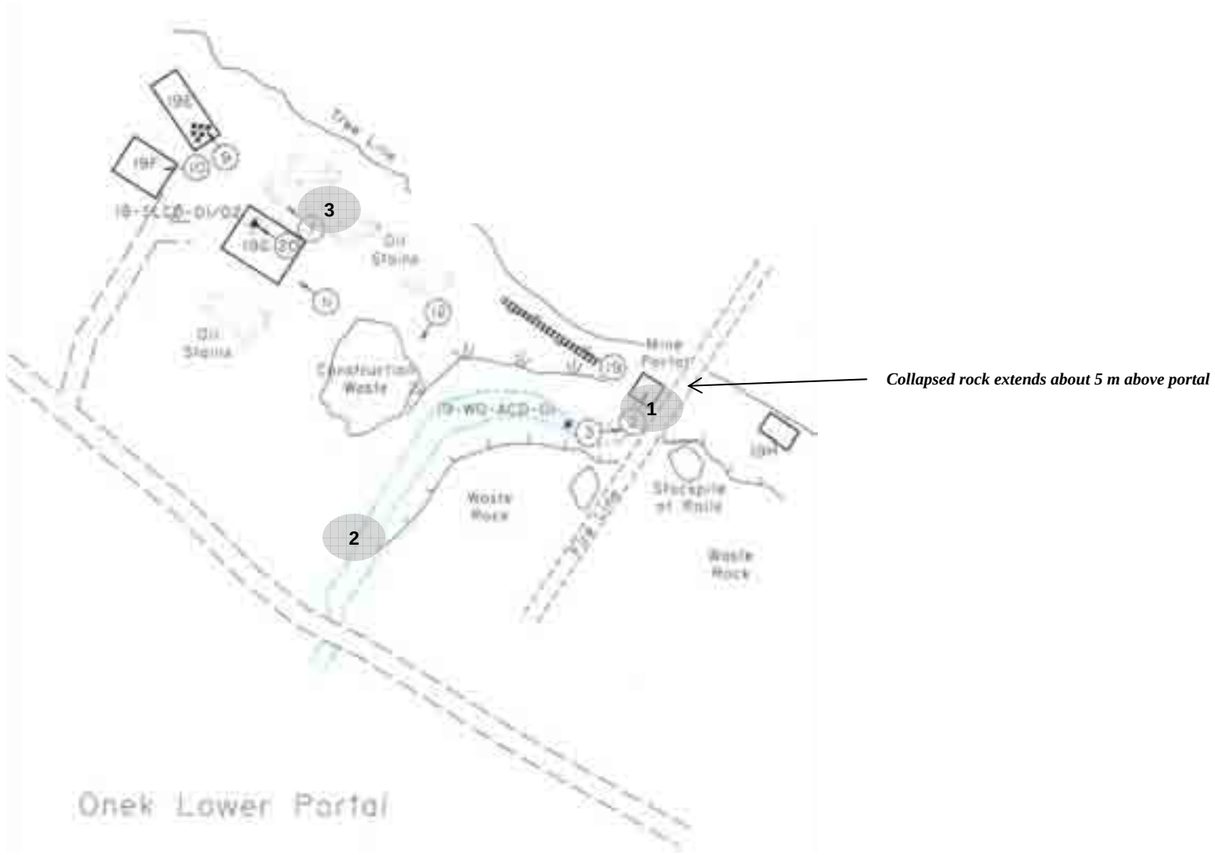
Onek Site #19
Onek Pit and Waste Dumps

Job No: 1CA009.000
Filename: Site 19_Onek_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date: Jan. 2007
Approved:
Figure: 72

- N -



#1 Ice blockage in portal. Outflow is not in discharge pipe, but flows along base (Photo 19.9). Timber bracing in poor condition (Photo 19.10).

New heat trace in place to maintain open flowpath through ice (Photo 19.11).

#2 Drainage from portal flows along ditch (Photos 19.7 and 19.8) and infiltrates about 10 m above culvert. Does not re-emerge downstream of road.

#3 No changes to buildings, debris, or rock pad since PWGSC (2000).

Collapsed rock extends about 5 m above portal

40 meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

SRK Consulting
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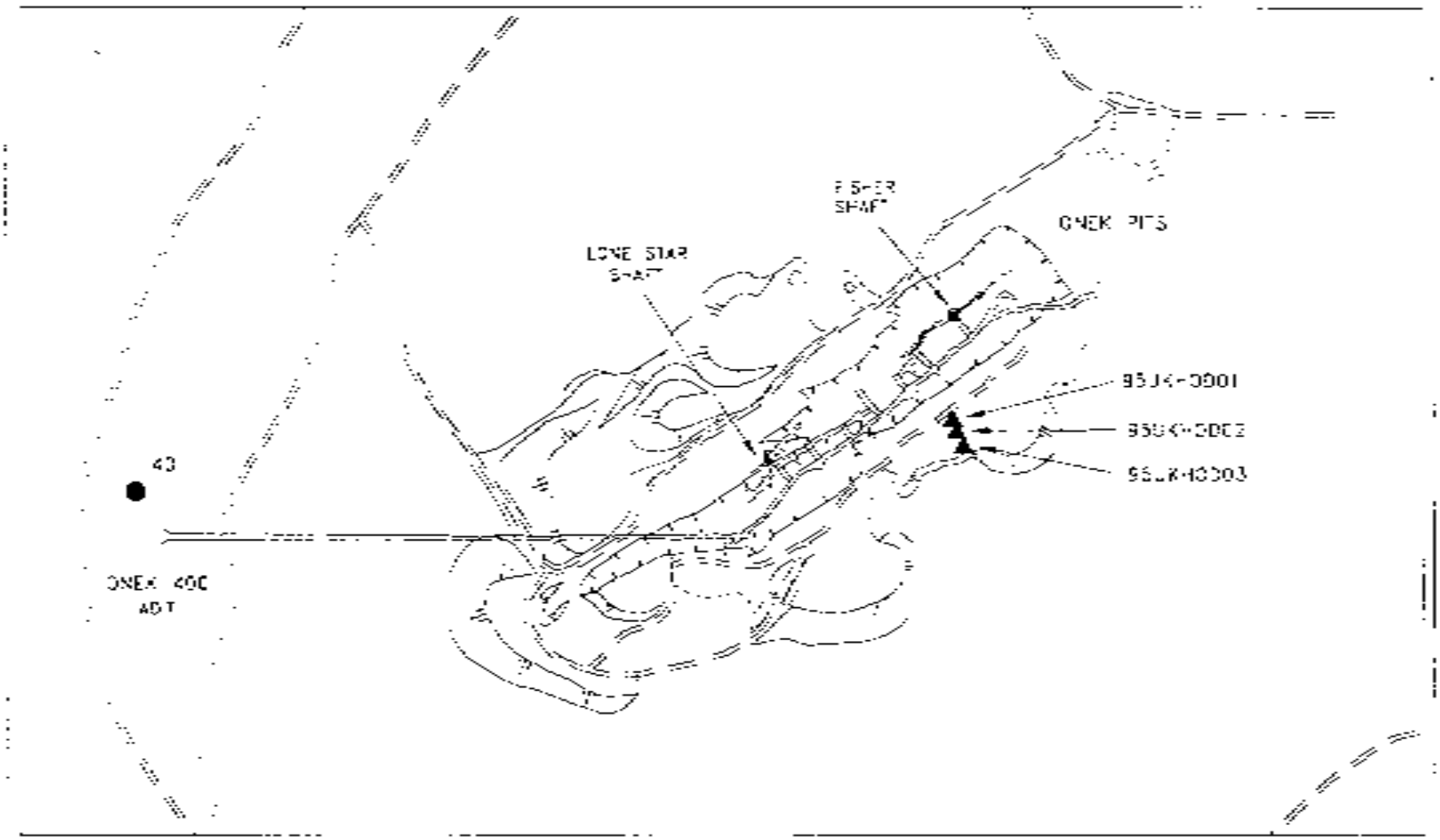
VANCOUVER

ALEXCO

Onek Site #19
Onek 400 Portal

Job No: 1CA009.000	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site 19_Onek_20070131.ppt			Figure: 73

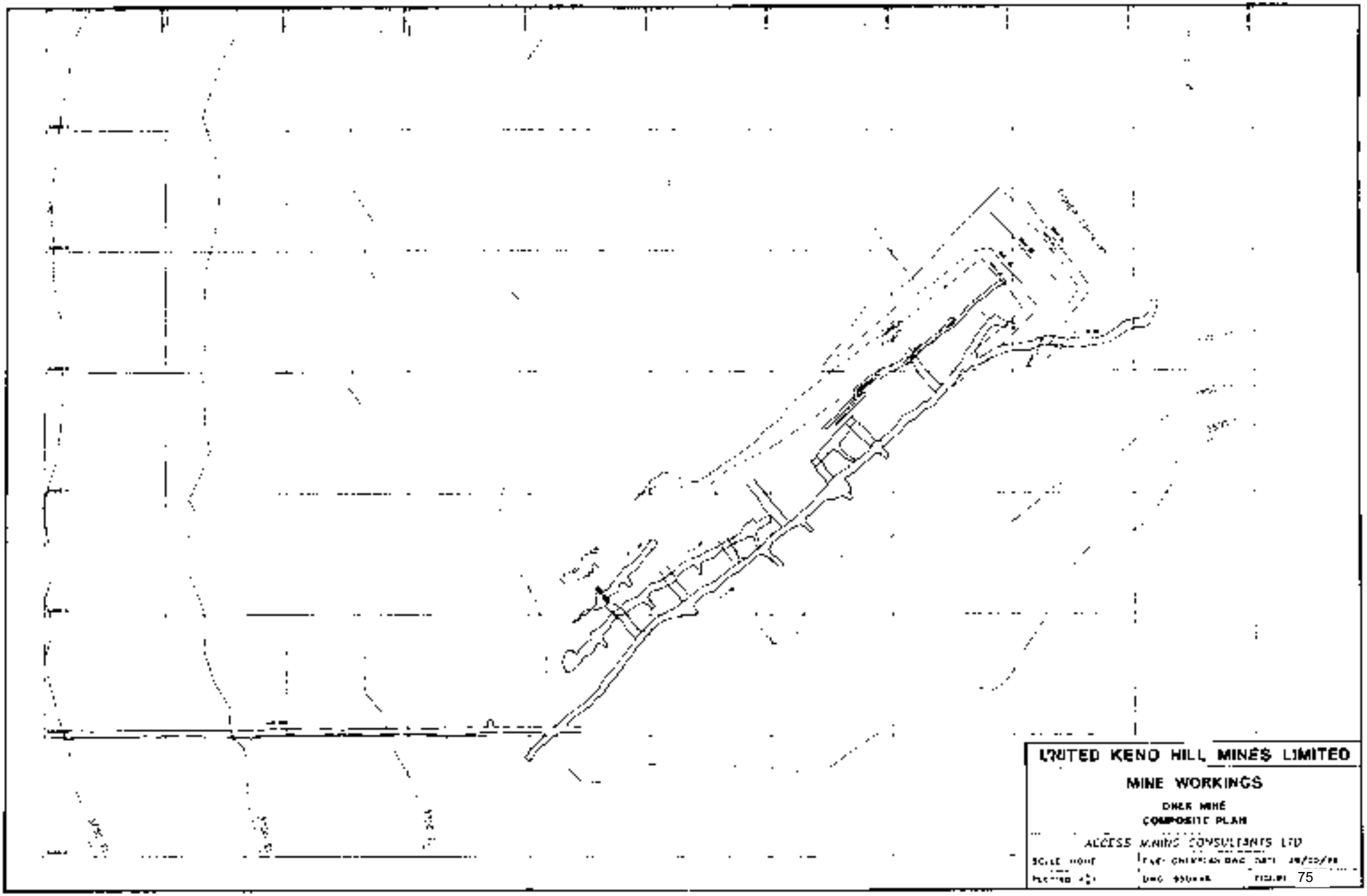


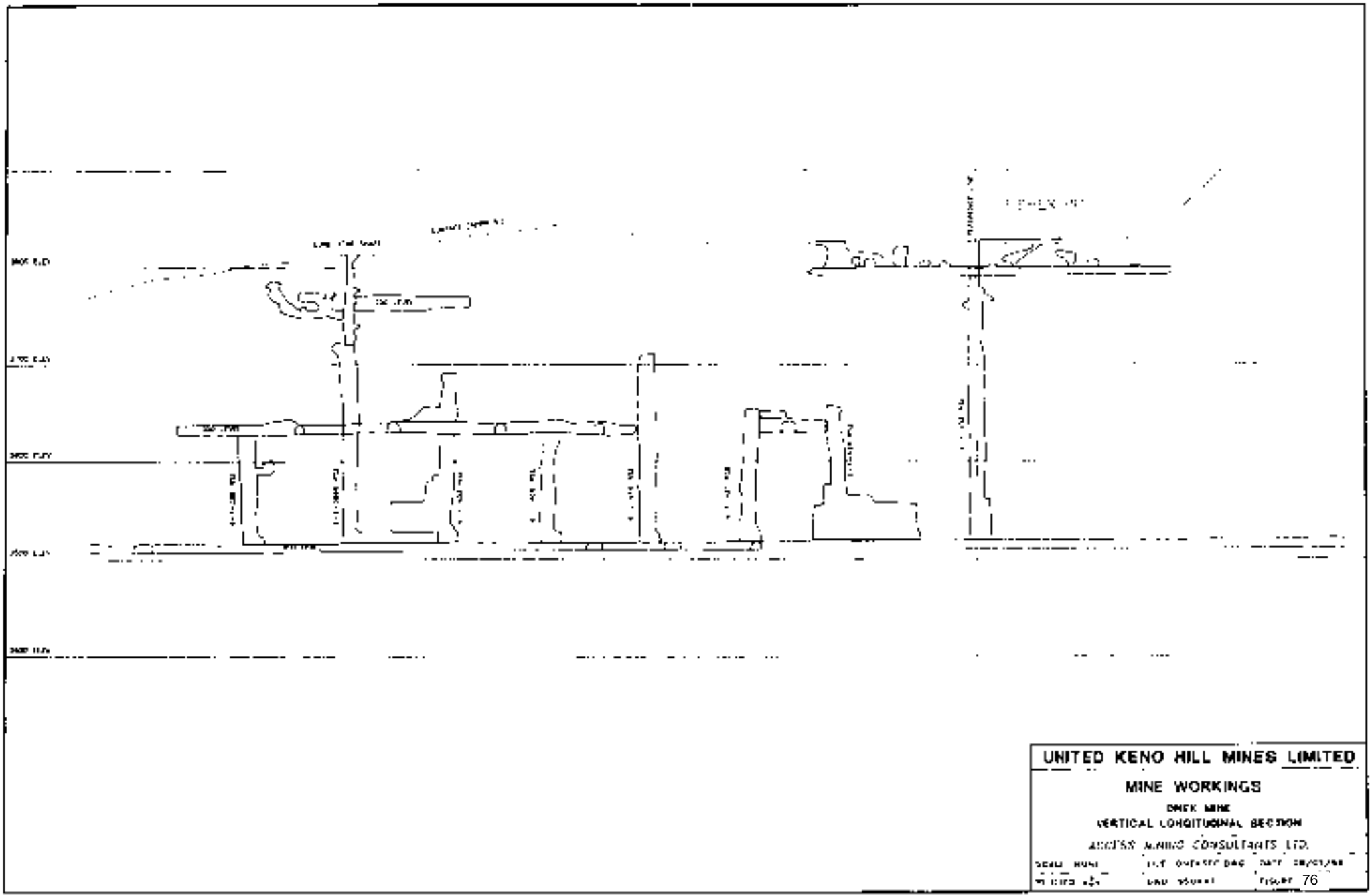
LEGEND

UNITED KENO HILL MINES LIMITED

ONEK

SITE PLAN


UNITED KENO HILL MINES LIMITED
MINE WORKINGS
DIXIE MINE
COMPOSITE PLAN
ACCESS MINING CONSULTANTS LTD



UNITED KENO HILL MINES LIMITED

MINE WORKINGS

DREK MINE

VERTICAL LONGITUDINAL SECTION

ACCESS MINING CONSULTANTS LTD.

3.17.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

3.18 KLONDIKE KENO

3.18.1 Description

Klondike Keno is located on the northwest slope of Keno Hill, approximately 1.5 km southwest of the Wernecke town site. The elevation of the site is approximately 38,500 m. The site is located near the road from Keno city to Wernecke town site, approximately 3.8 km from Keno City. The site is easily accessible by foot or four-wheel drive.

Klondike Keno is located on the northwest slope of Keno Hill. The elevation difference between the top of the site and the bottom is roughly 80 m. Site drainage flows southwest into the Christal Creek drainage area. The lower area of the site is well vegetated with bushes and spruce trees, the higher region of the site is vegetated by predominately grasses, and some dwarfed trees and bushes.

The dates of the adit and shaft workings are unknown. Bulldozing, drilling, and shipping of ore occurred in the 1950's (PWGSC, 2000).

3.18.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 21.

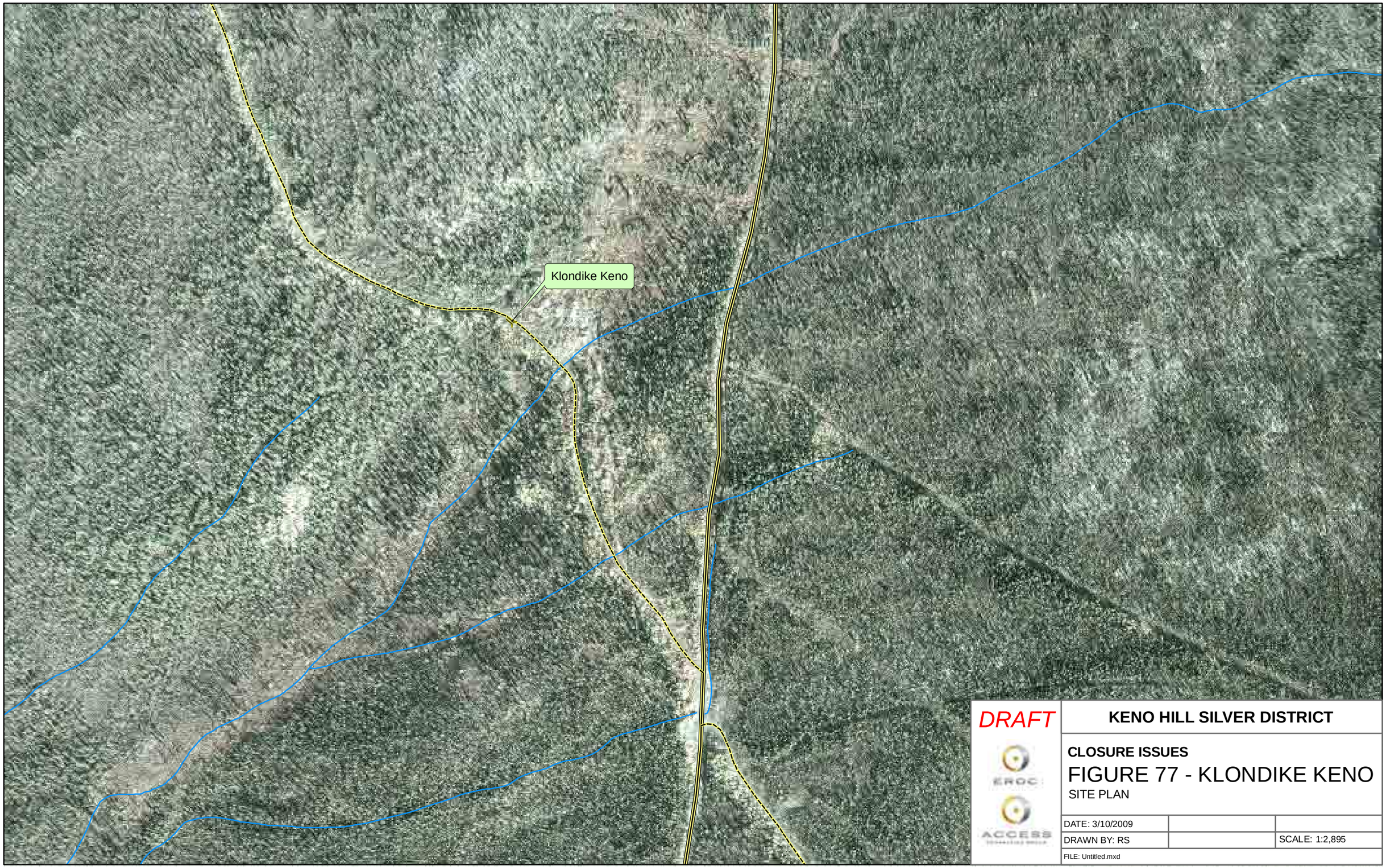
An ortho-map for the site is shown in Figure 77, while maps for the Sadie/Ladue site and Sadie Ladue 600 Adit created by the PWGSC follow as Figure 78 and 79 respectively. A PWGSC map of the Sadie/Ladue and Klondike Keno site plan is presented as Figure 80.

Table 21 Klondike Keno Closure Issues Matrix

Common Site Name: **Klondike - Keno**
PWGSC site #: 20

	easting	northing	
Site coordinates:	485597.00	7090841.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
General site	✔					
Linear depression between collapsed portal and collapsed adit				✔		
Townsite buildings	✔					



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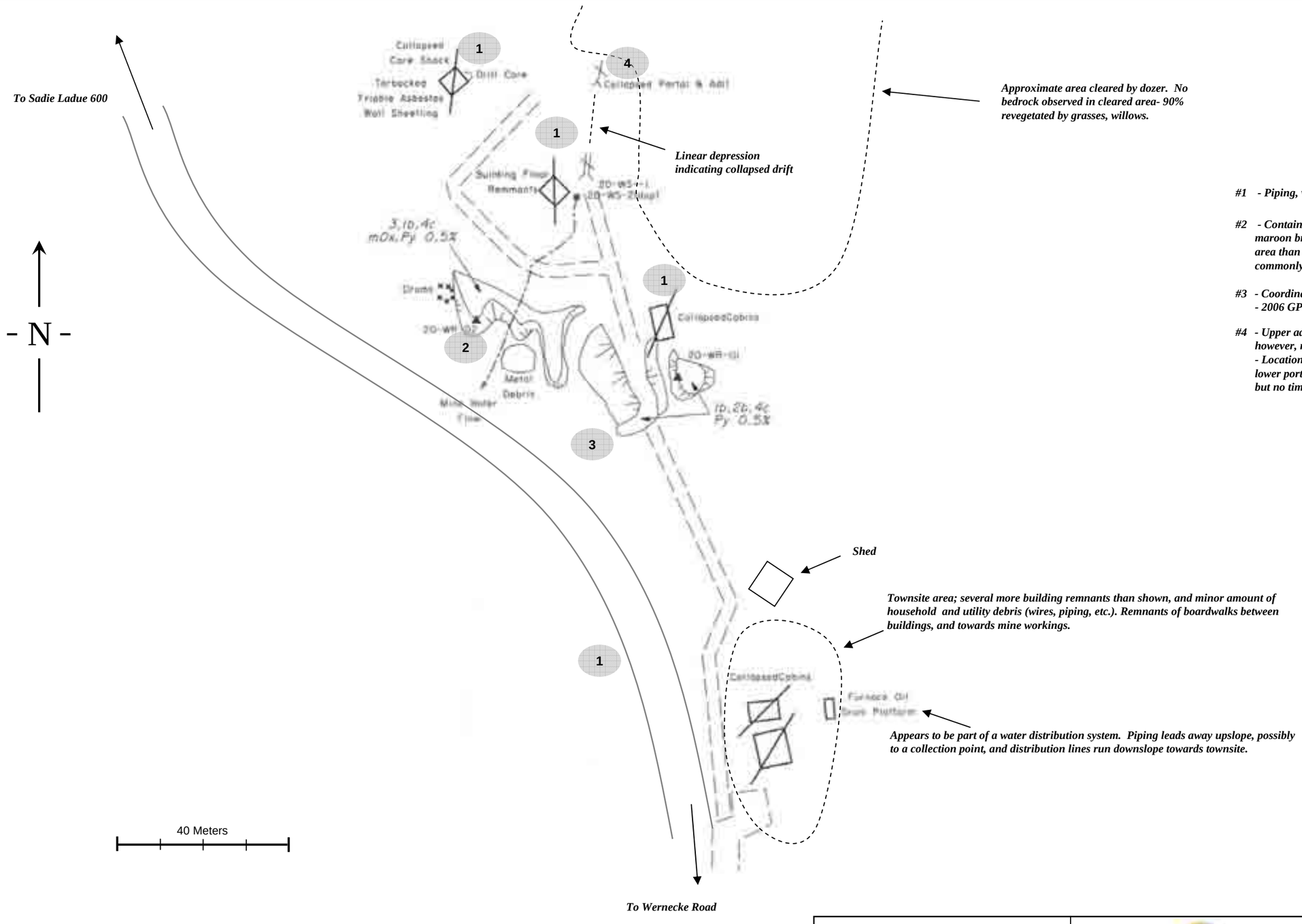
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 77 - KLONDIKE KENO

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,895
FILE: Untitled.mxd		



#1 - Piping, wood, and metal debris spread across site

#2 - Contains zones of 90% quartz siderite waste, weathering maroon brown. More orange-stained clasts (<1%) in this area than in other waste at this site; orange staining mostly commonly occurs on carbonaceous phyllite.

#3 - Coordinates and elevation in PWGSC 2000 are not correct.
- 2006 GPS position: NAD 83 UTM position 485597 E 7090841 N.

#4 - Upper adit not located. Reported to be 225 m from lower adit; however, map indicates approximately 20 m.
- Location as shown on map at upper limit of collapse drift of lower portal; service pipe was noted in collapsed rubble and soil, but no timbers were observed.

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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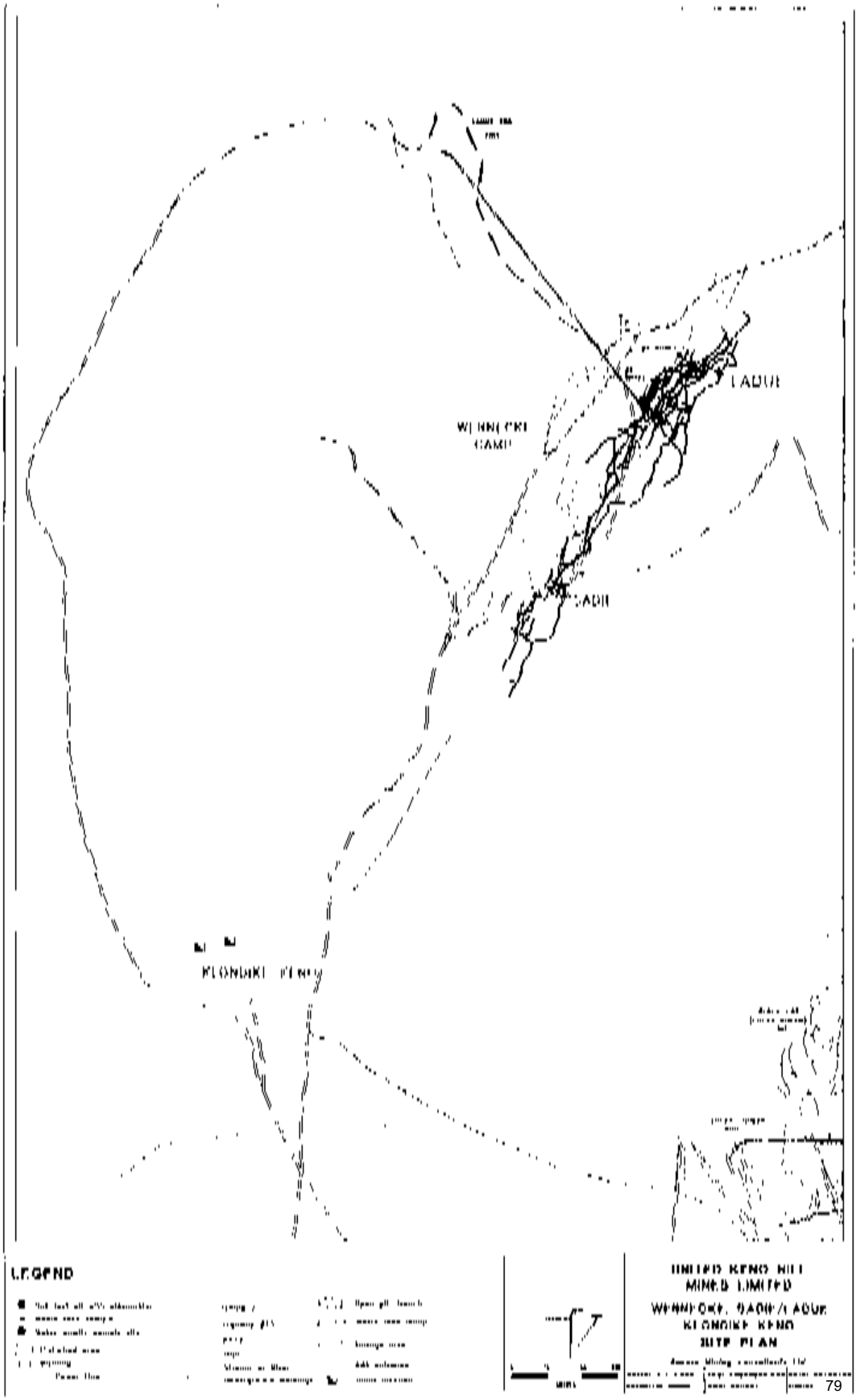
VANCOUVER

ALEXCO

Klondike-Keno Site #20

Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site20_KlondikeKeno_20070131.ppt		Figure: 78	


LADUE
LADUE
LEGEND

3.18.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)
Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.
Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).
Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.
Report:
ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.19 SADIE LADUE (WERNECKE)

3.19.1 Description

The Sadie Ladue underground workings are some of the oldest workings in the Keno Hill area, mined in the 1920's and 1930's. There were four shafts, two on the Sadie portion of the vein to the 400 level and two on the Ladue portion to the 600 level. The Sadie vein was developed on five levels (100 level to 400 level) and the Ladue and six levels (50 level to 600 level). The Sadie 600 level adit was driven for dewatering and access of men and materiel. Some rehabilitation work was done at the 600 adit in the late 60's and early 70's to remove the ice and allow access to the upper old workings. Frozen ground was noted to extend below 260 feet depth (Wernecke quoted in McTaggart, K.C., 1960).

There is still a small, shallow open pit at the Wernecke Camp. The Sadie-Ladue 600 adit has partially collapsed since it was last used in the 1960's, but does still drain water for some of the year.

The Sadie-Ladue surface disturbance was done by UKHM surface exploration trenching and Archer Cathro's hand mining operation. Before their work, a thick cover of alder up to 5 feet high covered the area. It is reported that all the shafts, as well as the two stopes and raises to surface, were filled in as of the 1980's (AMC, 1996a).

3.19.2 Closure Issues

A mill was located at Wernecke near the Sadie Ladue vein in the 1920's and 1930's. Tailings were apparently draped over the hillside and ran down a gully past the Sadie 600 adit. They may have eventually accumulated in a small lake at the base of the hill. None of this activity was by UKHM. Underground mining was accessed by shaft and later by a free draining adit at the 600 level. Much of the ground in this area is permanently frozen. The crown pillar of the vein was mined in a small open pit. Closure issues include contouring the surface mined area and ensuring shafts are safe but chemical issues are not significant. Frozen conditions may limit drainage water contamination. Water quality in the gully and the lake are unknown.

This area has already been discovered by hikers and tourists, and there is potential to enhance tourism opportunities. The closure priority therefore is public health and safety (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 22.

An ortho-map for the site is shown in Figure 80, while a map for this site created by the PWGSC follows as Figure 81. A plan showing the Wernecke, Sadie/LaDue and Klondike-Keno sites is presented previously as Figure 79. A composite plan of the Sadie Ladue Mine is presented as Figure 82.

Table 22 Sadie Ladue (Wernecke) Closure Issues Matrix

Common Site Name: **Sadie Ladue**
PWGSC site #: 21

Site coordinates:	easting	northing	
	486400.00	7092000.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Pit #5 - east side	✔			✔		
Sadie-WS-1 (south of Lucky Queen road)			✔			

Sadie Ladue

Wernecke Railroad

Workings

Sadie Ladue

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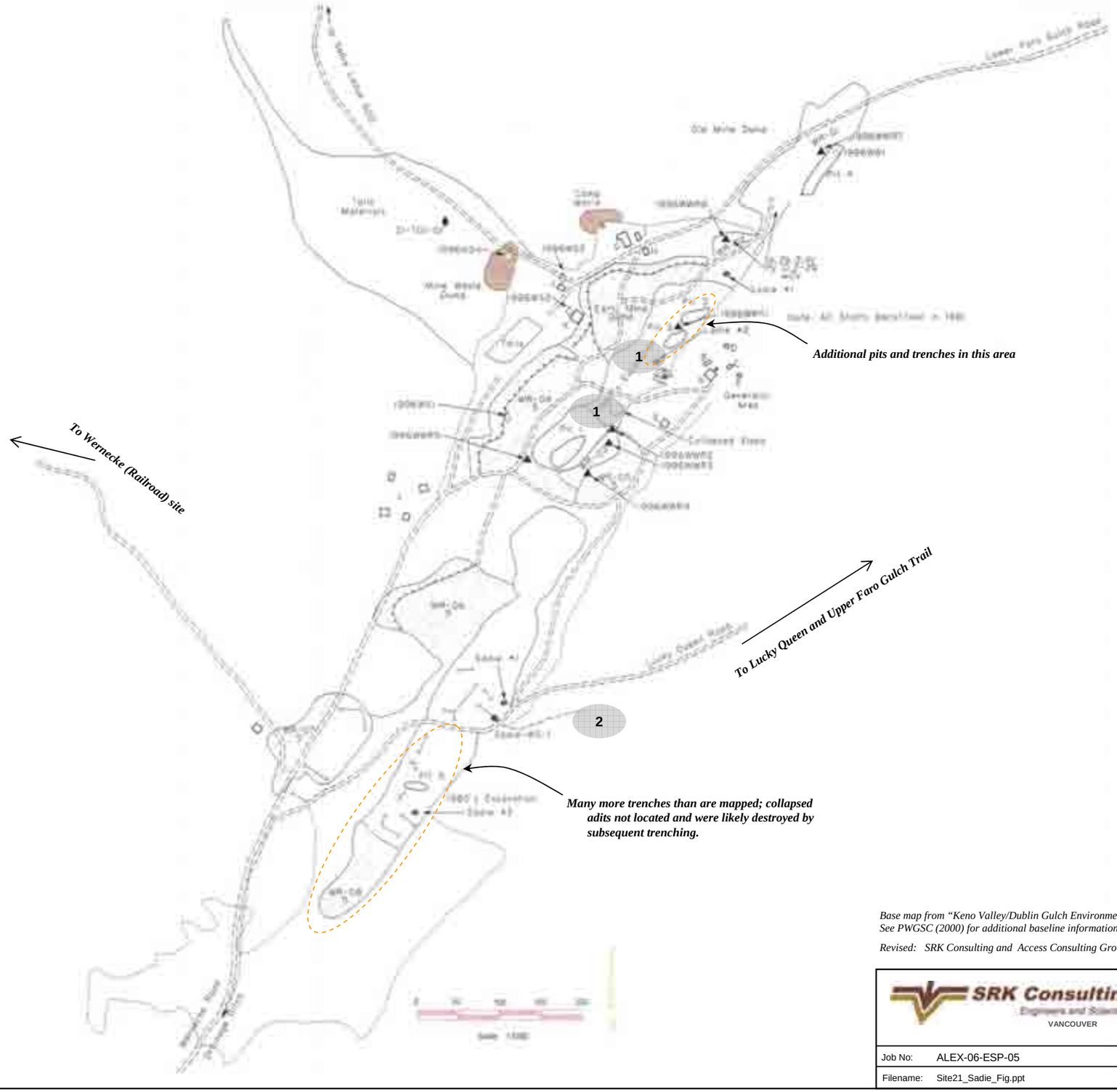
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 80 - SADIE LADUE & WERN

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:5,932
FILE: Untitled.mxd		



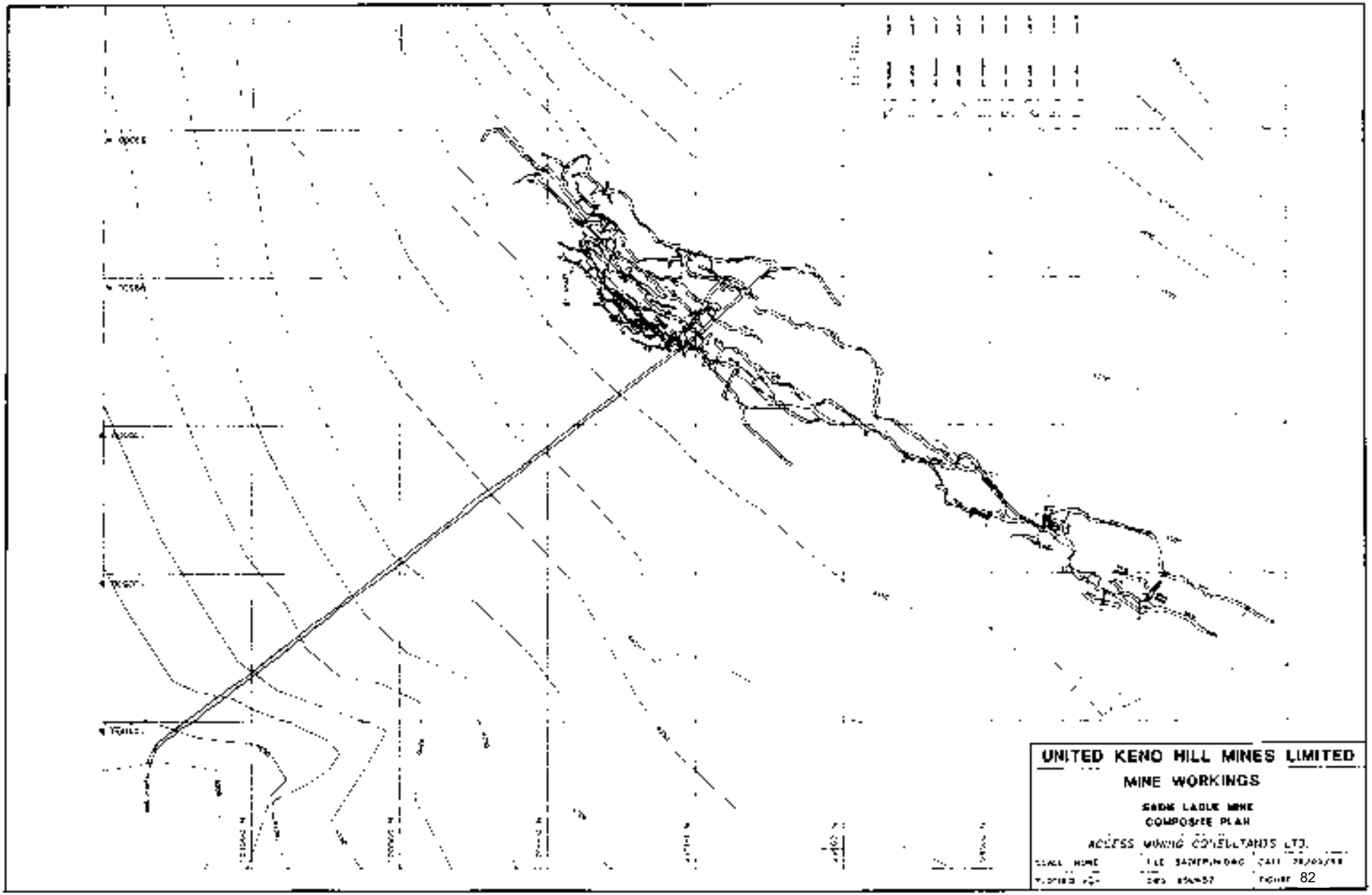
#1 Collapsed stope and Ladue #2 Shaft were backfilled in 2006

#2 Water flow continues to enter pit at this location (visual estimate of 0.5 L/second in Sept. 2005). Water infiltrates into pit bottom- no evidence of surface flow out of pit was observed. May enter underground workings below pit.

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

SRK Consulting Engineers and Scientists VANCOUVER	ALEXCO	**Sadie Ladue Site #21**
Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007 / Approved: / Figure **81**
Filename: Site21_Sadie_Fig.ppt		


UNITED KENO HILL MINES LIMITED
MINE WORKINGS
SAGA LADLE MINE
COMPOSITE PLAN
ACCESS MINING CONSULTANTS LTD.

3.19.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.20 BELLEKENO

3.20.1 Description

The only mine located on Sourdough Hill is the Bellekeno underground mine. It was originally mined by Mackeno Mines from adits at the 100 and 200 levels in the 1950's. The status of the adits with respect to closure requirements must be confirmed, although it is understood that they have collapsed at the portals. The ore was milled at the old Galkeno Mill located at Christal Lake, which has since been demolished and removed.

Mining began again in 1984 with the development of the adit at the 625 level. This was used to mine ore from the 500, 625, 700, 750 and 800 levels from 1984 through to 1989. Dewatering and rehabilitation of the 700 through 800 levels, from the 625 adit, began in 1994. Work is still in progress for exploration and development by a decline to the lower levels at Bellekeno.

Water treatment of the underground water was initiated with the rehabilitation work in 1994. The water is treated as it is pumped from underground, and settling occurs in two settling ponds at the 625 portal.

In addition, there was some minor trenching at the upper Bellekeno adits during the 1980's.

The only buildings that remain in place are at the 625 level, associated with the adit, and are currently in use. There was some foundation preparation done at the 200 level in anticipation of building a backfill plant to supply backfill through a drill hole to the lower workings of the mine (AMC, 1996a).

3.20.2 Closure Issues

The Bellekeno mine is a zinc-rich mine which produces moderately zinc rich mine drainage. Adit discharge flow is also moderate thus Bellekeno has potential to produce moderate loads to the receiving environment. Furthermore, there is little opportunity to mitigate due to the steep topography and permafrost. The adit discharge will continue to be monitored and other closure measures will be investigated. There are several adits that need work to ensure their safety (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 23.

An ortho-map for the site is shown in Figure 83, while maps for the Bellekeno 600 and the Bellekeno Eureka areas created by the PWGSC follow as Figures 84 and 85 respectively.

The site plan, level plan and the vertical longitudinal section diagrams for this site are presented as Figures 86 to 88 respectively.

Table 23 Bellekeno Closure Issues Matrix

Common Site Name: **Belekeno**
PWGSC site #: 22

	easting	northing	
Site coordinates:	487355.63	7086979.01	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Waste rock pile toe - west side of Thunder Gultch			✔	✔		
Waste Rock toe in creek - Thunder Gultch		✔				
Settling ponds		✔	✔			
Secondary containment			✔	✔		
Waste rock slope				✔		
Settling ponds			✔			
Waste rock pile toe - north side		✔				
Belekeno Site - Eureka Area						
Rise - north side of building	✔					
Hole in adit area - south of Eureka Shaft #3	✔					
Belekeno general site issue						
Level 100 shaft	✔			✔		

0

Settling Pond

Mayo Mine

Workings

Belkeno 100

DRAFT

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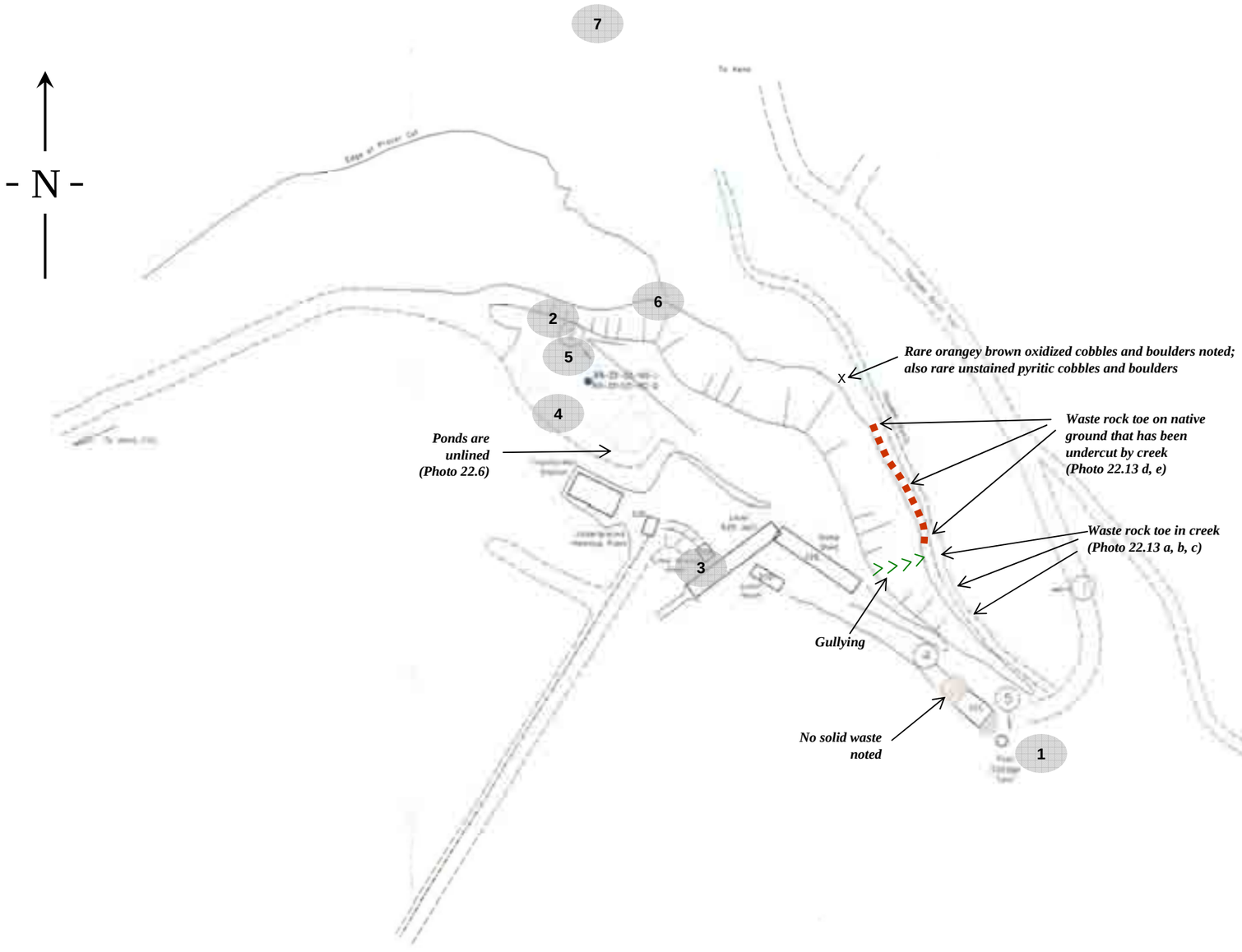
CLOSURE ISSUES

FIGURE 83 - BELLEKENO

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:6,428
FILE: Untitled.mxd		



#1 Secondary Containment
- *wood lumber crib lined with black plastic*
- *plastic is compromised on west side, i.e. a spill would not be contained*
- *containment has ponded water and algae inside to depth of 5 cm*

Tank contains ~8" of product
- *appears to be drawn down to level of outlet pipe and valve*

#2 Minor tension cracks along edge of pond and along crest of waste rock slope (Photos 22.7 and 22.8)

#3 Lime addition system in Bellekeno 625 adit shack
- *lime slurry storage tank with single mixer*
- *peristaltic pump*
- *slurry drips into adit outflow in half-round 16" corrugated pipe*
- *system is connected to grid power (Photos 22.1, 22.2, 22.3, 22.4)*

#4 Upslope runoff drains into poorly graded ditch along south side of pond and may seep into pond (Photo 22.5a)

#5 Pond discharge via 16" corrugated pipe over edge of waste rock pile (Photos 22.9 and 22.9a)

#6 5 – 8 Seeps, no staining but some unhealthy vegetation (Photo 22.12)

#7 Active placer operation on Lightning Creek above and below confluence with Thunder Gulch

***General Notes** - September 20, 2005*
- *inflow to ponds ~5L/s (Photo 22.11)*
- *outflow via discharge pipe ~ 0.4 L/s (Photo 22.9a)*
- *remainder lost to seepage*

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

SRK Consulting
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ALEXCO

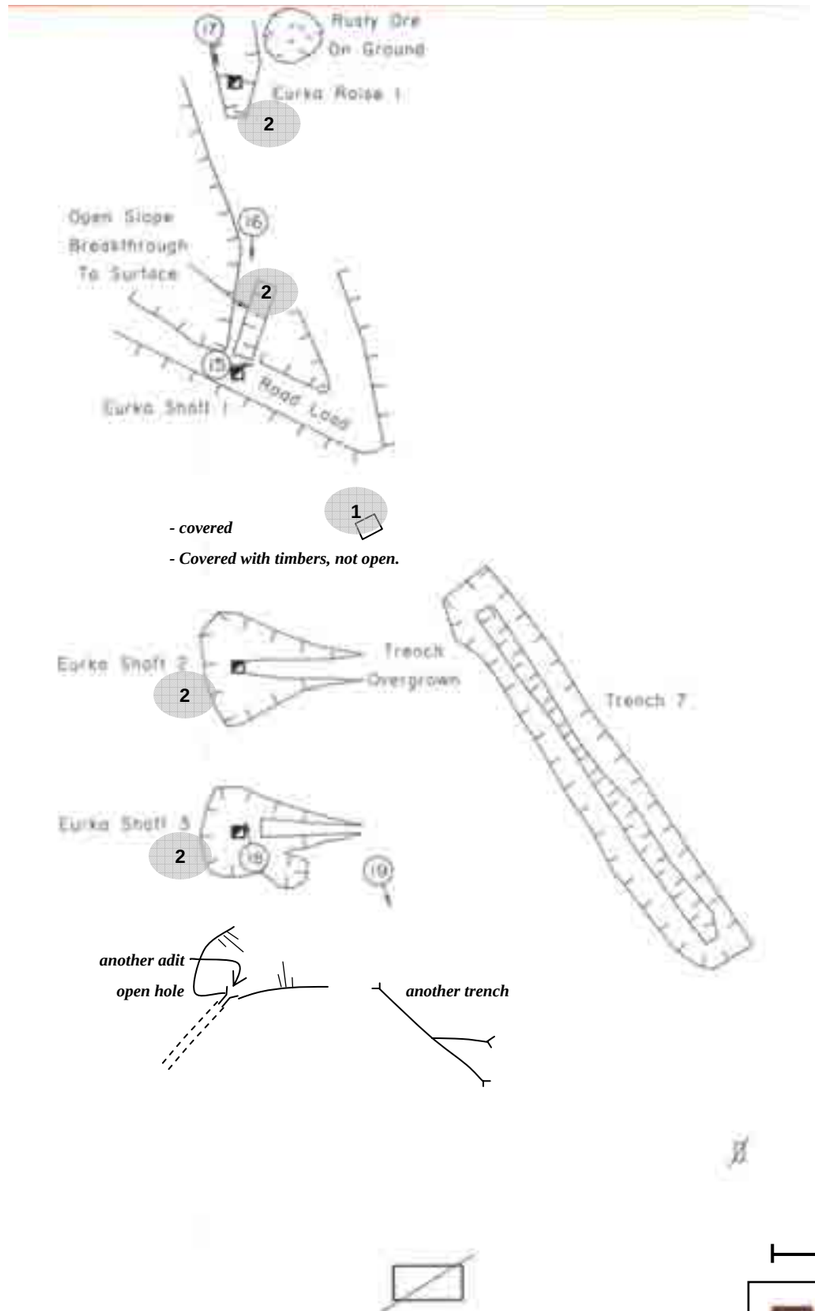
Bellekeno Site #22
Bellekeno 600 area

Job No: 1CA009.000
Filename: Site 1_Silver King_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007
Approved:
Figure: **84**

- N -



#1 - Unmapped vertical raise identified in 2005.
- 6 – 8 ft of the raise is exposed. Lower down is closed as the sides may have collapsed.
- May have been backfilled in 2006.

#2 - Eureka Raise 1, Eureka Shaft 1 and adjacent collapsed stope, Eureka Shaft 2, Eureka Shaft 3 all backfilled in 2006

200 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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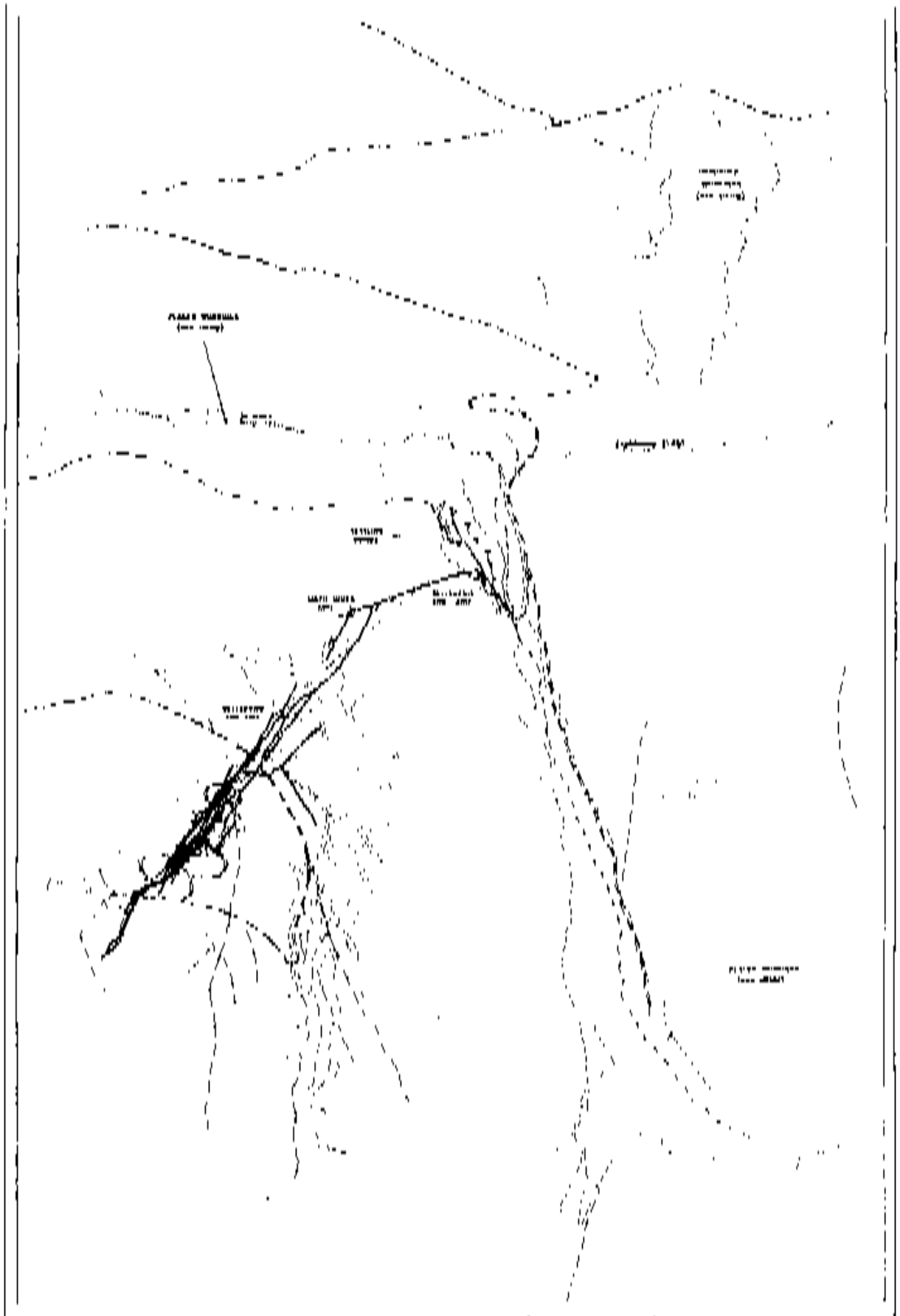
ALEXCO

Bellekeno Site #22
Eureka area

Job No: 1CA009.000
Filename: Site 1_Silver King_20070131.ppt

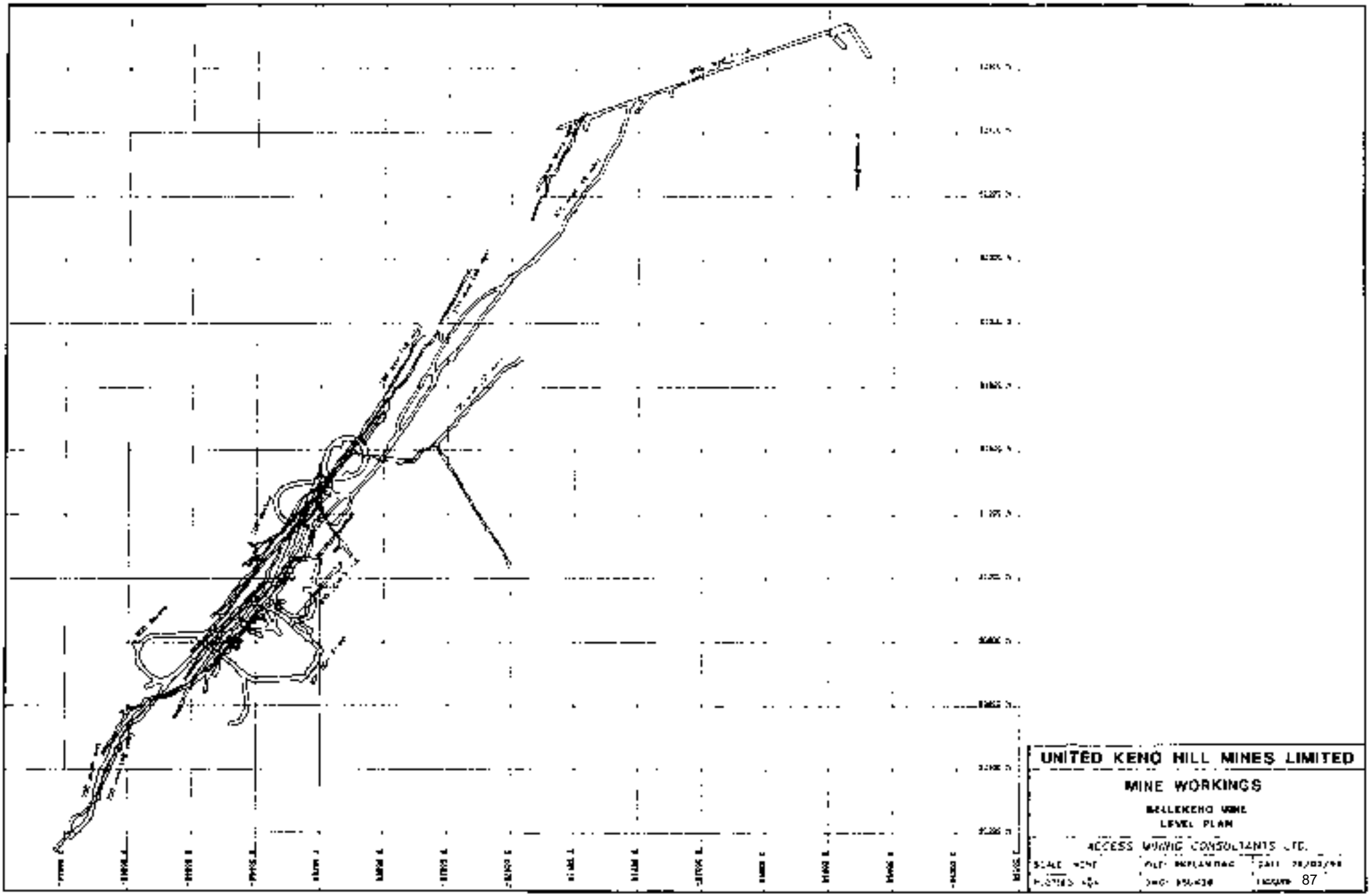
Baseline Environmental Report,
United Keno Hill Mines Property

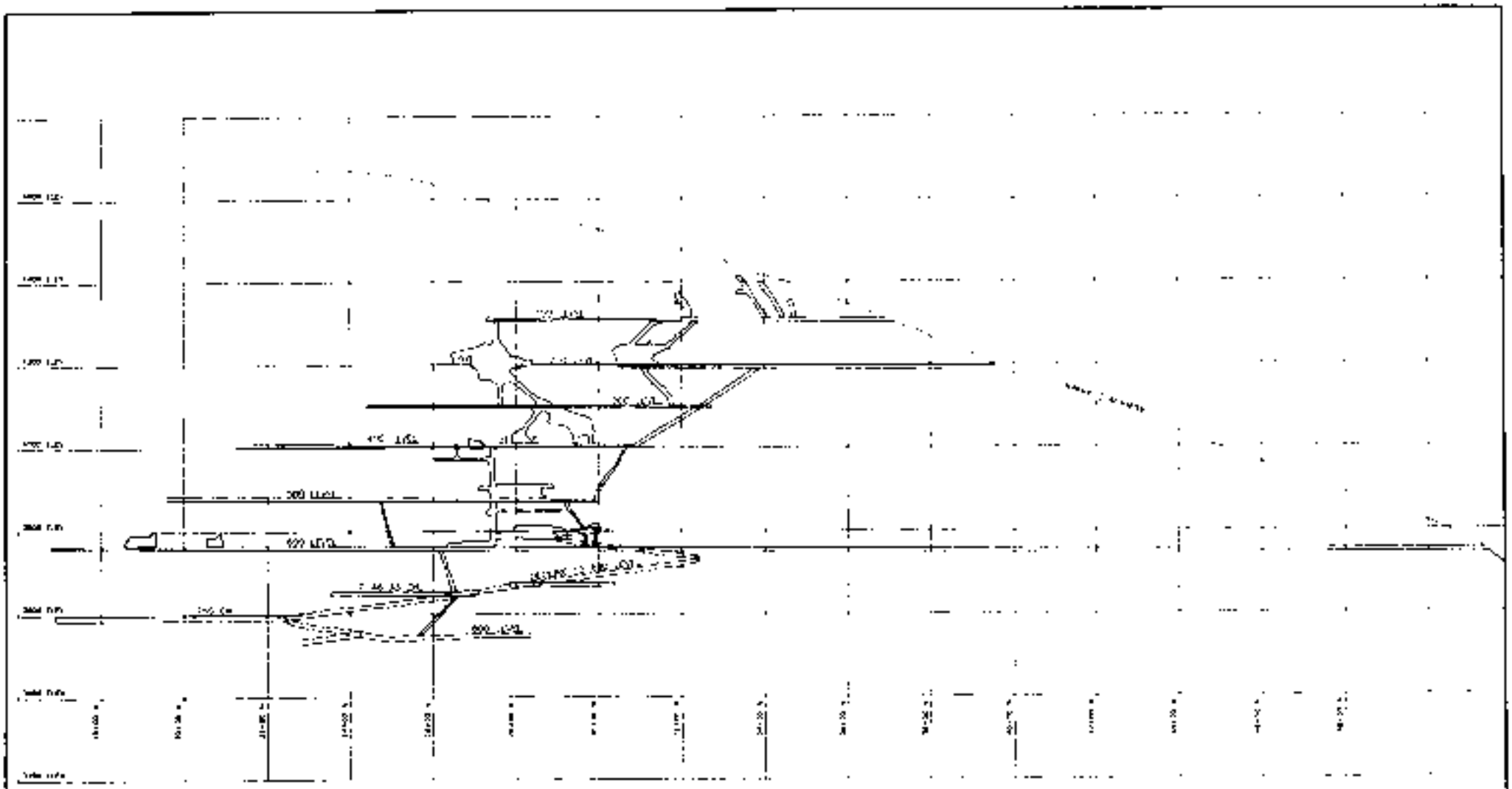
Date: Jan. 2007
Approved:
Figure: **85**



UNITED KENO HILL
MINES LIMITED

BELLEKENO
SITE PLAN


UNITED KENO HILL MINES LIMITED
MINE WORKINGS
BELLEKENO MINE
LEVEL PLAN
ACCESS MINING CONSULTANTS LTD.



UNITED KENO HILL MINES LIMITED

MINE WORKINGS

BELLEKENO MINE

VERTICAL LONGITUDINAL SECTION

ACCESS MINING CONSULTANTS LTD

3.20.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.21 KIJO

3.21.1 Description

Kijo is on the mid-southwest slope of Keno Hill at an elevation of 1200m. The site is roughly 500m north of Erikson Gulch. Two wheel drive access is possible via Blackcap Road, which branches southeast off of Wernecke Road (3.8krn from Keno Hill town site). Access to the Kijo site is best gained by proceeding 0.9 km up the Blackcap Road and then walking down slope off the road approximately 80m at an azimuth 240°.

The Kijo site area is moderately sloped (15-20") and is at an aspect of 220". The site is situated at the perimeter of the Erickson Gulch catchment. No surface runoff streams or pathways were observed. Moderately thick residual and colluvial soils and till cover the underlying host rock. Evidence of permafrost was observed in the vicinity on the Croesus No. 1 site (site #24) roughly 400m to the southeast. The area is thickly vegetated with fir, balsam, and spruce trees. Willows, moss growth, and shrubs were also observed. Wildlife game trails were observed throughout the immediate area.

Site exploration includes bulldozer trenching and the development of three adits. The date of this exploration work is unknown. Given the amount of revegetation that has occurred, it is probable that the work took place sometime in the 1920s to 1930s.

Mine development at this site includes an upper, middle and lower adit/trench. Due to the low topography, long trenches were excavated to the portal of the 3 adits. Waste rock piles are located at the end of the upper and lower trenches. Based on the evidence presented by the waste rock piles and portal excavation, it is likely only minimal development was conducted into bedrock. A small pile of ore is stockpiled near the middle trench (PWGSC, 2000).

3.21.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

No new closure issues were noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting. A closure issues table follows as Table 24.

An ortho-map for the Kijo site is shown in Figure 89, while a map created by the PWGSC follows as Figure 89.

Table 24 Kijo Closure Issues Matrix

Common Site Name: **Kijo**							
PWGSC site #: 23							
	easting	northing					
Site coordinates:	486195.00	7089814.00	*coordinates are projected to UTM zone 8 N, Nad 1983				
General Location Description		Closure Issue Categories					
		Human & Wildlife Health and	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Adits							
Trench							
Pits							

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CLOSURE ISSUES

FIGURE 89 - KIJO

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,257
FILE: Untitled.mxd		

#1 - Coordinates in PWGSC (2000) are not correct.
NAD 83 UTM position 486195 E 7089814 N.

#2 - Minor (10%) orange, black, and dark rusty brown clasts exposed on lower margin of pile- remainder is revegetated. Fines are light greyish brown.

100 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Kijo Site #23

Job No:	ALEX-06-ESP-05
Filename:	Site23_Kijo_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**90**

3.21.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

3.22 CROESUS NO. 1

3.22.1 Description

Croesus No. 1 occurs midway up the western slope of Keno Hill, extending roughly 350m along an azimuth of roughly 005° up the north side of Erikson Gulch from the creek at 1160m a.s.l. to 1280m a.s.l. Two-wheel drive access is possible via Blackcap Road which branches off of Wernecke Road, 1.3 km to the northwest. The site is off the road roughly 160m southeast of a Blackcap Road switchback along an azimuth of 120°.

No surface water was observed associated with the Croesus No. 1 mine workings. Shallow seeps are likely based on the presence of coarse talus below 1230m. All runoff from the mine site flows southward to Erikson Gulch, a tributary of Christal Creek. Shallow ditches, probably cut by the early miners to channel spring runoff to the mine workings, were found above the site. Runoff from the upper section of the Blackcap Road is channeled off the end of the switchback and down the slope adjacent to the Croesus No. 1 workings. There are no culverts or waterbars along the Blackcap Road to dissipate the runoff on to the shallow west facing slope above. The excess runoff has cut a gully into the unstable slope adjacent to the Croesus No. 1 site.

The history of the Croesus No.1 is not well documented. Most of the underground development work is considered to date from the 1930s. The larger cat trenches possibly date from the 1940s. The Minfile report (MINFILE# 105M 001ab) lists all work as pre-1965. Work completed on the site includes 4 adits, 3 shallow shafts into overburden, 2 bulldozer trenches, and a small hand trench. A total of 9 tonnes of ore grading 7.43 1 g/t silver were shipped offsite, probably in the 1930s.

There are four collapsed adits, three shafts and three trenches located on the property. There are five waste rock piles associated with these excavations. All the workings occur along a trend of azimuth 005° at the western edge of a prominent greenstone outcrop located roughly 160m east of the Blackcap Road switchback.

3.22.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 25.

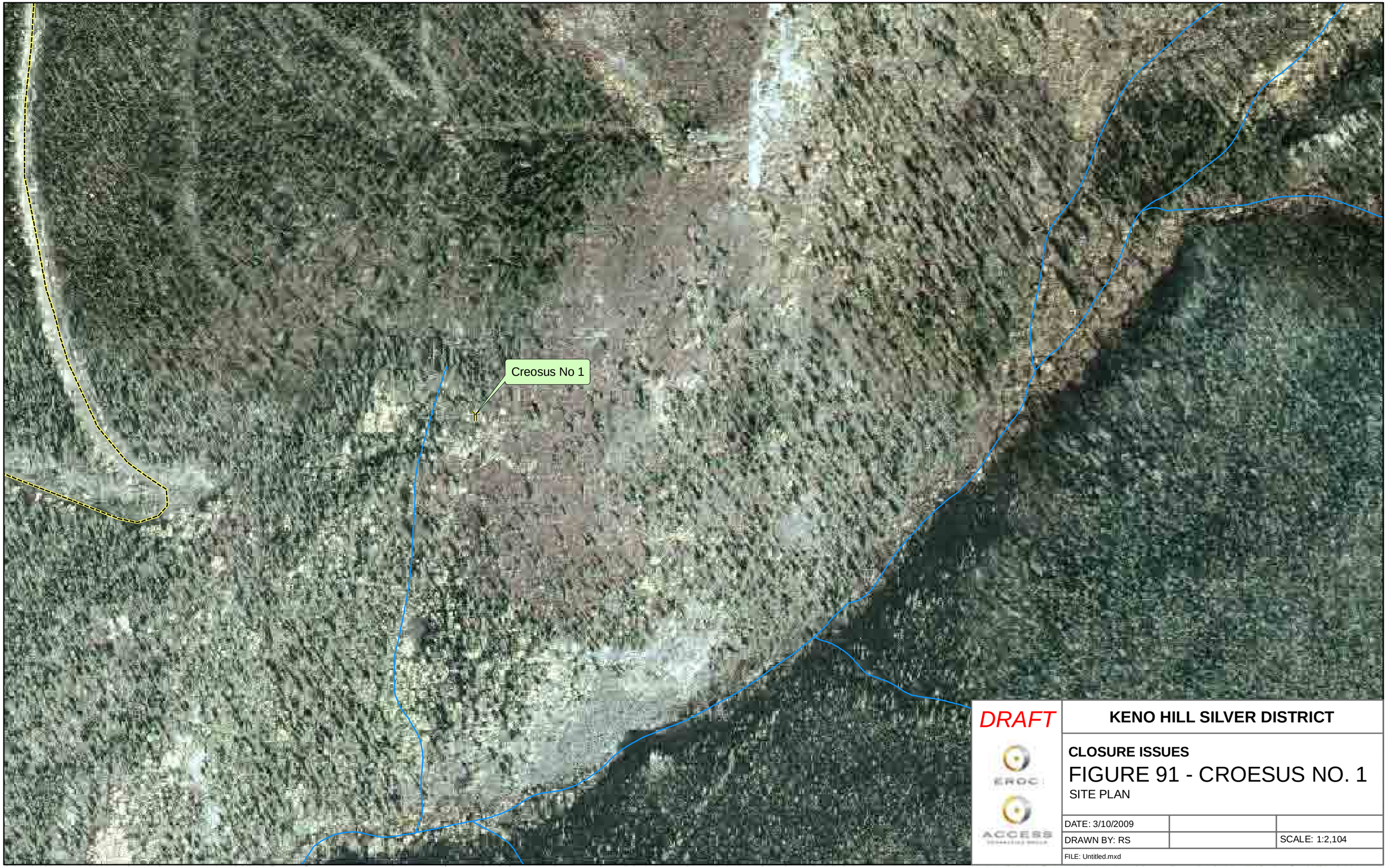
An ortho-map for the site is shown in Figure 91, while a site map created by the PWGSC is presented as Figure 92.

Table 25 Croesus No.1 Closure Issues Matrix

Common Site Name: **Croesus**
PWGSC site #: 24

Site coordinates:	easting	northing	
	486641.00	7089731.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Trench #2			✔			
Waste rock pile - WR-02				✔		



DRAFT

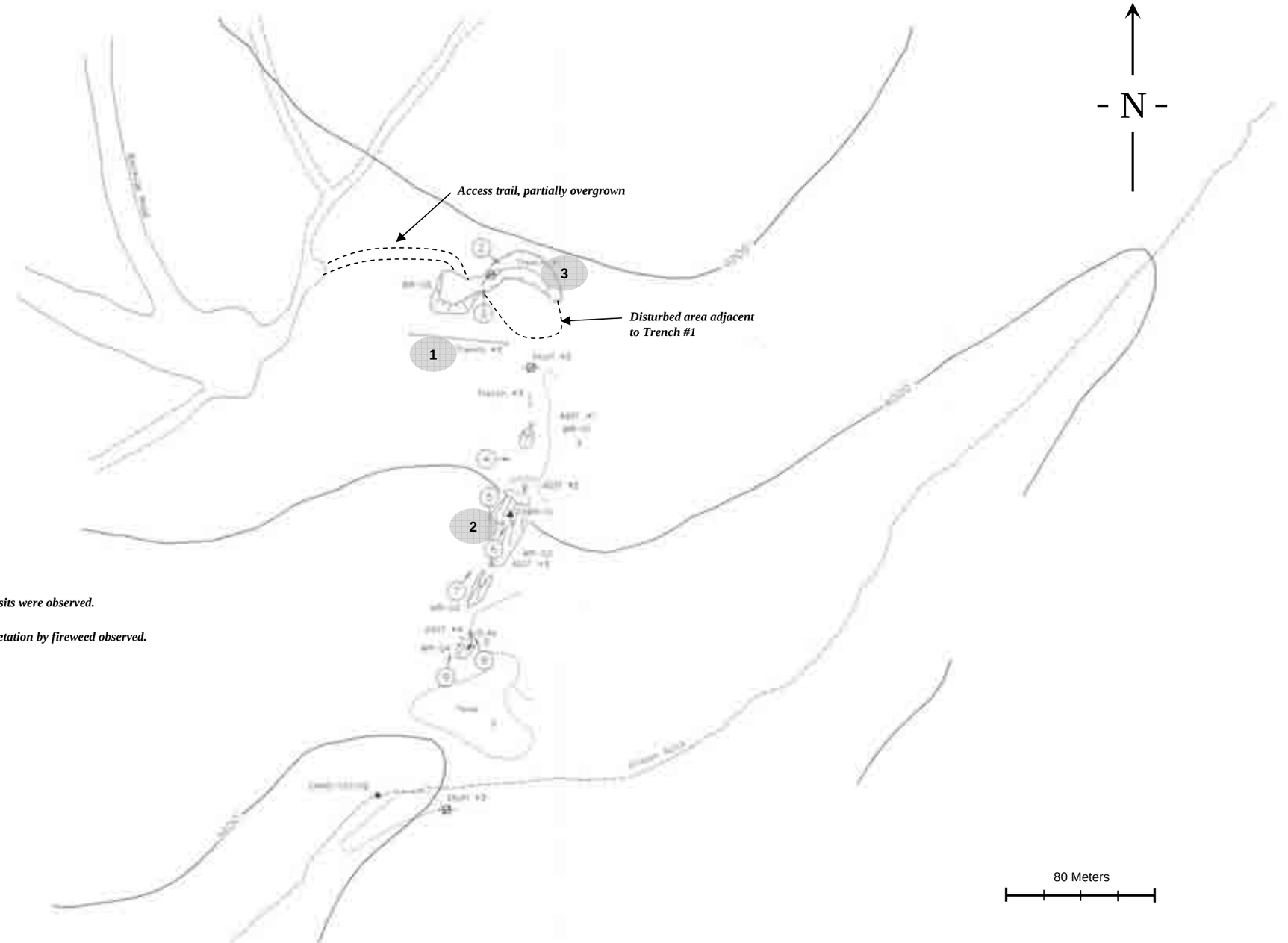
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 91 - CROESUS NO. 1

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,104
FILE: Untitled.mxd		



#1 - Trench #2 appears to channel surface runoff, but no erosion or sediment deposits were observed.

#2 - Slope of waste rock pile WR-02 is ravelling, but otherwise stable. Minor revegetation by fireweed observed.

#3 - Minor quartz and quartz-siderite veining observed in trench wall.

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Croesus No. 1 Site #24

Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site24_Croesus_20070131.ppt			Figure: **92**

3.22.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

3.23 BLACK CAP

3.23.1 Description

The Black Cap workings comprise both open pit and underground workings. The primary access to underground was via two adits; the Brewis Red Lake Adit worked in 1951, and the UKHM Black Cap Adit worked for four months in 1966. The extent of the underground workings are small, about 1000 ft of lateral development for each. It is also reported that there were two small shafts, both located within the open pit area.

The majority of the mining of the Black Cap was from the open pit, mined in 1986 and 1987. Waste rock from the pit is deposited in a series of small dumps around the pit.

3.23.2 Closure Issues

The closure issues related to the Black Cap are, like the Shamrock and other workings on upper Keno Hill, primarily related to protection of public safety by limiting access (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 26. An ortho-map of the site is shown in Figure 93, while a map showing the Black Cap/Shepherd and Lucky Queen Adits is presented as Figure 94. Also, a map showing the location of the Black Cap Mine relative to the Luck Queen Mine is presented as Figure 97.

Table 26 Black Cap Closure Issues Matrix

Common Site Name: **Black Cap / Shepard and Lucky Queen Adit**
PWGSC site #: 25

Site coordinates:	easting	northing	
	486877.20	7090632.59	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
North Black cap pit and South pits			✔	✔		
Black Cap Adit	✔		✔	✔		
WR01			✔	✔		
WR03				✔		
Lucky Queen Portal	✔			✔		

Black Cap

Lucky Que

Brewis Red Lake Adit

DRAFT

KENO HILL SILVER DISTRICT

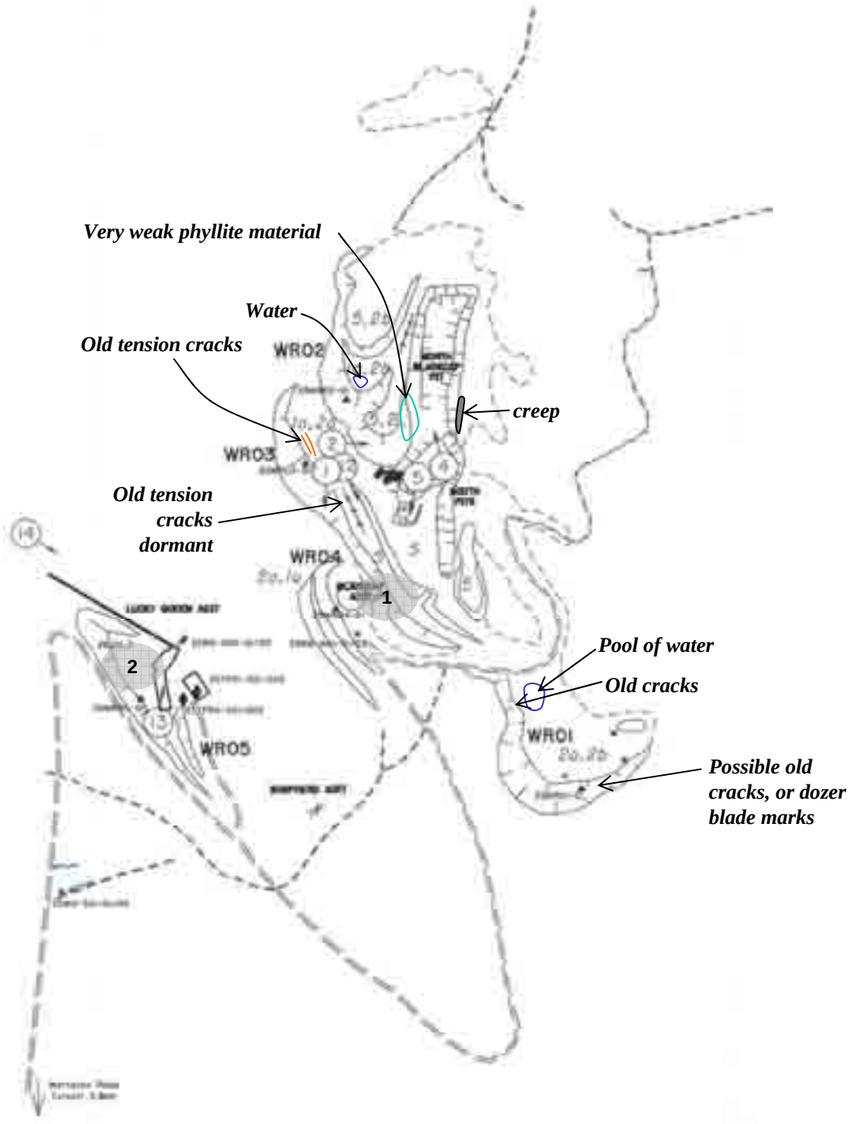
CLOSURE ISSUES

FIGURE 93 - BLACK CAP & SHEPAR

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,850
FILE: Untitled.mxd		

- N -



200 Meters

Pit Notes:

- *Small operation with some poor blasting practices*
- *East wall is benched on a 10 ft lifts; slope angle is low*
- *The west wall was mined with no benches, very ragged appearance*
- *The dip of ore body is at a low angle to the east.*
- *The faces are unravelling substantially on the western entrance*
- *Water pooling on the dump on the west side*
- *Some tension cracks exist on the west dump; these appear dormant*
- *Berms are placed on approximately 50% of the waste dumps*

#1 - water coming out of adit
- adit timber collapsed, access fairly easily
- 5 – 10 l/minute
- water runs down the ramp
- check pooling on the photos

#2 - Lucky Queen portal and garage have been completely dismantled and materials have been removed by vandals (inspected August 2006).
- Timber support and rock at portal are collapsing, but material removed by vandals has made it possible to enter the opening.
- This is clearly a hazard, as the degree of vandalism shows that restrictions to access are minimal.

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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Black Cap/Shepherd and Lucky Queen Adit- Site #25

Job No: 1CA009.000
Filename: Site25_Balck Cap_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007
Approved:
Figure: **94**

3.23.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.24 LUCKY QUEEN

3.24.1 Description

Lucky Queen was mined for a four year period, from 1928 to 1932, from an incline shaft and levels at the 50, 100, 200 and 300 levels and then again from 1984 to 1988. From 1984 to 1988 UKHM drove an adit on the 500 level to explore the Lucky Queen vein below the old 300 level workings. The adit, over 5,700 feet in length, was collared near the Black Cap open pit. The old incline shaft was de-iced to the bottom of the shaft and a raise from the 500 adit was driven to just above the 400 level. Archer Cathro also did some surface "hand mining" in the late 1980's around the shaft.

The shaft is covered by a building, in good condition, but not locked. Subsidence has taken place in two areas above the old workings. The portal, which is near the Black Cap Open pit, is open but the road is blocked by a locked gate. There are reported to have been three short adits at Stone Claims, associated with Lucky Queen, but all three are caved.

Permafrost is reported to extend below the 300 level of the mine. The Lucky Queen was not reported to be a wet mine; the adit continues to drain during the summer only (AMC, 1996a).

3.24.2 Closure Issues

The Lucky Queen mine was accessed by shaft like the Sadie Ladue. Later a long adit was driven at the 500 level to access the lower levels of the workings. The adit is free draining seasonally, but water quality is good. Like Sadie-Ladue and Keno 700, much of the Lucky Queen is also in permafrost. The main issues are safety and security of workings and possible re-contouring of small pit workings at the crown pillar (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 27. An ortho-map of the site is shown in Figure 95, while a map created by the PWGSC is included as Figure 96. Further, the site plan and composite plans are included as Figure 97 and 98 respectively.

Table 27 Lucky Queen Closure Issues Matrix

Common Site Name: **Lucky Queen**
PWGSC site #: 26

	easting	northing	
Site coordinates:	486577.07	7090560.84	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Building - containing Shaft #1	✔					
Shaft #1	✔					
Shaft #2			✔			
Location where powerline crosses road						✔
Road - adjacent to Trench 3			✔			

DRAFT

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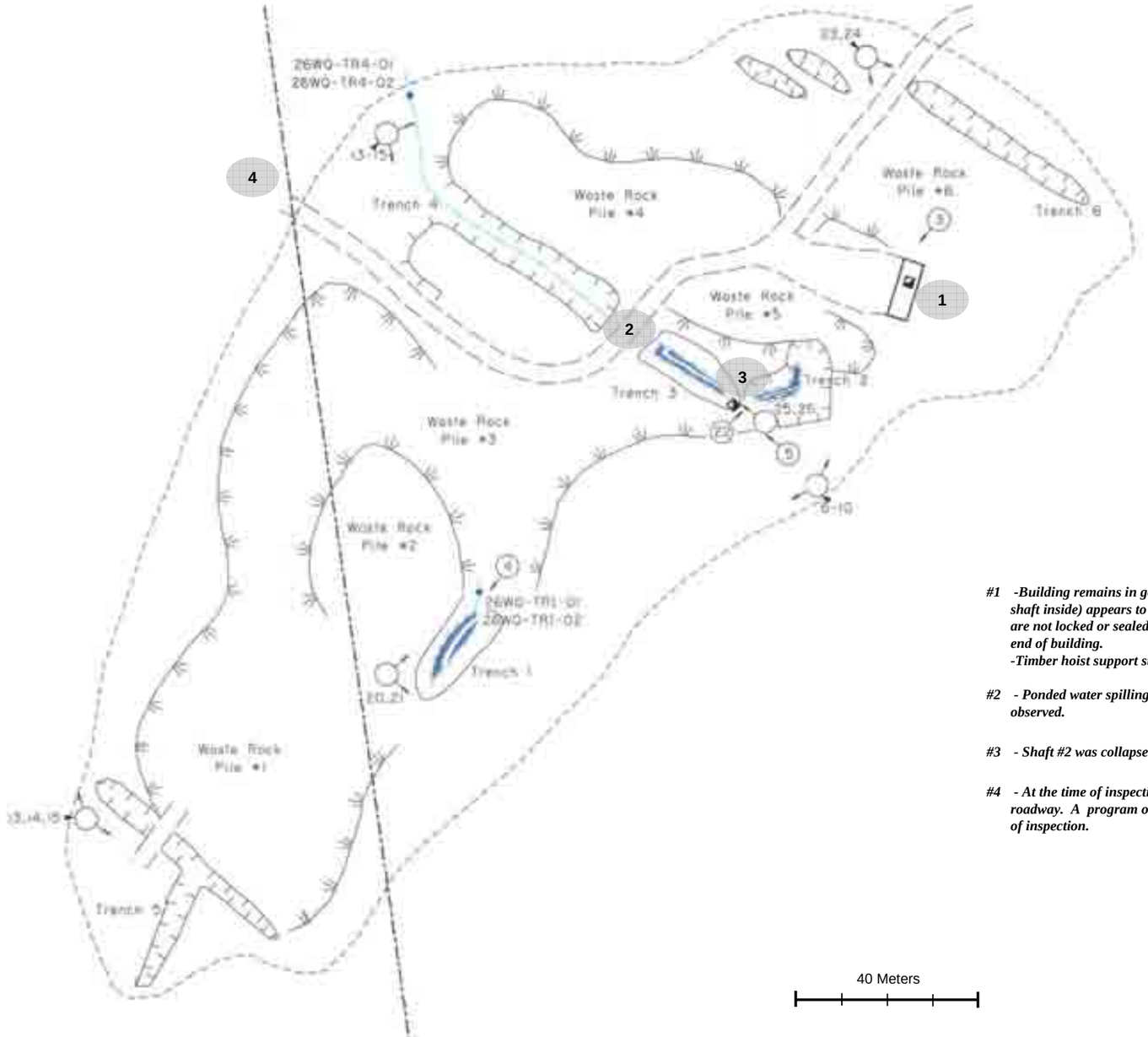
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 95 - LUCKY QUEEN

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,553
FILE: Untitled.mxd		



- N -

40 Meters

#1 -Building remains in good condition and is easily accessible. Shaft #1 (inclined shaft inside) appears to be in excellent condition and is easily accessible- entry doors are not locked or sealed, and access is also possible through open ore chute at north end of building.
-Timber hoist support structure inside is in good condition.

#2 - Ponded water spilling over roadway in August 2006. No erosion of roadway observed.

#3 - Shaft #2 was collapsed and inaccessible.

#4 - At the time of inspection (August 2006), the powerline was down across the roadway. A program of wire clean-up was underway, but wire remained at the time of inspection.

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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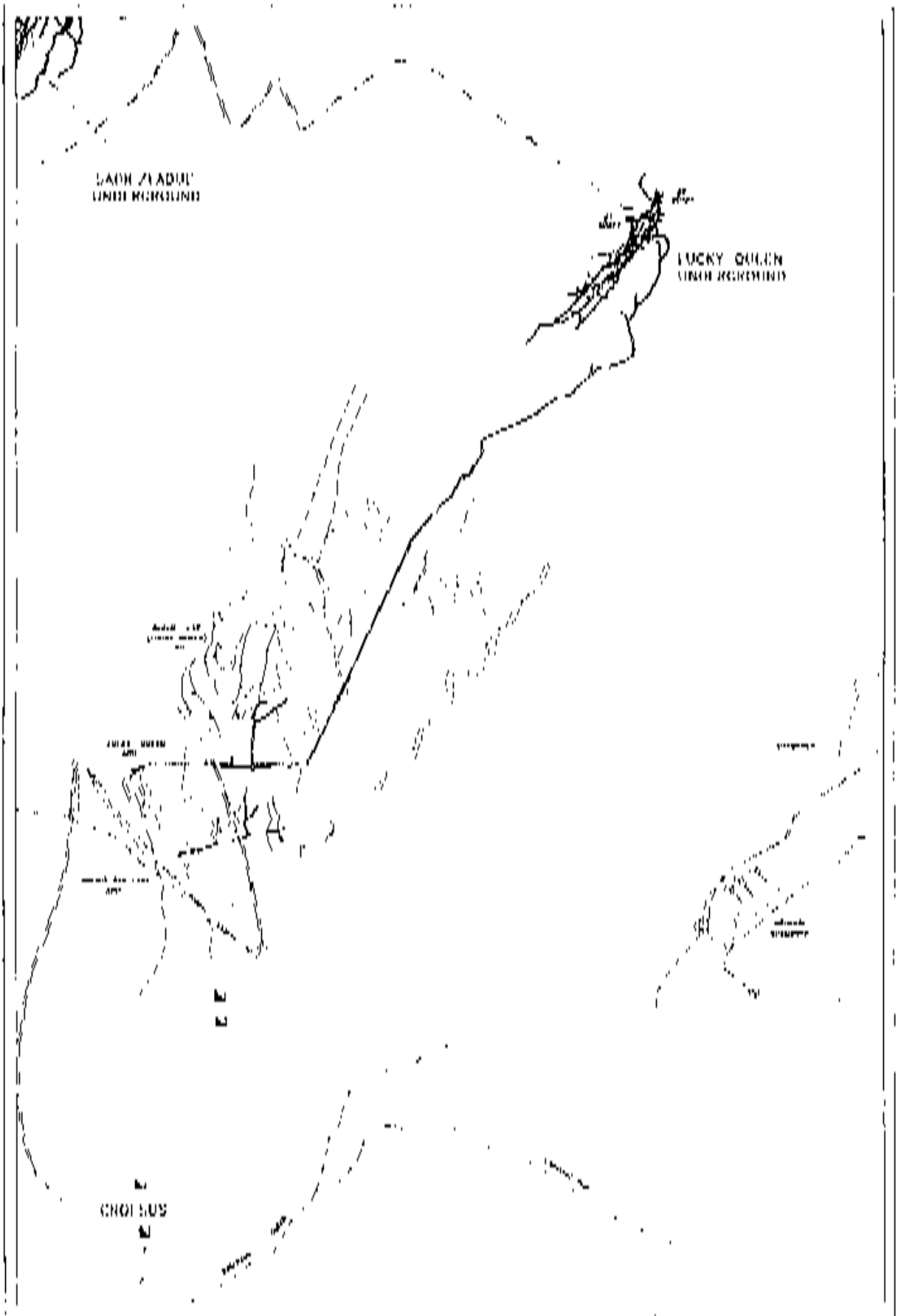
ALEXCO

Job No: ALEX-06-ESP-05
Filename: Site26_LuckyQueen_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Lucky Queen Site #26

Date:	Approved:	Figure:
Jan. 2007		96



LEGEND

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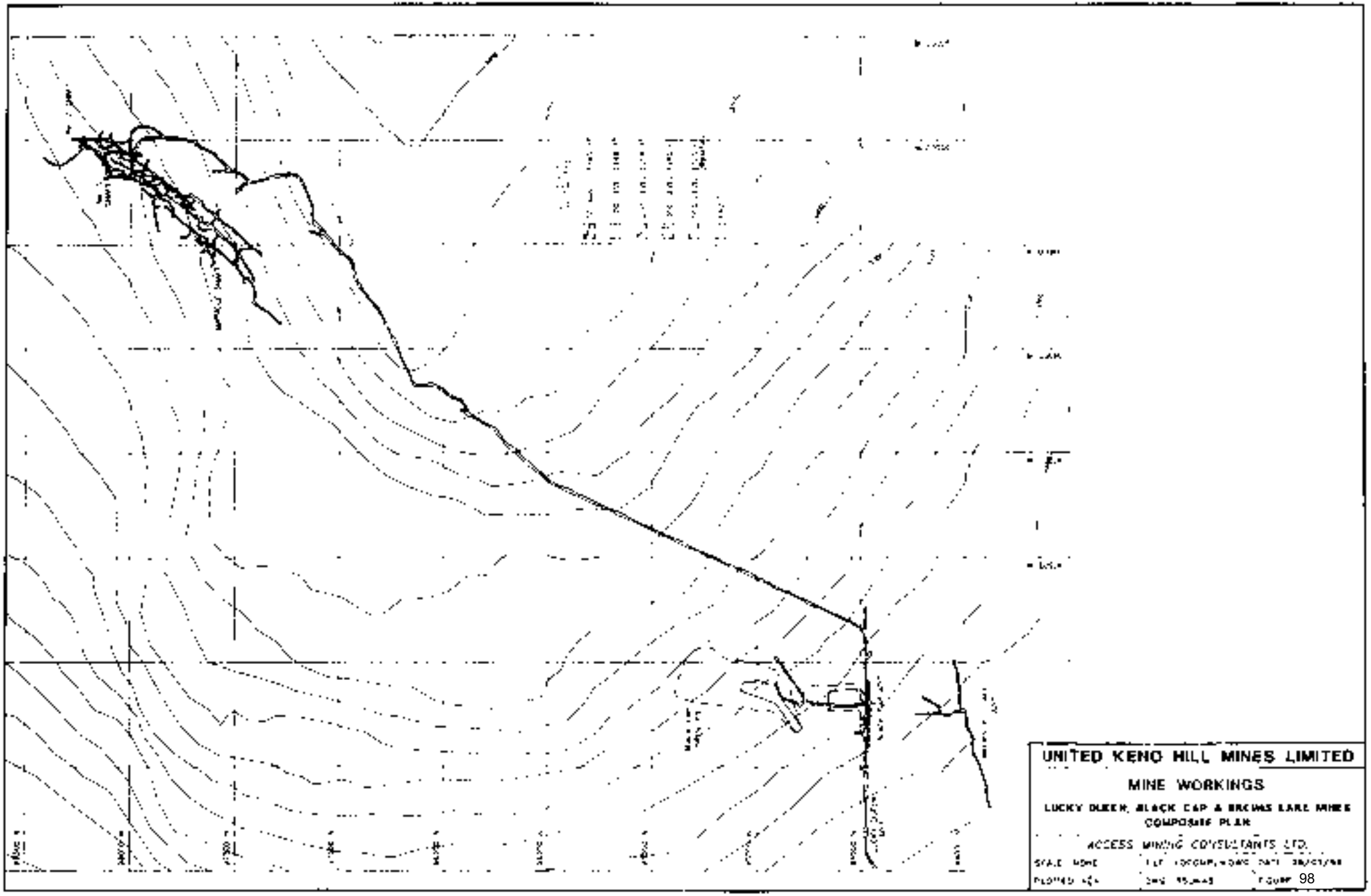
LUCKY QUEEN

SITE PLAN



UNITED KENO HILL MINES LIMITED

MINE WORKINGS

LUCKY QUEEN, BLACK CAP & BROMS EARE MINES
COMPOSITE PLAN

ACCESS MINING CONSULTANTS LTD.

SCALE NONE

3.24.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available.

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.25 LAKE

3.25.1 Description

The Lake exploration mine site is located mid-way down the northwestern slope of Keno Hill at an elevation of 1190m. The site is located approximately 250m west of Gambler Gulch. Access to site is via the Lower Faro Gulch Trail, which follows an overgrown mine road east from the Wernecke Camp. The lake site is located roughly 140m north of a point 650m east from the Wernecke Camp along the Lower Faro gulch Trail.

The site is on a gentle northeast slope in the Gambler Gulch. Given the site aspect, elevation, and presence of ice in some of the mine workings, the site is likely underlain by permafrost. The surface runoff from the mine site flows northward into Gambler Gulch, a tributary of Keno Ladue River. The area is well vegetated with willows, alders, balsam fir and young spruce trees.

Little is known about the history of the site. Given the age of the second-growth vegetation, the property is believed to have been worked in the 1950s or 1960s. Most of the work on the site centred around a small pit with an inclined shaft. Waste dumps associated with the shaft suggest 50 to 100 metres of underground development. The surrounding area was extensively cleared, with numerous bladed roads and level pads developed.

Mine development encountered at Lake includes two shafts, a collapsed adit and three trenches. The mine workings are referred to as the upper shaft, the main shaft and the lower adit. A possible forth, collapsed mine opening (either a raise or an adit) was also identified near the main shaft. There are four waste rock piles associated with these workings. The main shaft is located at the southwest end of a trench cut more than 3 m into bedrock.

3.25.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 28. An ortho-map of the site is shown in Figure 99, while a map created by the PWGSC is included as Figure 100.

Table 28 Lake Closure Issues Matrix

Common Site Name: **Lake**
PWGSC site #: 27

Site coordinates:	easting	northing	
	487229.00	7092812.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Lower shaft	✔			✔		
Upper shaft				✔		

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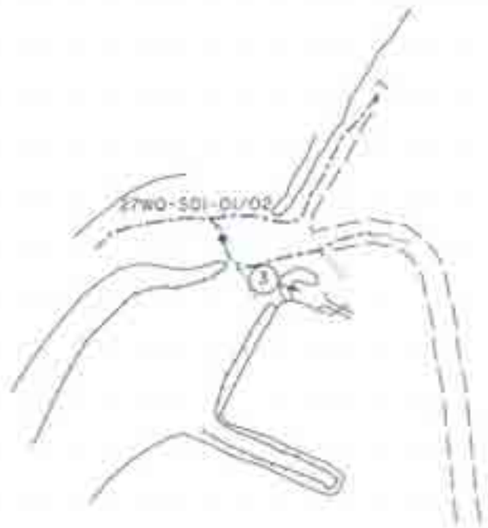
KENO HILL SILVER DISTRICT

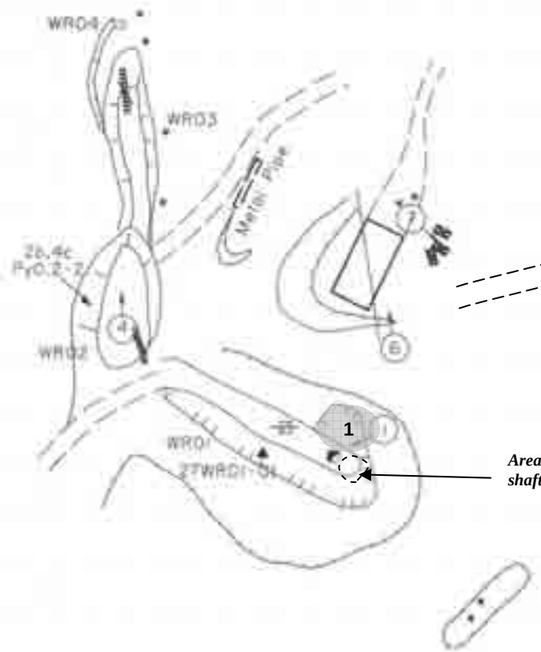
CLOSURE ISSUES

FIGURE 99 - LAKE

SITE PLAN

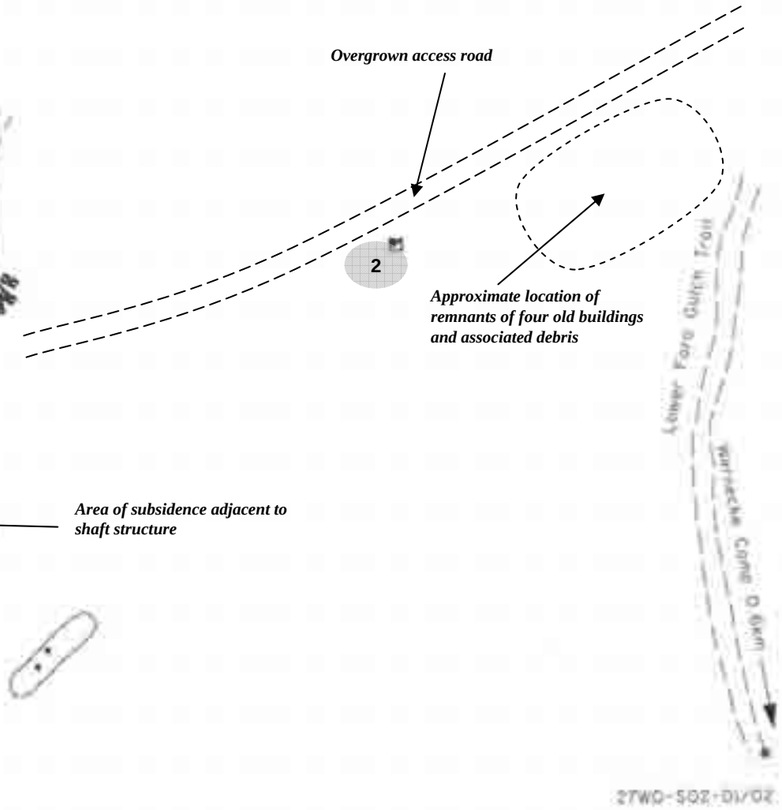
DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:3,050
FILE: Untitled.mxd		



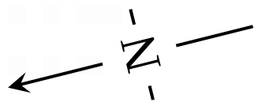


#1 - Hanging wall to shaft has collapsed, and there appears to be an open void. Risk of inadvertent access was low at the time of inspection; however, wood structure that formed a roof over the opening was observed to be actively deteriorating, and may lead to the development of an open hole in the future. May be exacerbated by continued failure of hanging wall. Intrigue risk is high and access could be gained with intent. (Photos 1 and 2).
- Area of subsidence immediately west of shaft structure is overgrown with willows (Photo 3).
- Manway was secured at time of inspection by planking nailed over entry, as noted in PWGSC (2000).

#2 - Upper shaft forms stable open hole, with water at a depth of 3m. Warning flagging strung by PWGSC remained in place.
- Minor subsidence observed adjacent to shaft on north side, over an area of 2m x 3m x 1m deep.



Area of subsidence adjacent to shaft structure



40 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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VANCOUVER

ALEXCO

Lake Site #27

Job No:	ALEX-06-ESP-05
Filename:	Site27_Lake_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**100**

3.25.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.26 SHAMROCK

3.26.1 Description

The site is located near the summit on the south west side of Keno Hill and is visible from Keno City. The site is accessible by 2 or 4-wheel drive vehicle from Keno City via a gravel road heading west along the face of Keno Hill and continuing on to the summit. The site is positioned at an elevation between 1505 and 1610 m above sea level.

The site, consisting of a series of test pits, shafts and adits, drains down the steep southwest talus slope of Keno Hill through a single ravine. A second larger and deeper ravine to the east cuts across the bottom of this ravine forming the west branch of Erickson Gulch. The gulch enters Christal Creek approximately 5 km to the west of the site, approximately 1.5 km north of Christal Lake. It appears that seasonal runoff through the site has resulted in little vegetation growth or soil accumulating near the bottom of the ravine. The entire site is located within an alpine ecosystem above the treeline. Permafrost features were not noted at the site.

The original Shamrock mine was developed and mined from 1919 to 1939. A 37 m inched shaft was sunk with levels at 65 and 110 feet. The 65 level broke out to an adit. Several small adits, shafts and test pits were mined in the area down slope from the Shamrock in this era. In 1953 and 1954 a new adit was driven at the 200 foot level, with further drilling and production. The 200 level adit is still visible. An open pit mine was constructed around the shaft in the period from 1985 to 1989. The open pit was excavated to the upper levels of the mine.

Several deep bulldozer trenches were dug to the southwest of the Original Shamrock in this era. The Shamrock King vein was mined by shallow open pit in 1988 and 1989. This mine lies about 100m east southeast of the Original Shamrock mine (MINFILE# 105M 001ah) (PWGSC, 2000).

3.26.2 Closure Issues

The relatively small development at the Shamrock mine poses concerns only with respect to physical stability. The hand-cobbing operation done by others left a trench or

"pit" with steep and therefore unstable slopes. Thus limiting access to the pit is the main closure priority. There are no significant chemical issues since the area of disturbance and volume of waste is small, and there is no groundwater discharge (AMC, 1996b).

No new closure issues were noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting. A table indicating site components possibly presenting issues relating to closure activities is presented as Table 29.

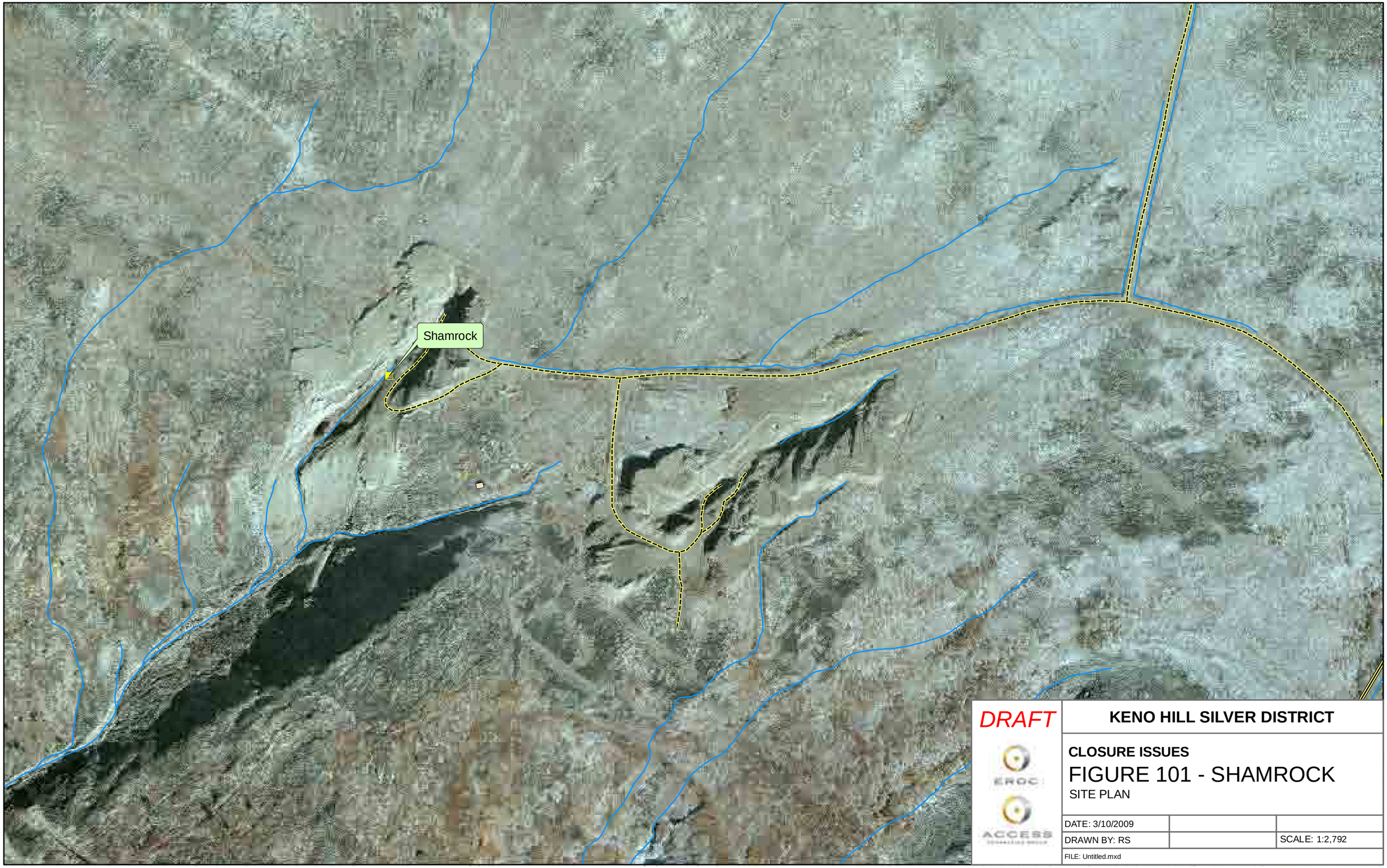
An ortho-map for the site is shown in Figure 101, while a site map created by the PWGSC is presented as Figure 102. A composite plan and a vertical longitudinal section diagram are presented as Figures 103 and 104 respectively.

Table 29 Shamrock Closure Issues Matrix

Common Site Name: **Shamrock**
PWGSC site #: 28

Site coordinates:	easting	northing	
	488018.00	7090536.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
No new closure issues notes.						



DRAFT

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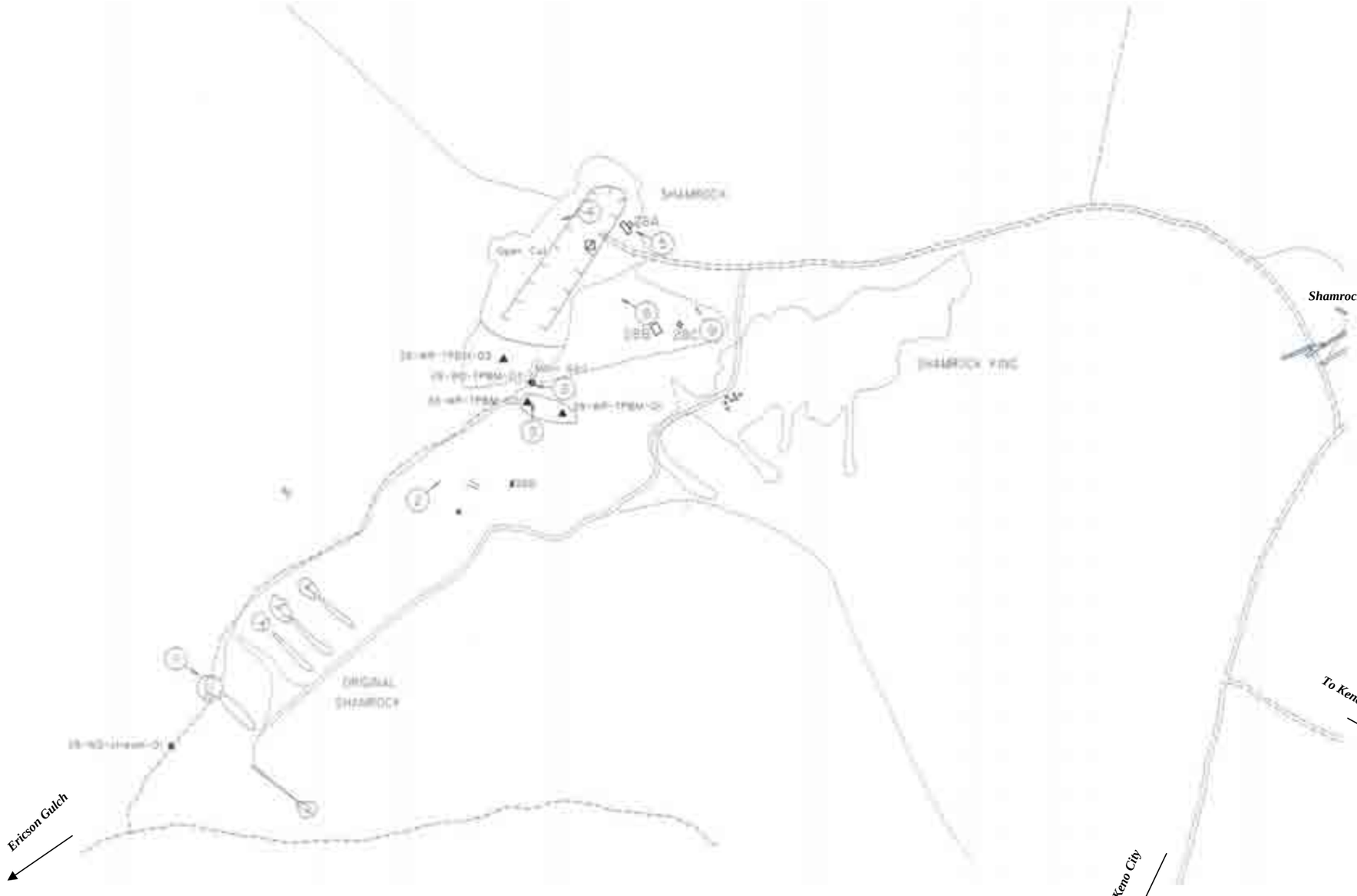
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 101 - SHAMROCK

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,792
FILE: Untitled.mxd		



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Shamrock Site #28

Job No:	ALEX-06-ESP-05
Filename:	Site28_Shamrock_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**102**

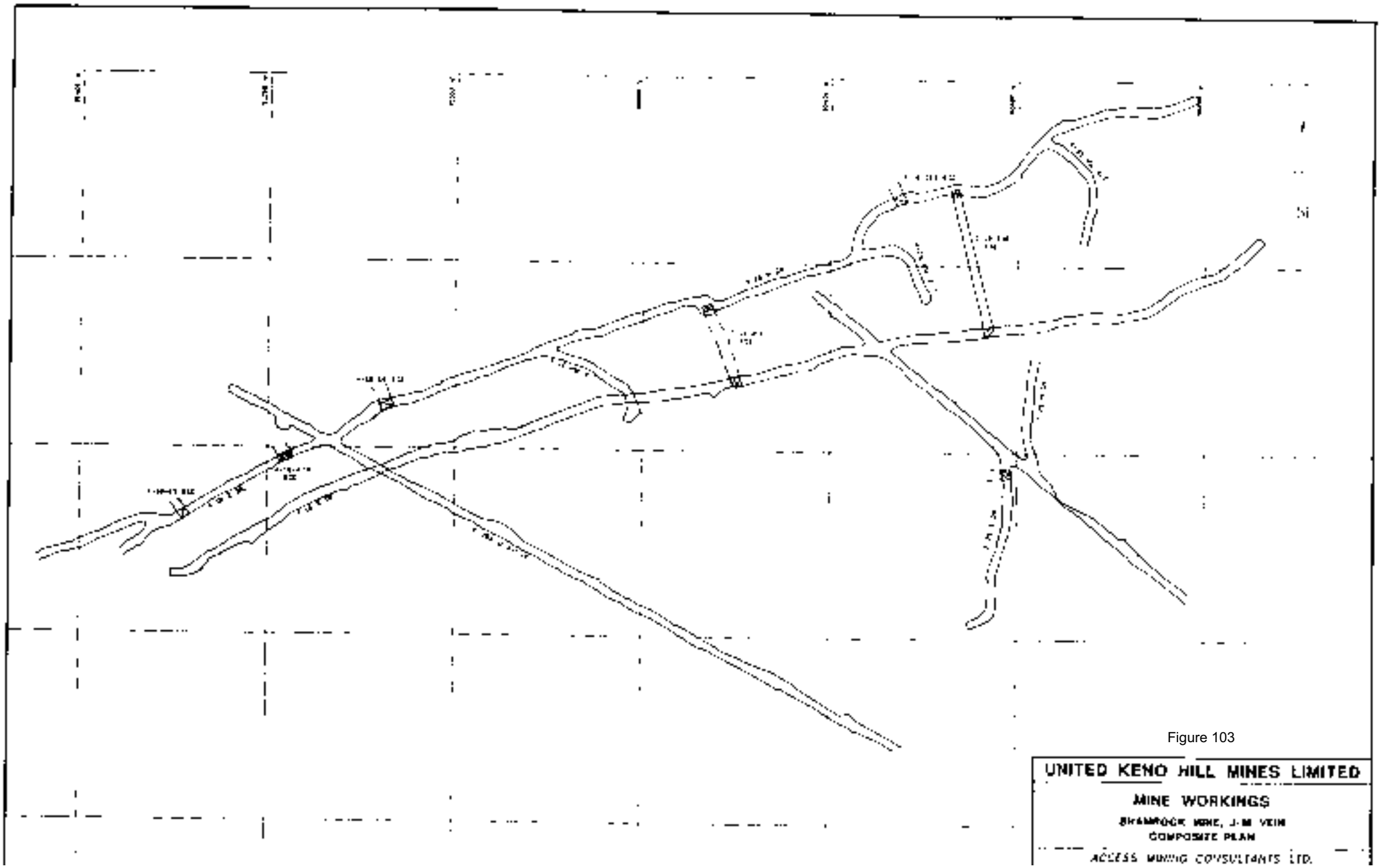

UNITED KENO HILL MINES LIMITED
MINE WORKINGS
SHAMROCK MINE, J-M VEIN
COMPOSITE PLAN
ACCESS MINING CONSULTANTS LTD.

Figure 103

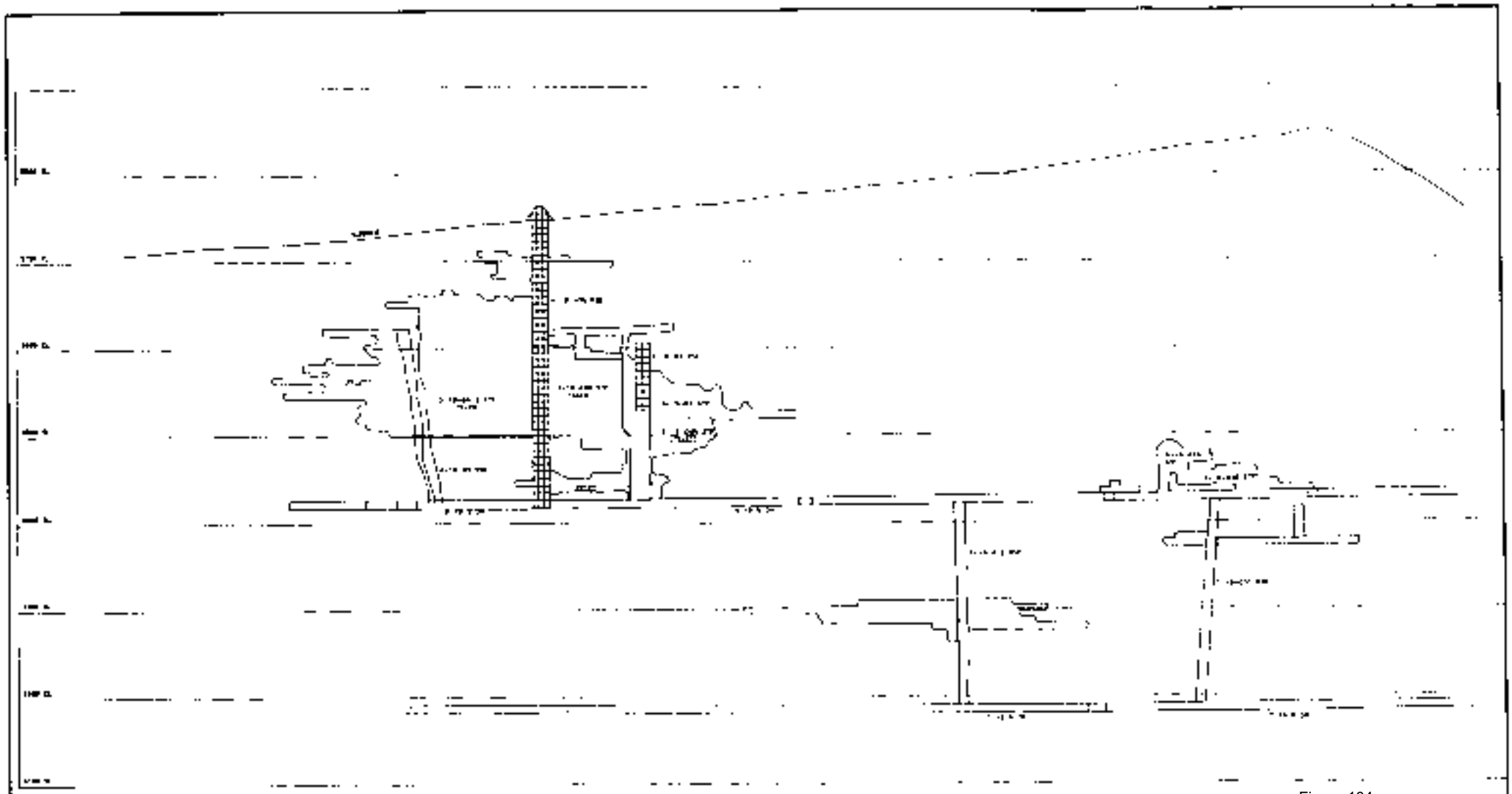


Figure 104

UNITED KENO HILL MINES LIMITED

MINE WORKINGS

SHAMROCK MINE, J-14 VEIN

VERTICAL LONGITUDINAL SECTION (Looking Northeast)

ACCESS MINING CONSULTANTS LTD

3.26.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.27 HIGHLANDER

3.27.1 Description

The Highlander abandoned mine site is 6 km north-northeast of the community of Keno Hill and 2 km northwest of Keno Summit, at 1370 metres to 1440 metres above sea level. Access to the property is via the Silver Trail Tourism Association's Keno City Trail Network, Trail Number 4 - Gambler Gulch Trail, and Trail Number 5 - Faro Gulch Trail. An un-serviced gravel road, with rough sections, from Keno City provides vehicle access to within 1 km of the site. The last kilometre is a footpath that is suitable for all-terrain vehicles, with minor upgrading.

The Gambler Gulch area is found on the north side of Keno Hill. Soil around the site is well-drained and coarsely textured. Highlander is in an area of discontinuous permafrost on a north facing slope. No surface indications of permafrost were observed during the site visit. Vegetation consists of stunted black spruce, a variety of willow (2 to 3 metres high), scrub brush, heather, Hudson Bay tea, a variety of mosses and lichens, black berries, low bush cranberries, fireweed and sedges. The stream in Gambler Gulch runs through dense willow thickets.

Untreated mine water flows from a collapsed adit to Gambler Gulch along a 10-metre channel. All surface water from this site drains into Ladue Creek, which connects an unnamed lake (containing Wernecke tailings) and Gambler Lake.

The Highlander property was likely staked in 1919-1920, following the discovery of the rich No. 9 vein on Keno Hill. Work on the Highlander claim and adjacent claims to 1929 included six open-cuts (most of which sloughed in by 1929), and an inaccessible 8 metre shaft that terminated in a drift, 14.6 metres long (GSC Memoir 284, p.603). Inaccessible open-cuts and shaft on the Highlander claim are also described by RW. Boyle (GSC Bulletin 11 1, p. 35.) after visiting the site between 1953 and 1955.

The buildings appear to have been built between 20 and 40 years ago, and the 10,000 to 15,000 tonnes of waste rock on the site was probably generated at least that long

ago. The volume of waste rock indicates that at least 500 metres of underground development occurred at the Highlander site (SRK, 1996).

3.27.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 30.

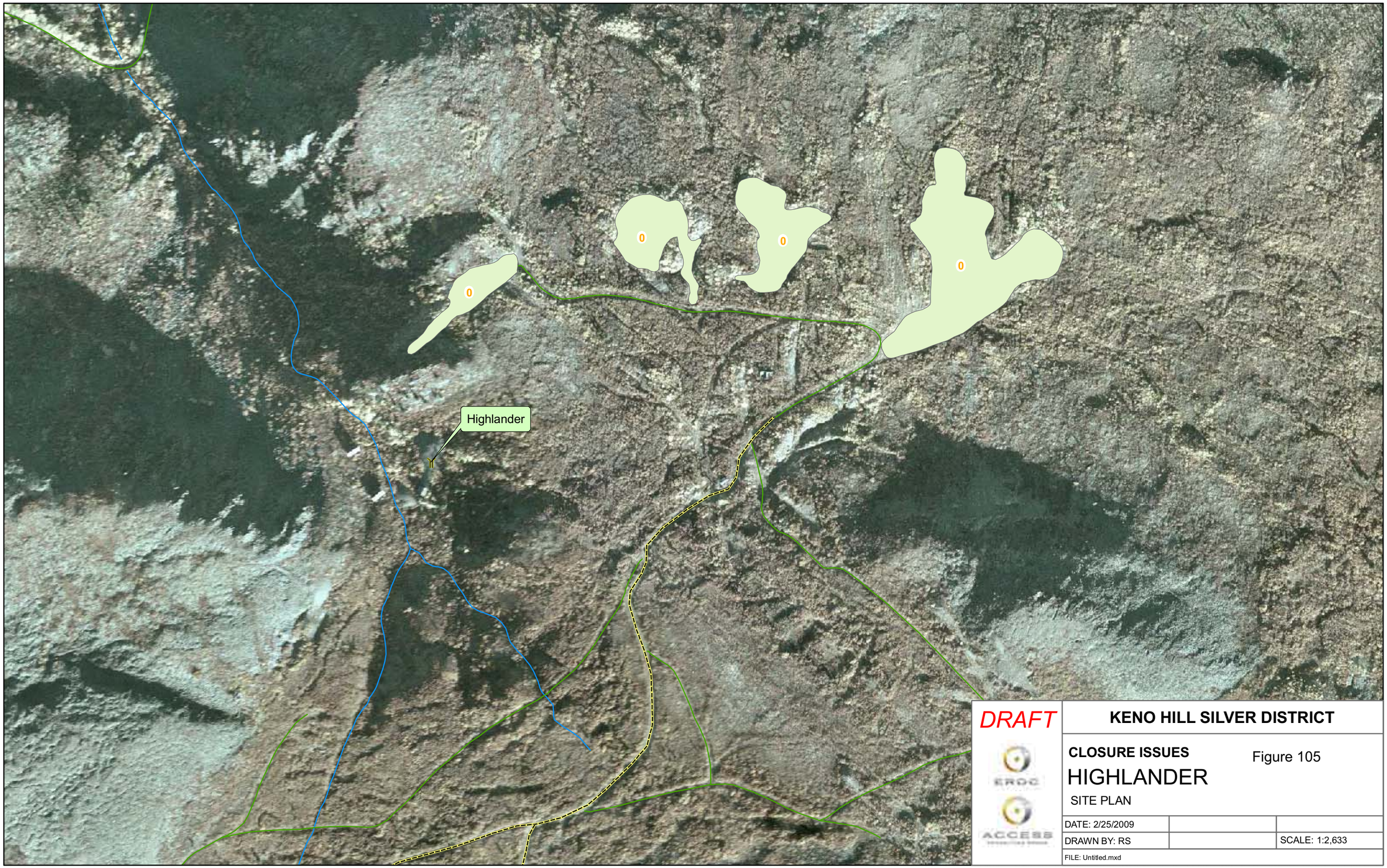
An ortho-map for the site is shown in Figure 105, while a site map created by the PWGSC is presented as Figure 106.

Table 30 Highlander Closure Issues Matrix

Common Site Name: **Highlander**
PWGSC site #: 29

Site coordinates:	easting	northing	
	487933.00	7092237.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Adit - east of Gambler gultch and south of pit			✔			
Adit - north of Highlander-WR-1 pit	✔					
Collapsed cabin - south of Highlander-WR-1	✔					



DRAFT

KENO HILL SILVER DISTRICT

CLOSURE ISSUES Figure 105

HIGHLANDER

SITE PLAN

DATE: 2/25/2009		
DRAWN BY: RS		SCALE: 1:2,633
FILE: Untitled.mxd		

- N -

#1 - Collapsed adit producing approximately 2 L/min at time of inspection. Water was clear and colourless, with no precipitates or staining observed.

#2 - Waste rock consists of graphitic phyllite with minimal greenstone material. Little to no vein material or orange staining observed.

#3 - Waste rock consists of 70% greenstone with light orange staining, 30% graphitic phyllite and minor siderite vein material.

#4 - Waste rock consists of greenstone, graphitic phyllite, and minor dark orange to purplish black vein material. Northern-most adit remains accessible as noted in PWGSC (2000); opening is roughly the size of a side window of a small car. Open space appears to be no greater than 2 m long.

40 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Highlander Site #29

Job No:	ALEX-06-ESP-05
Filename:	Site29_Highlander_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**106**

3.27.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.28 CUB AND BUNNY

3.28.1 Description

The Cub and Bunny site is on the northeast facing slope of Faro Gulch. It is about 1.5 km northwest of the Keno Summit. The site can be accessed on foot from the Upper Faro Gulch Trail. The Upper Faro Gulch Trail is the continuation of the Lucky Queen Road, which intersects the Wernecke Road near the Wemecke town site. These roads can be driven in a four-wheel drive vehicle. The site is about a 7.5 km drive out of Keno City. The Cub and Bunny site consists of a large trench (French 1) and a pit (Pit 1) located about 300 m apart. The elevation of the site ranges from 1375 m to 1500 m.

The Stone site is located on a moderately steep north-facing slope on Keno Hill, and is likely underlain by permafrost. The site and surrounding area is thickly vegetated with willows, alders, and spruce trees as well as shrubs. The ground is covered with a blanket of moss and decaying leaves. Surface runoff from the mine site flows northward via a small tributary of Faro Gulch, eventually joining the Keno Ladue River 3.1 km to the north. The tributary of Faro Gulch starts 65m downslope of the lower adit and flows northward 300m before joining Faro Gulch.

Prior to 1952, two adits were excavated on the property. During this period, 135 tonnes at 3919 g/t silver and 30.3% lead were shipped from the site to Wernecke or Elsa for processing. In 1952, a third adit was driven between two of the earlier adits.

There are three adits on the property and all three were inspected during the site visit. The air photo indicates possible activity below the road, but this was not investigated.

Waste rock piles are located outside the three adits. The three adits are in a line running northeast southwest at different elevations (PWGSC, 2000).

3.28.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 31.

An ortho-map for the site is shown in Figure 107, while a site map created by the PWGSC is presented as Figure 108.

Table 31 Cub and Bunny Closure Issues Matrix

Common Site Name: **Cub and Bunny**
PWGSC site #: 30

Site coordinates:	easting	northing	
	488540.00	7091951.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Trench - upslope of Upper Faro Gultch Trail			✔			
Trench #1			✔			
Adit - between Upper Faro Gultch Trail and Pit #1				✔		

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CLOSURE ISSUES

FIGURE 107 - CUB & BUNNY

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,494
FILE: Untitled.mxd		

- N -

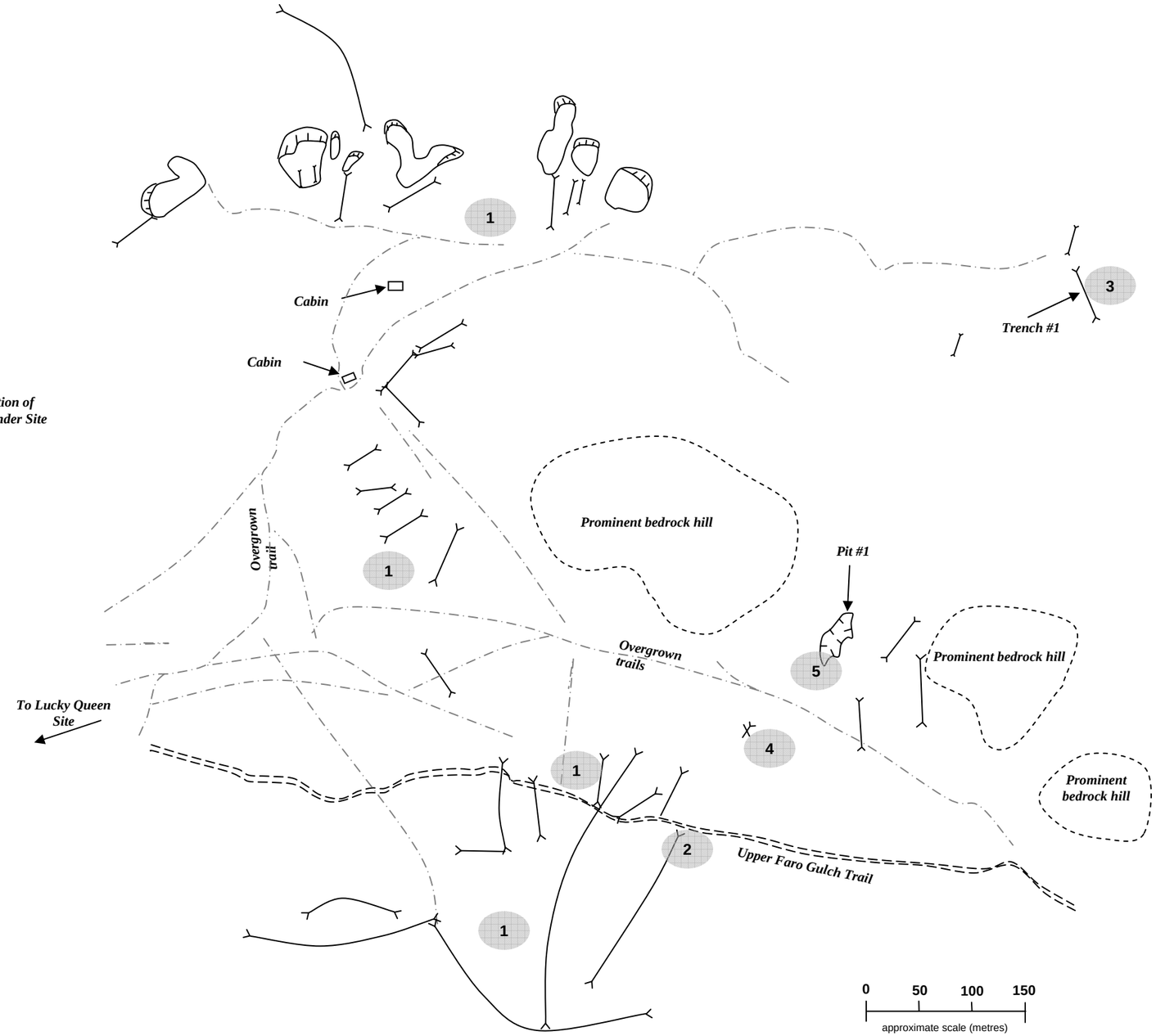
#1 - Extensive clearing, stripping, and trenching in these areas, and rough trails and test pits are located throughout (Photos 30-1 to 30-4).

#2 - Ponded water in trench upslope of Upper Faro Gulch Trail (0.5 m deep x 2 m wide x 7 m long). Water was clear, with grasses growing around edges of pond (Photo 30-5). Trickling flow observed from spill point onto trail, then flow infiltrated into surface of trail.

#3 - Trench #1 appears to collect and channel water during freshet; a 0.3 m deep incised channel (Photo 30-6) was observed in the base of the trench at the northwest end over a length of 10 m. This incised channel contains a 5 m long zone bearing intermittent orange staining on exposed phyllite surfaces.
- Trench #1 is similar to the many other trenches shown. Revegetation of trench base and walls is occurring by willows, grasses, moss, and lichens (Photo 30-7).
- Trench location is NAD 83 488824 E, 7092324 N

#4 - A collapsed adit into a shallow hillside was identified at this location. The site is marked by a broken wheelbarrow with an iron wheel, and several panels of galvanized sheet roofing material, and miscellaneous debris (Photo 30-8). The adit is not accessible.

#5 - Orange to dark brown to purplish stained vein material exposed in east wall of pit (Photo 30-9).
- Solifluction is causing fine grained soils at south end of pit to flow into excavation (Photo 30-10).
- Pit and dump appear stable.
- Pit location is NAD 83 488622 E, 7092047 N



Aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Cub & Bunny Site #30

Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site30_Cub&Bunny_320070131.ppt			Figure: 108

3.28.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**
  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.
  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)
  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.
  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).
  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.
  Report:
  ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.29 STONE

3.29.1 Description

The Stone mine site is located in Faro Gulch, 2.3 krn north of Keno Summit at 1220m to 1340m elevation. UTM co-ordinates for the site are 7092500 N and 488 800 E. Access by foot is possible along the Lower Faro Gulch Trail which starts at the Sadie Ladue site, 3 km to the west. Except for one building, the site is located to the south of this trail.

The Stone site is located on a moderately steep north-facing slope on Keno Hill, and is likely underlain by permafrost. The site and surrounding area is thickly vegetated with willows, alders, and spruce trees as well as shrubs. The ground is covered with a blanket of moss and decaying leaves. Surface runoff from the mine site flows northward via a small tributary of Faro Gulch, eventually joining the Keno Ladue River 3 km to the

north. The tributary of Faro Gulch starts 65m downslope of the lower adit and flows northward 300m before joining Faro Gulch.

Prior to 1952, two adits were excavated on the property. During this period, 135 tonnes at 3919 g/t silver and 30.3% lead were shipped from the site to Wernecke or Elsa for processing. In 1952, a third adit was driven between two of the earlier adits.

There are three adits on the property and all three were inspected during the site visit. The airphoto indicates possible activity below the road, but this was not investigated. Waste rock piles are located outside the three adits. The three adits are in a line running northeast southwest at different elevations (PWGSC, 2000).

3.29.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 32.

An ortho-map for the site is shown in Figure 109, while a site map created by the PWGSC is presented as Figure 110.

Table 32 Stone Closure Issues Matrix

Common Site Name: **Stone**
PWGSC site #: 31

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	488921.00	7092747.00	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Building 31A	✔			✔		
Building 31C	✔			✔		
Building 31D	✔			✔		
Adit - middle adit level	✔					
Adit area - middle adit level				✔		

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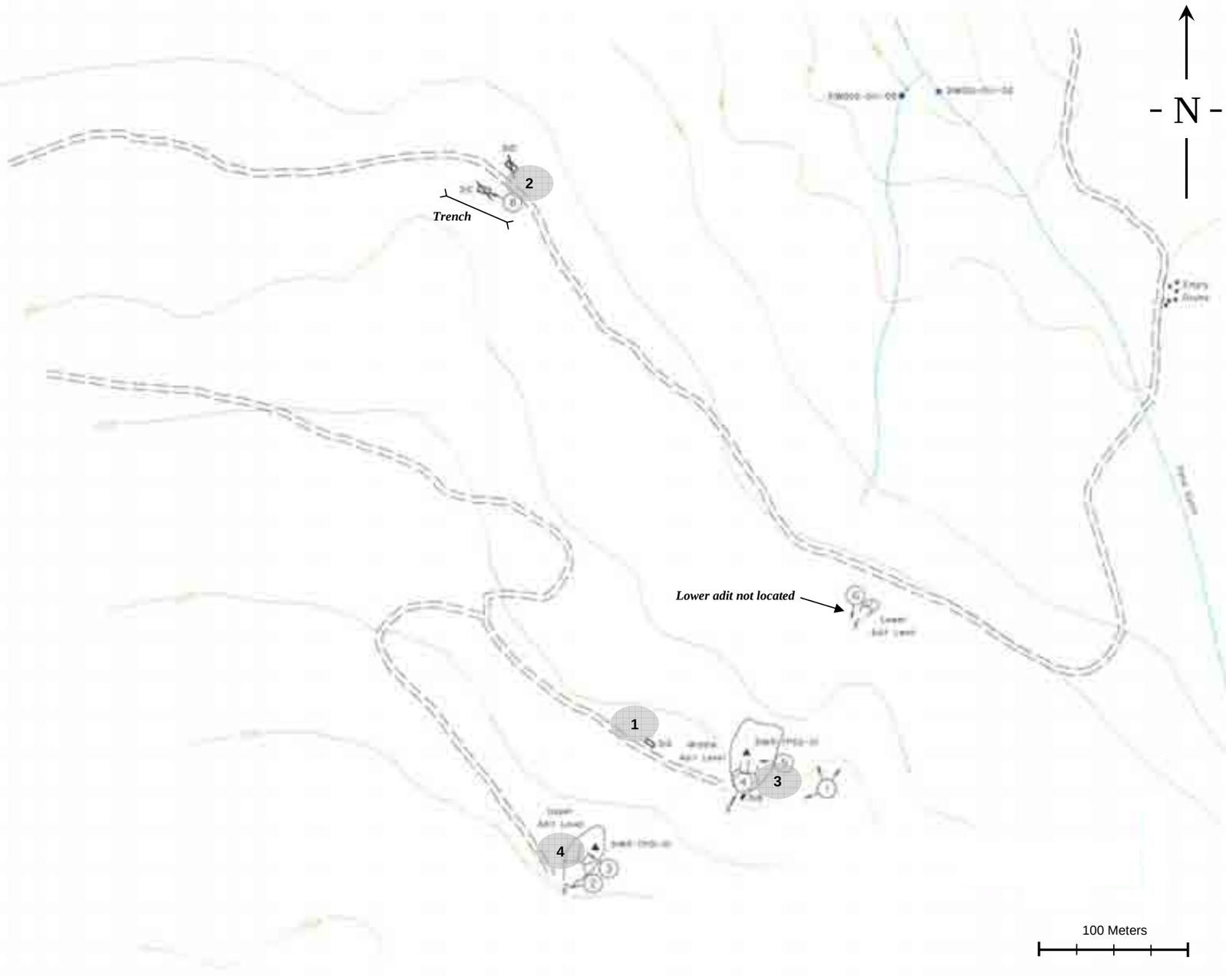
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 109 - STONE

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,685
FILE: Untitled.mxd		



#1 *- Ceiling of building 31A has collapsed. Siding is white tarpaper shingles. Unidentified outhouse observed to east of building 31A.*

#2 *- Buildings 31C and 31D area collapsed- tarpaper, particle board, lumber, asbestos shingle siding (<1 m^3), other household debris remain.*

#3 *- Adit is blocked, but access to collapsed portal structure via a 0.5 m x 0.5 m opening is possible. Open space observed to extend for 2.5 to 3 m.*
- Dripping and trickling sounds coming from fill in front of adit. No surface flow observed.
- Portal shed is collapsed.
- Surface subsidence extends from collapsed portal for ~5 m upslope. Area of collapse is revegetated and appears stable; no exposed mineral soil was observed.

#4 *- Waste rock is mostly graphitic phyllite with minor greenstone or foliated gabbro. East side of waste rock pile has oxidized siderite waste over length of dump for a width of 3 m.*
- Test pit, likely excavated during PWGSC investigations, has ~25 willow seedlings growing in it. Dump otherwise has minor revegetation- willows, fireweed, bearberry.

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Stone Site #31

Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site31_Stone_20070131.ppt			Figure: **110**

3.29.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.30 KENO 700

3.30.1 Description

The Keno 700 adit accessed an underground mine, working the No. 9 Vein. The No. 9 vein was first mined in the 1920's by Keno Hill Limited. The workings were in the upper part of the hill, with access via the 100 level adit (located in Faro Gulch) and from the shaft extending from surface to the 300 level. The 100 level adit is caved and iced in. An adit at the 200 level was also developed, in 1955, from Faro Gulch but is also caved and iced in.

UKHM worked No. 9 vein via the Keno 700 adit from 1958 to 1982. There was considerable further development, with an additional adit at the 200 level (on the south side of the hill), an incline from the 200 to 400 levels, and the No. 4 shaft developed from the 700 to 1075 levels. Overall, there are nine levels on the No. 9 vein from the 200 level to the 1075 level. Much of the ground in the No. 9 vein is frozen (to at least the 400 level).

The majority of the infrastructure was located at the 700 level and included the No. 4 shaft hoist (underground), and buildings, shops, power, offices and housing facilities located at the portal. Most of these buildings remain in place today. Development rock from the 700 adit was used for foundations for these buildings, with the remainder deposited downslope from the Keno 700 portal. The dump has failed locally and been eroded; some of the rock has been carried into the galley below the portal.

The only remaining facilities at the Keno 200 adit are the portal, which is blocked by doors, and a section of tracks from underground.

Two other adjoining veins were also worked as part of "Keno 700" Mine; the Shamrock J-18 vein (described below) and the Comstock - Keno - Porcupine. The three mines are connected by workings at the 400 and 700 levels.

The Shamrock J18 vein was developed from the 400 level of the No. 9 vein with access from Keno 700 portal. There was a raise from the 400 level to surface for ventilation and

for access of men and material to stopes. The raise is covered by a building which is collapsing.

Several other small veins were worked in conjunction with the No. 9 vein over the years. These include the No. 1 vein with two adits, one from Faro Gulch; the No. 3 vein, accessed by adit from Faro Gulch; the No. 12 vein accessed by 2 adits; the No. 5 vein also accessed by 2 adits at the northeast and southwest end of the vein, respectively; the No. 4 vein with an upper and lower adit; the No. 6 vein intersected by the Keno 200 adit with an old shaft from surface; and lastly, the No. 2 vein accessed by a shaft from surface. The condition of these various adits and shafts is not fully known but most predate the 1950's and are likely to be caved.

Drainage from the underground workings, including the Keno 200 through 700, Comstock - Keno - Porcupine and Shamrock J-18, is collected at, and discharged from the 700 level to Hope Gulch, via a culvert through the waste rock. Hope Gulch reports to Lightning Creek (AMC, 1996a).

3.30.2 Closure Issues

The Keno 700, like most other Keno Hill mines, drains seasonally but does not pose much of an environmental risk due to fairly low levels of zinc and other metals. Surface cleanup and safety are the main issues at Keno 700. Consideration should be given to preserving the last accumulation of significant buildings on Keno Hill as a potential tourist attraction, however, the closure plan calls for demolition (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 33.

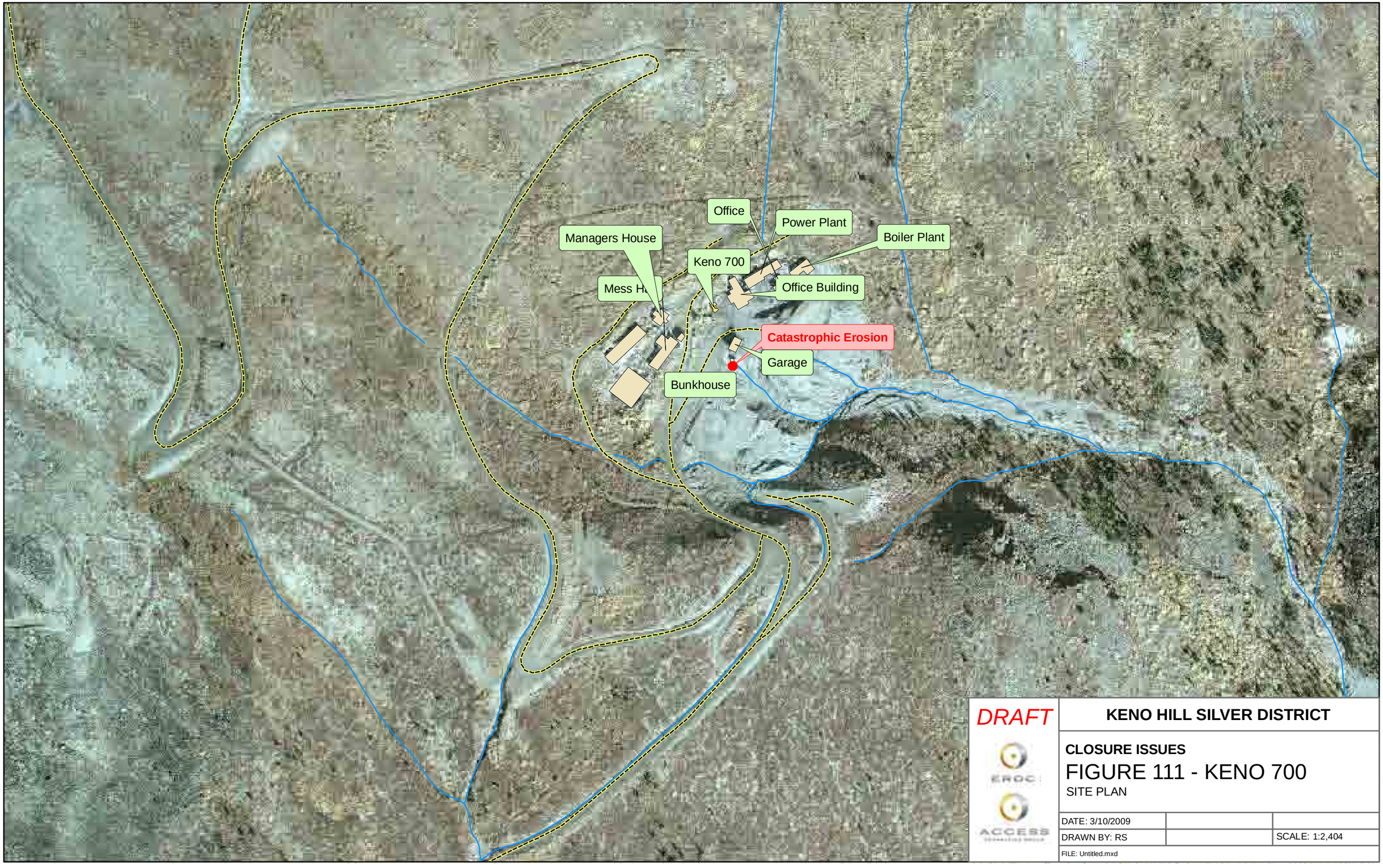
An ortho-map for the site is shown in Figure 111, while a site map for this area created by the PWGSC is presented as Figure 112. A composite plan for the Keno 700 Site is presented as Figure 113.

Table 33 Keno 700 Closure Issues Matrix

Common Site Name: **Keno 700**
PWGSC site #: 32

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	489969.49	7089596.39	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Waste dumps				✔		
Waste dump - into Hope Gulch		✔		✔		
Waste dump cribbing				✔		
Garage foundation				✔		
Underground culvert for drainage - outflow point			✔	✔		
Underground culvert for drainage - intake point			✔			
Keno 700 adit			✔			
various buildings				✔		
Blocked culvert - first gulch in Keno direction from site.			✔			



DRAFT

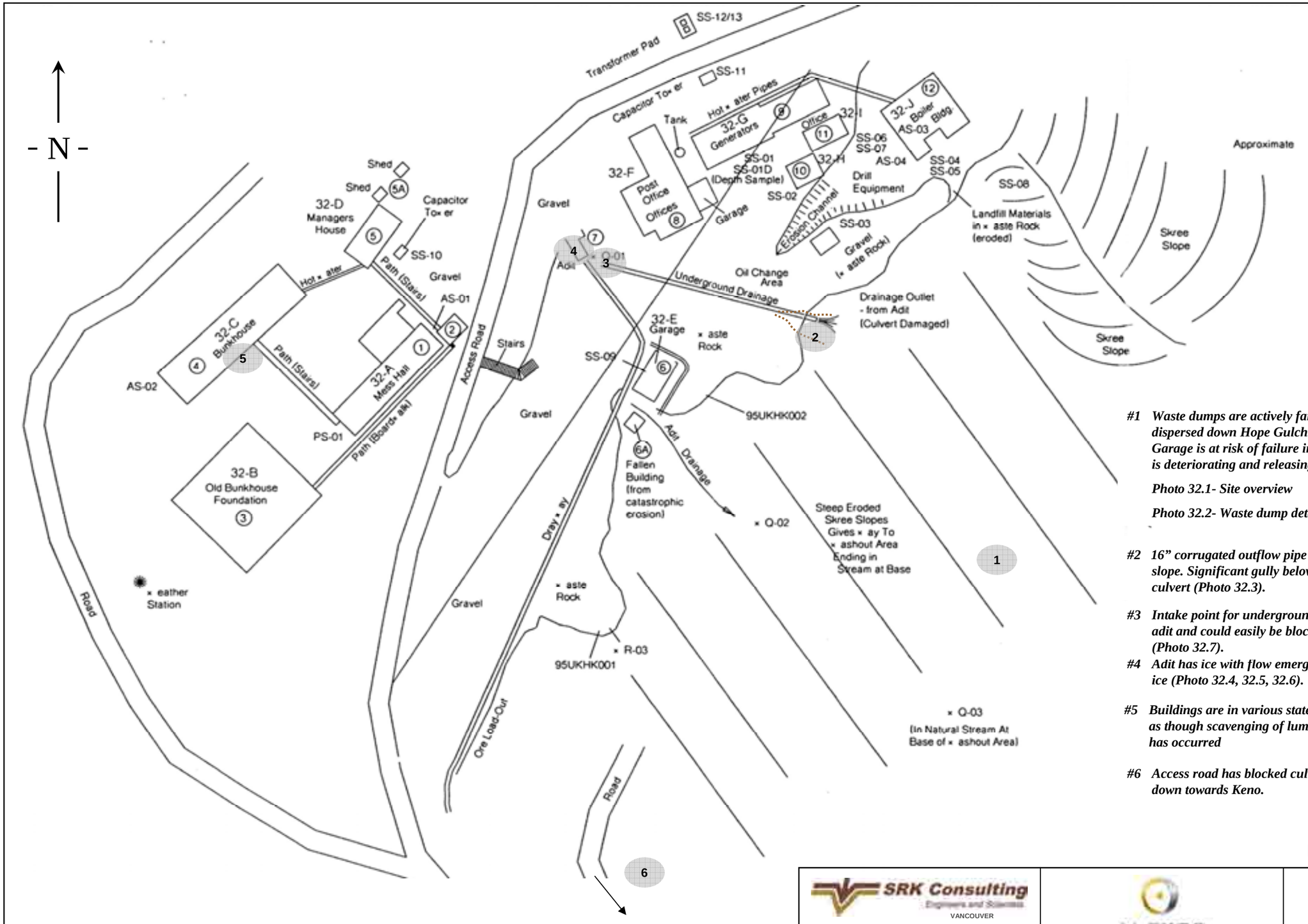
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 111 - KENO 700

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,404
FILE: Untitled.mxd		



#1 Waste dumps are actively failing and waste material is being dispersed down Hope Gulch. Waste that forms foundation of Garage is at risk of failure in the short term. Timber cribbing is deteriorating and releasing retained waste material.

Photo 32.1- Site overview

Photo 32.2- Waste dump detail

#2 16" corrugated outflow pipe has unwound at crest of slope. Significant gully below unwound section of culvert (Photo 32.3).

#3 Intake point for underground culvert is outside of adit and could easily be blocked by ice (Photo 32.7).

#4 Adit has ice with flow emerging from underneath ice (Photo 32.4, 32.5, 32.6).

#5 Buildings are in various states of disrepair. It appears as though scavenging of lumber from building frames has occurred

#6 Access road has blocked culvert at first gulch back down towards Keno.

30 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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Keno 700 Site #32

Job No: 1CA009.000

Filename: Site32_Keno 700_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007

Approved:

Figure: **112**

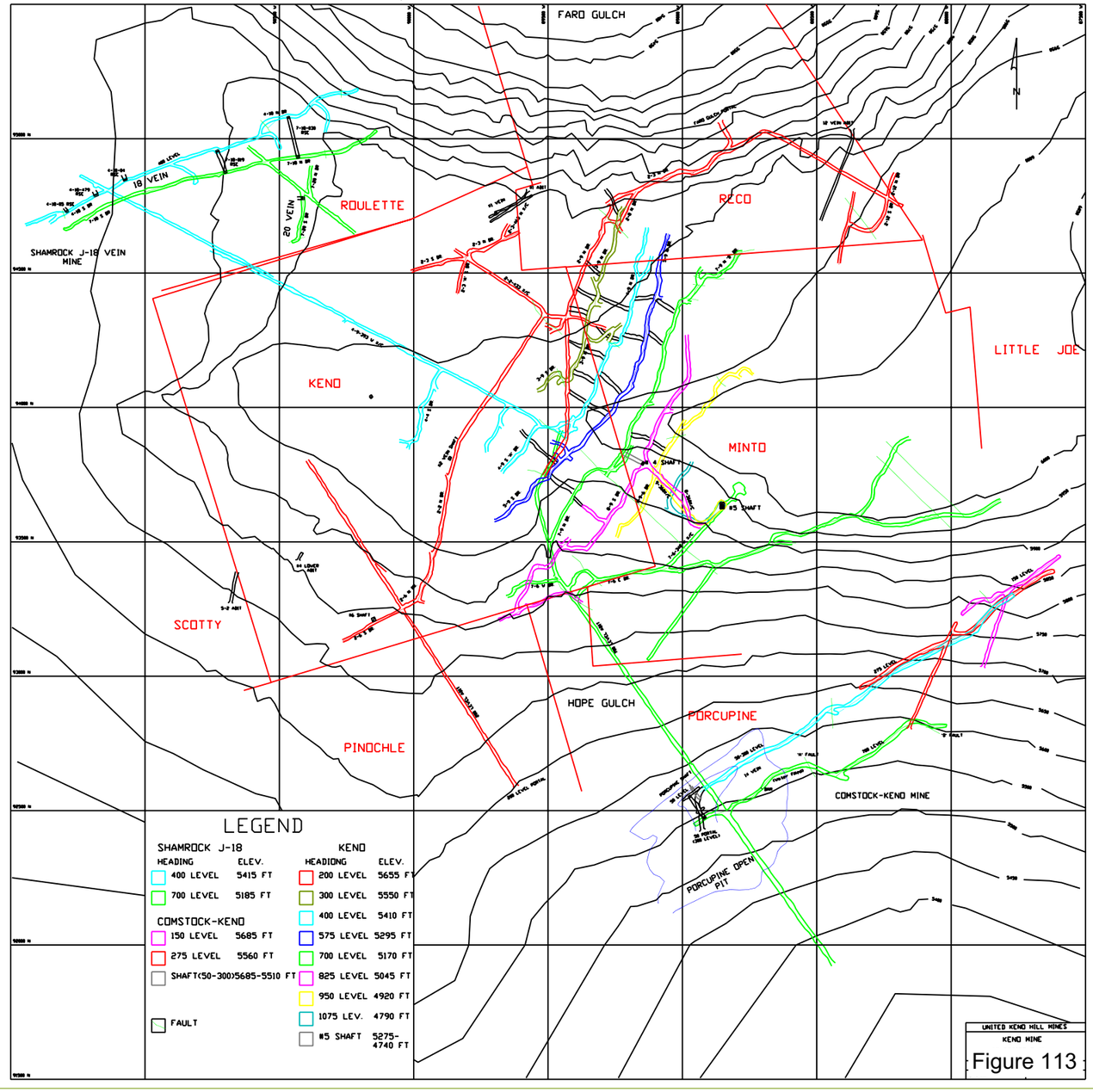
FARO GULCH
ROULETTE
RECO
LITTLE JOE
KENO
MINTO
SCOTTY
HOPE GULCH
PORCUPINE
PINOCHLE
COMSTOCK-KENO MINE
SHAMROCK J-18 VEIN MINE
18 VEIN
20 VEIN
#5 SHAFT
PORCUPINE OPEN PIT
LEGEND
SHAMROCK J-18
HEADING ELEV.
400 LEVEL 5415 FT
700 LEVEL 5185 FT
COMSTOCK-KENO
150 LEVEL 5685 FT
275 LEVEL 5560 FT
SHAFT(50-300) 5685-5510 FT
FAULT
KENO
HEADIONG ELEV.
200 LEVEL 5655 FT
300 LEVEL 5550 FT
400 LEVEL 5410 FT
575 LEVEL 5295 FT
700 LEVEL 5170 FT
825 LEVEL 5045 FT
950 LEVEL 4920 FT
1075 LEV. 4790 FT
#5 SHAFT 5275-4740 FT
UNITED KENO HILL MINES
KENO MINE

Figure 113

3.30.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.31 KENO NO. 9 SYSTEM

3.31.1 Description

The Keno No. 3 and 9 Vein Open Pits are located on Keno Hill summit at the Signpost, at the end of the Keno Signpost road. The Faro Gulch Portal is approximately 300m east northeast of the Signpost in the cliff forming Faro Gulch cirque and is inaccessible.

The site area is spread between elevations of 1,460m to 1,700m on the northern, western and southern facing slopes of Keno Summit. The areas south of the Faro Gulch headwall have very shallow to shallow slopes. All of the workings are above treeline and the area is populated with sparse grasses, moss and small shrubs. The area is underlain by permafrost conditions that extend to depths of up to 120m. Soils are poorly developed to absent over all of the area. Surface water runoff from the No. 3 Vein and the No. 9 Vein pits has formed channels in the loose waste rock dump material below the pits in headwall of Faro Gulch.

The No. 3 Vein fault was investigated in the early 1920s by a 45.7m shaft and underground development on three levels. A small quantity of ore was mined during this period.

The No. 9 Vein was first developed in the 1920s by shafts, adits, and winze to 450 feet below surface, and drifting on levels to 300 feet below surface. Massive high-grade ore was mined, placed into sacks at the surface and transported to Mayo for shipment by paddle wheeler. Approximately 9,000 tons of disseminated ore remains in the mine.

Small open pits were established on the No. 3 and 9 Veins by Archer, Cathro & Associates Limited during the period 1989-90. The No.3 Open Pit is up to 15m deep and the No. 9 Vein is 30m deep. Both encountered old workings dating from the 1920's that were ice filled. The original No.3 and No.9 Vein Shafts were collapsed and backfilled at this time (PWGSC, 2000).

3.31.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 34.

An ortho-map for the site is shown in Figure 114, while site maps for this area created by the PWGSC are presented as Figures 115 and 116.

Table 34 Keno No.9 Closure Issues Matrix

Common Site Name: **Keno No. 9**
PWGSC site #: 36

Site coordinates:	easting	northing	
	489550.00	7090500.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Drift area				✔		
Drift area - hole on north side	✔					
Drift area - adjacent waste				✔		
Shaft - south side of Trench L5	✔			✔		

Shamrock "J" Raise

#1 Adit

Faro Gulch

12 Vein Adit

Keno No. 9 System

#4 Lower

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FIGURE 114 - KENO NO. 9

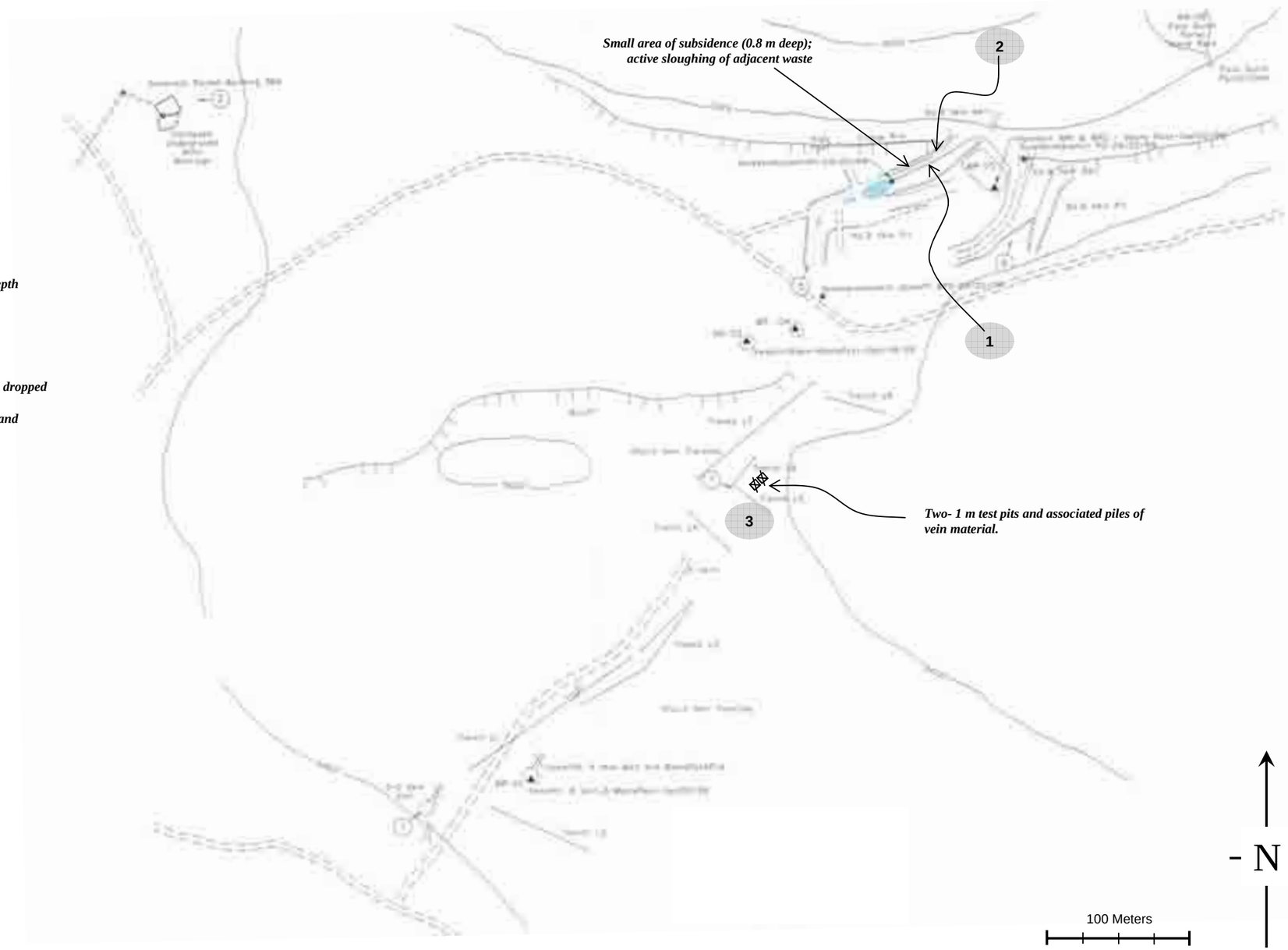
SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,617
FILE: Untitled.mxd		

#1 - Collapse of supports for drift; open hole with high potential for access. Depth estimated to be a minimum of 4 m. High risk due to proximity to Signpost.

#2 - Open hole (opening 0.5 m x 1 m).
- Easy to crawl into; void appears to be 3 m x 2 m x 1.5 m. High risk due to proximity to Signpost.

#3 - Timber-lined shaft, 3 m x 1.5 m, partially collapsed. Water at 2 m depth- a dropped rock suggested water depth was about 0.3 m.
- Associated waste rock pile (1.5 m x 15 m x 10 m) composed of rusty brown and black vein material and blocky greenstone.



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Keno No. 9 Site #36 (Map 1)

Job No: ALEX-06-ESP-05
Filename: Site36_Keno9_200_20070131.ppt

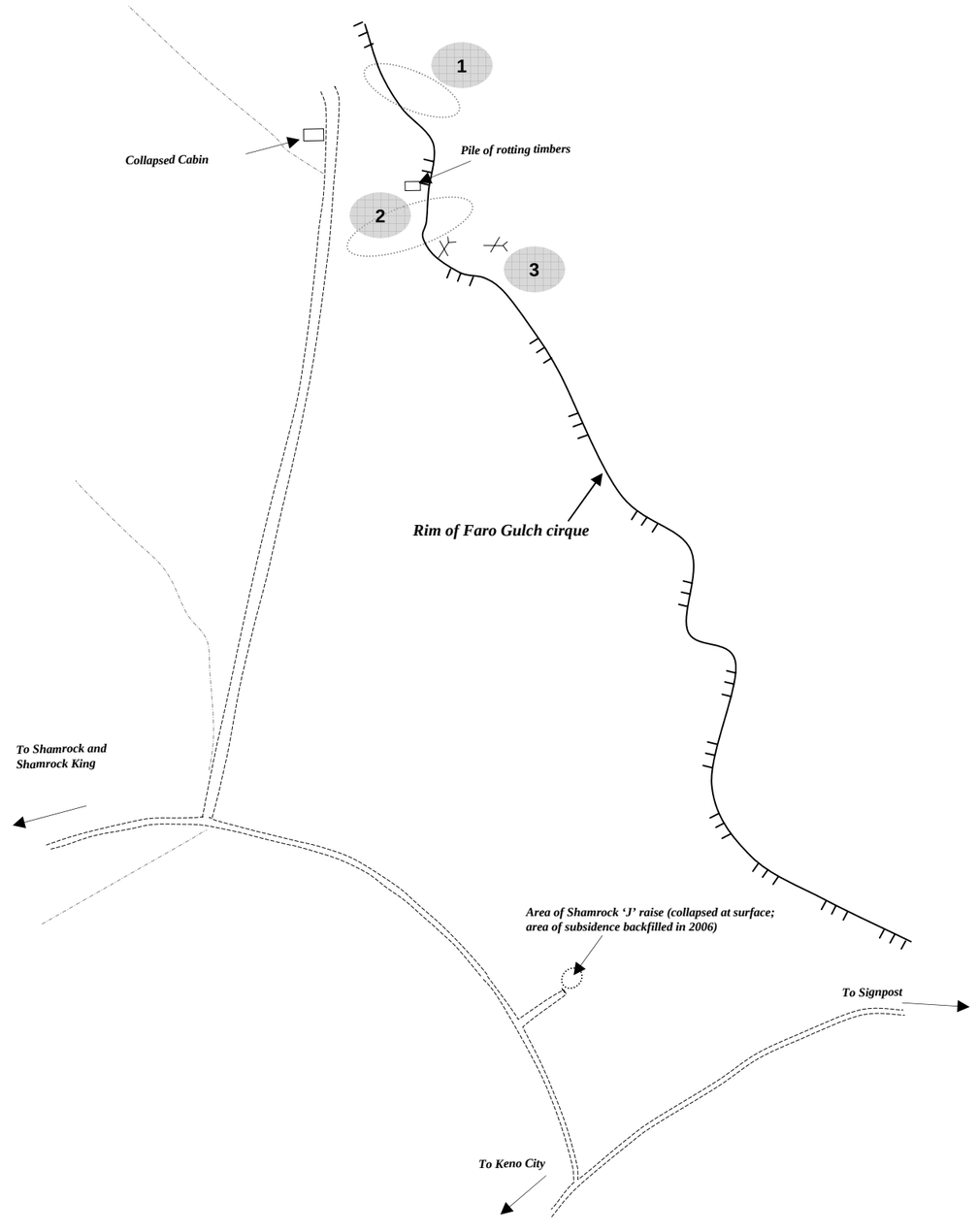
Baseline Environmental Report,
United Keno Hill Mines Property

Date: Jan. 2007
Approved:
Figure: **115**

#1 - Areas of trenching and test-pitting near rim of Faro Gulch.

#2 - Area of several shallow hand shafts and hand trenches.

#3 - Two collapsed adits had small waste piles on slope below adit mouth. Waste rock is blocky light grey quartzite, greenstone, and carbonaceous phyllite.
- Support timbers protruding from the collapsed rock at both adits; no accessibility to underground.
- Audible trickling noise of water coming from collapsed rock at upper adit; no surface flow observed.



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Keno No. 9 Site #36 (Map 2)

Job No:	ALEX-06-ESP-05
Filename:	Site36_Keno9_200_20070131.ppt

6Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**116**

3.31.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Open Pit(s):

- **Water Management:**

  Information Gap: Lack of closure strategy for mine components.

  Research Study: Open Pits. (Summer 2007 - Priority: High)

  Inventory and develop closure strategy for each open pit. Closure strategy should consider public safety issues, ABA and metal leaching potential and connection and effects on adit ice plugs.

  Evaluate storage of treatment sludge in pits and incremental benefits / costs to closure.

  Reports:

  SRK 2008 – Geotechnical Closure Studies complete

  SRK 2008 – Geochemical Closure Studies Report complete

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available.

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

Report:

ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.32 GOLD HILL NO. 2

3.32.1 Description

Gold Hill Number 2 is located on Keno Hill at an elevation of roughly 5900 ft (1800 m), 350 m west of Monument Hill Summit. Four-wheel drive access is possible via the Monument Hill Trail, which branches off the Silver Basin Gulch Trail about 800 m east of the signpost on top of the Keno Hill summit.

Gold Hill Number 2 is on a gentle east-facing slope near the Monument Hill summit. Given the elevation, the area is presumably underlain by permafrost. The site is well above the treeline and the vegetation is dominated by grasses. Surface runoff in the area drains to the north into Faro Gulch, a tributary of Keno Ladue River, located approximately 1 km downslope.

Exploration work consists of an old shallow shaft, extensive bulldozer trenching and limited diamond drilling undertaken in 1980.

Mine development at the site consists of twelve trenches, one shallow prospecting shaft and associated waste rock piles. No ore was processed at the site and no tailings were encountered. There is no waste water treatment facility at the site (PWGSC, 2000).

3.32.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 35.

An ortho-map for the site is shown in Figure 117, while a site map for this area created by the PWGSC is presented as Figures 118.

Table 35 Gold Hill No.2 Closure Issues Matrix

Common Site Name: **Gold Hill No. 2**
PWGSC site #: 37

Site coordinates:	easting	northing	
	490740.00	7090400.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Trench T8			✔			
General site debirs	✔					

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CLOSURE ISSUES

FIGURE 117 - GOLD HILL NO. 2

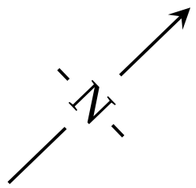
SITE PLAN

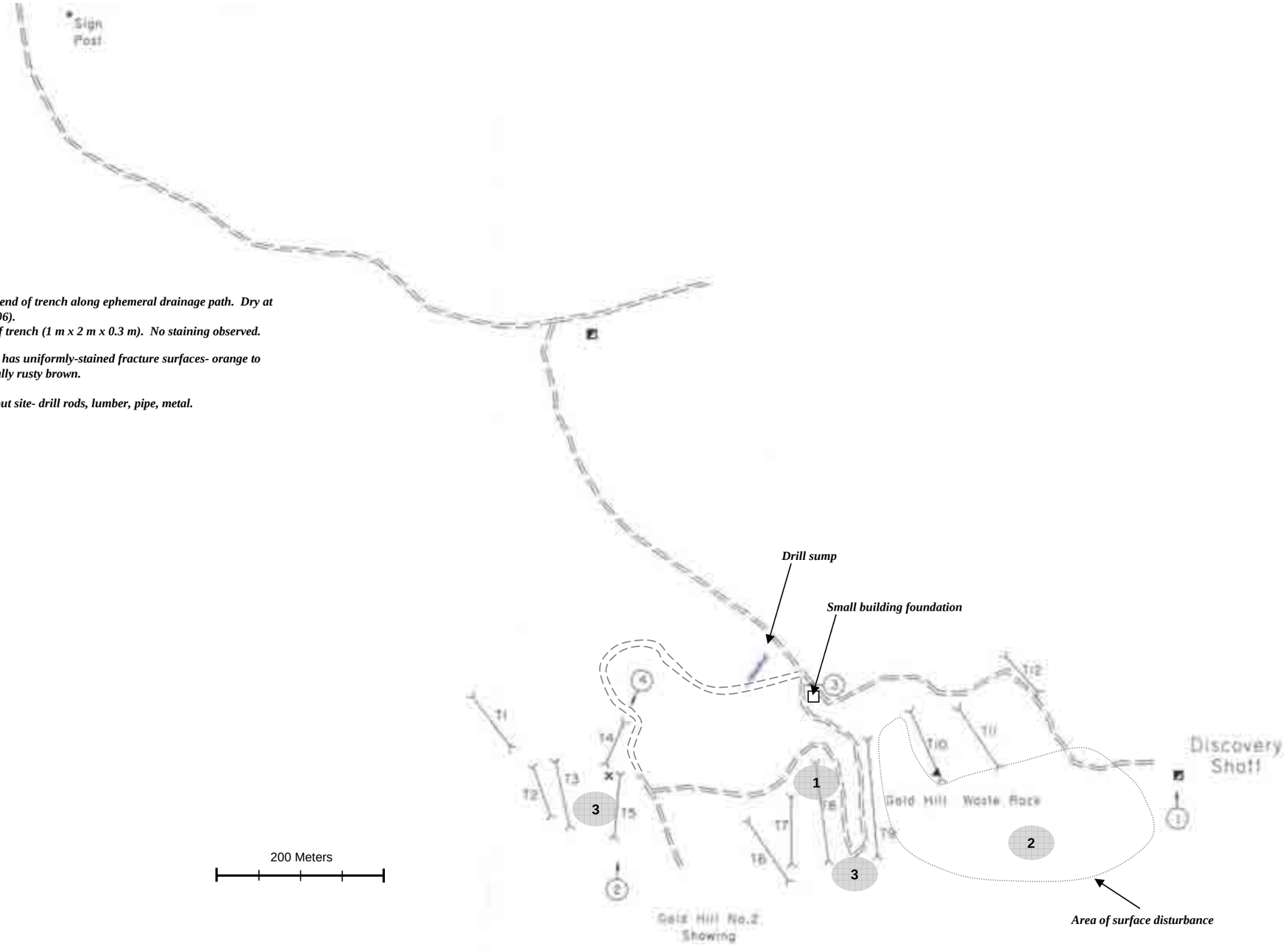
DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,803
FILE: Untitled.mxd		

#1 - Orange staining at upper end of trench along ephemeral drainage path. Dry at time of inspection (Aug. 2006).
- Small pond at lower end of trench (1 m x 2 m x 0.3 m). No staining observed.

#2 - Waste rock from trenches has uniformly-stained fracture surfaces- orange to brownish orange, occasionally rusty brown.

#3 - Debris scattered throughout site- drill rods, lumber, pipe, metal.





200 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Gold Hill No. 2 Site #37

Job No:	ALEX-06-ESP-05
Filename:	Site37_GoldHill_20070131.ppt

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United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**118**

3.32.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

3.33 Fox

3.33.1 Description

The Fox showing is located on the north side of Keno Hill, approximately 1.5 km north-northwest of Monument Hill summit. Four wheel drive access is possible via the Silver Basin Gulch Trail, approximately 2 km from the Keno Hill Signpost.

The Fox site is situated on a gently sloping knob to the north of Monument Hill. The site is located at 5,400 ft (1,650 m), above treeline, and is vegetated with subalpine species, predominantly small shrubs and grasses. Given the altitude, the site is probably underlain by permafrost. Since the site is located on the top of a knob, surface runoff likely drains in three directions: to the west into Faro Gulch, to the north into McKay

Gulch and to the east into Silver Basin Gulch. All three gulches are tributaries of the Keno Ladue River.

Three or more shallow prospecting shafts are reported. Only two bulldozer trenches were found at the site. The prospecting shafts were probably removed by the bulldozing.

There are two trenches and associated rock piles at this site. No ore was processed at the site and no tailings were encountered. There is no waste water treatment facility at the site (PWGSC, 2000).

3.33.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

No additional closure issues for this site were noted in the 2007 report from SRK (SRK, 2007). A list of site components potentially presenting closure issues is presented as Table 36.

An ortho-map for the site is shown in Figure 119, while a site map for this area created by the PWGSC is presented as Figures 120.

Table 36 Fox Closure Issues Matrix

Common Site Name: **Fox**			
PWGSC site #: 38			
	easting	northing	
Site coordinates:	490650.00	7091600.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
No new closure issues noted.						

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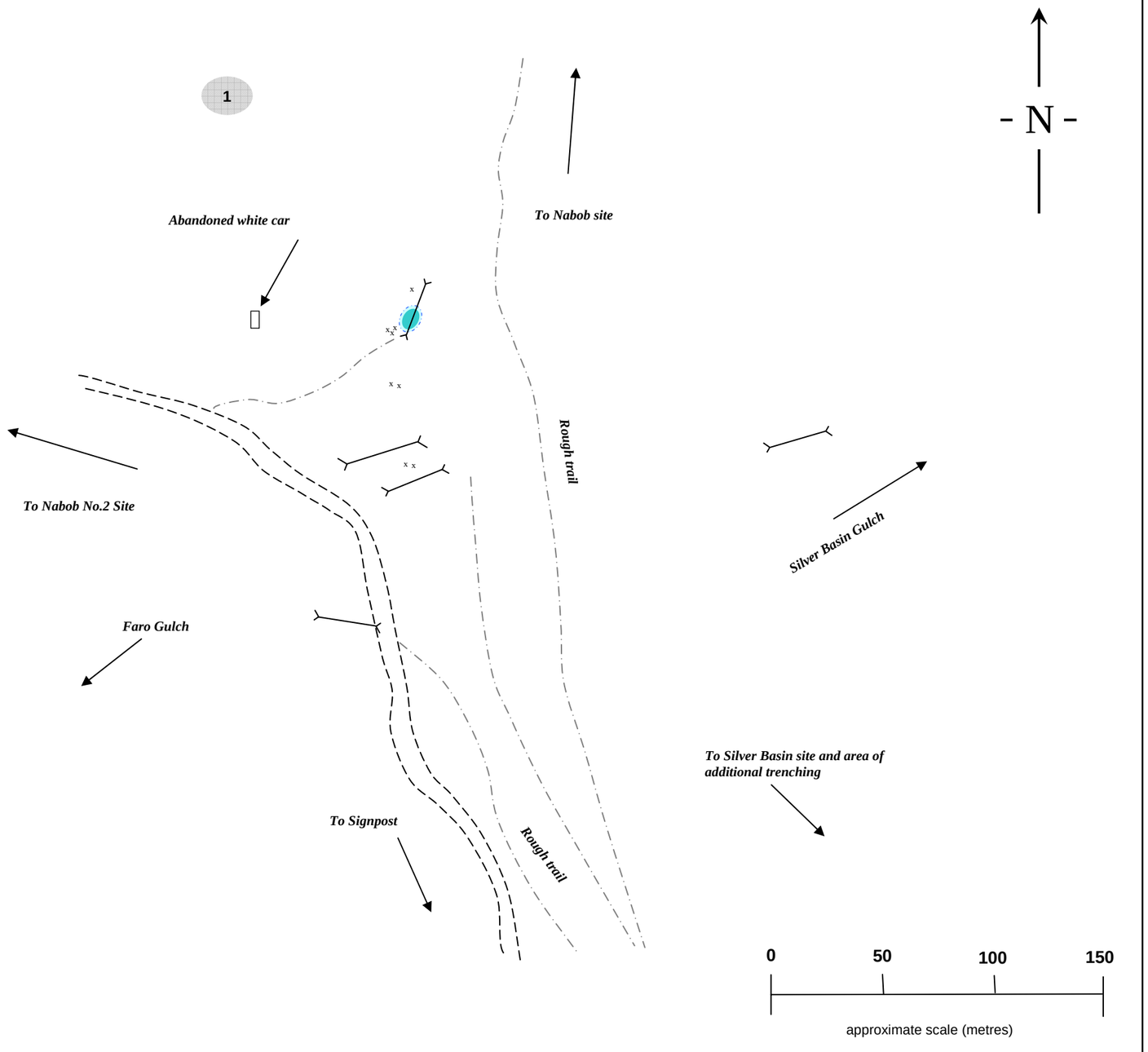
CLOSURE ISSUES

FIGURE 119 - FOX

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,859
FILE: Untitled.mxd		

#1 - Surface topography in this area prevents surface drainage from flowing to north into McKay Gulch. All surface drainage from the Site reports east to Silver Basin Gulch or west to Faro Gulch.



2006 aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Fox Site #38

Job No:	ALEX-06-ESP-05
Filename:	Site38_Fox_20070131.ppt

Baseline Environmental Report,
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Date:	Approved:	Figure:
Jan. 2007		120

3.33.3 Information Gaps

There were no information gaps identified for this location. Please refer to Section 4.0 (Summary of Global District Issues/ Summary of Information Gaps) for general gaps in information pertaining to the sites across the Keno Hill Silver District.

3.34 DIVIDE

3.34.1 Description

The Divide site is located on the south side of Keno Hill, between Hope and Faith Gulches, approximately 1.5 km southwest of Caribou Hill. Access is by a 5 km trail (possibly suitable for 4x4 vehicles) that leaves the Lightning Creek Road near the mouth of Hope Gulch.

The area is located at an elevation of roughly 5,300 ft (1,620 m) on a flat to gently rolling plateau to the south of Caribou Hill and Monument Hill. Surface runoff from the site either flows into Hope Gulch or into Faith Gulch. Surface runoff from the stripped areas in the northwest (Zone 'A') flow westward into Hope Gulch, a tributary of Lightning Creek. Surface runoff from the stripped areas in the southeast (Zones 'B' and 'C') flow eastward into Faith Gulch, which eventually joins the Keno Ladue River system. The plateau is above treeline and the vegetation is predominately moss and grasses.

Extensive stripping and bulldozer trenching in the area was undertaken prior to 1962.

The area has been extensively stripped and trenched. No ore was processed at the site and no tailings were encountered. There is no wastewater treatment facility at the site (PWGSC, 2000).

3.34.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 37.

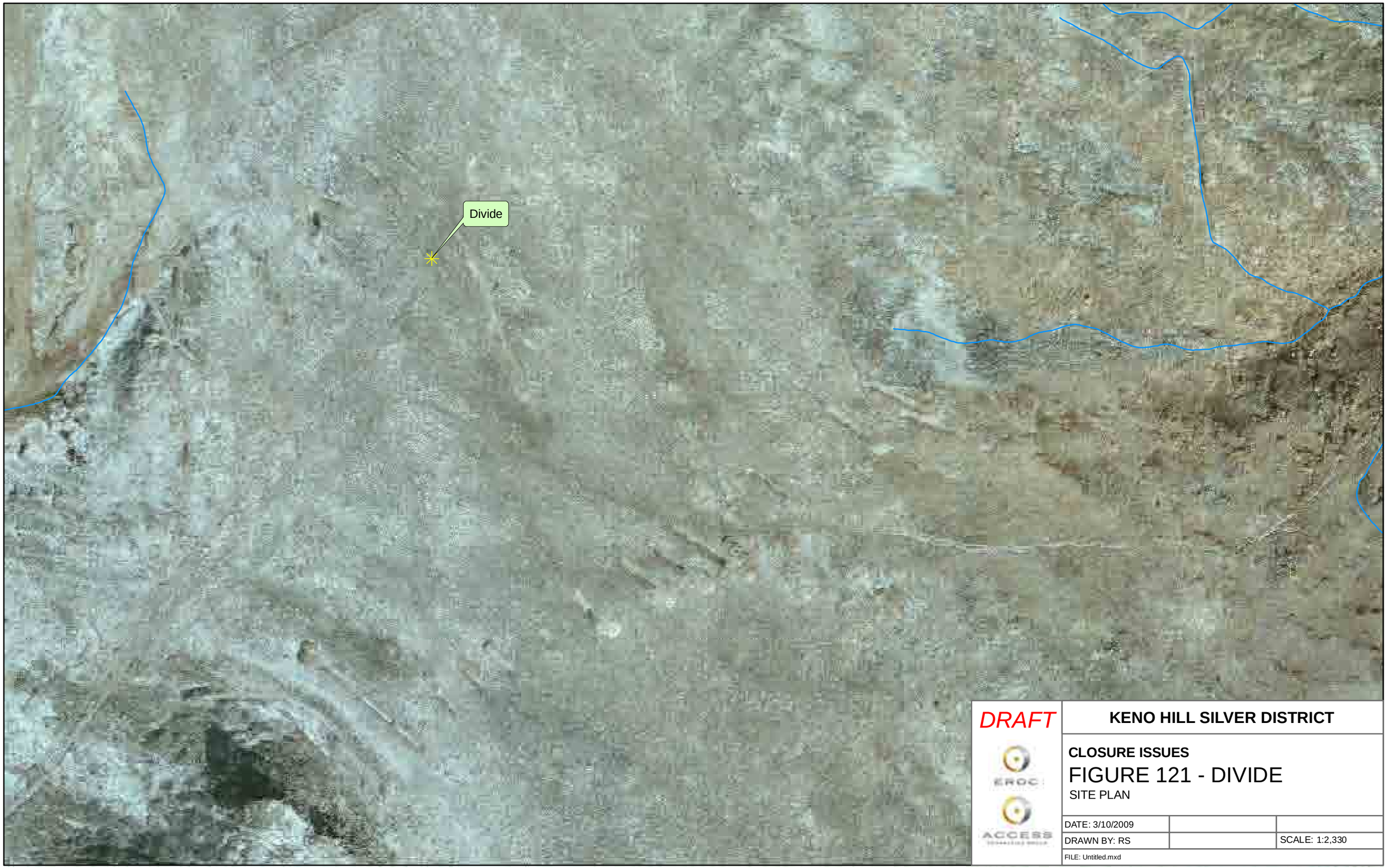
An ortho-map for the site is shown in Figure 121, while a site map for this area created by the PWGSC is presented as Figures 122.

Table 37 Divide Closure Issues Matrix

Common Site Name: **Divide**
PWGSC site #: 40

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	492367.00	7090040.00	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Barrel - within area of scattered debris		✔				
Collapsed building - north end of Trench B-5	✔					
Barrel in Trench B-9		✔				
Trench c-1				✔		



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CLOSURE ISSUES

FIGURE 121 - DIVIDE

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,330
FILE: Untitled.mxd		

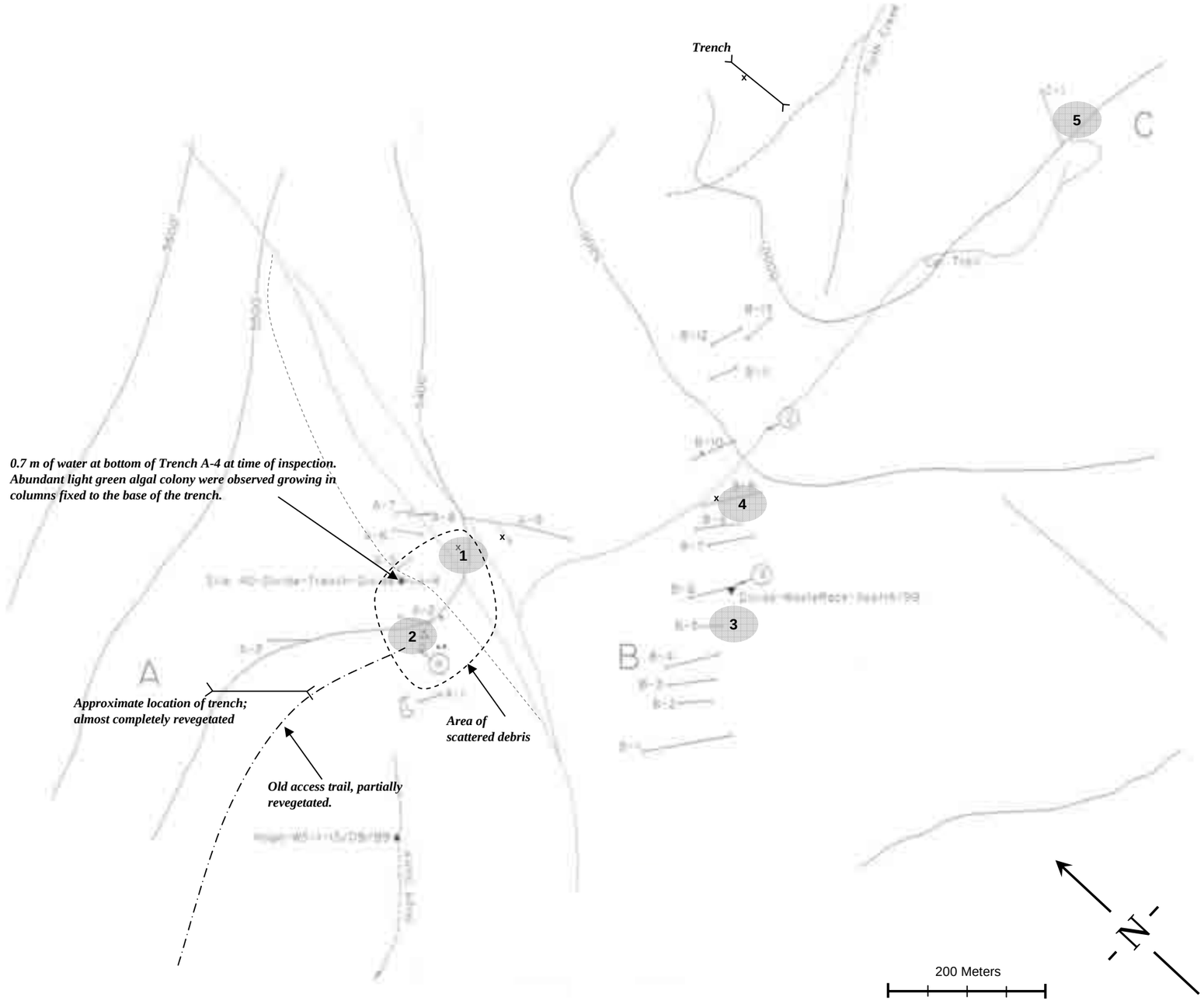
#1 - Previously unidentified barrel, approximately 50% full of fluid- odour and texture suggests hydraulic oil. No staining observed on adjacent ground.

#2 - Building reported in PWGSC 2000 was observed to be laying on its side at the north end of Trench A-2.

#3 - Minor remnant pyrite observed in oxidized material in Trench B-5.

#4 - Barrel in Trench B-9, not in Trench B-10. Remains ~50-% full of fluid.

#5 -Solifluction is causing trench infill; process observed at many trenches at this site. Minor revegetation is occurring where fines have accumulated. Trench is free-draining.



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

SRK Consulting Engineers and Scientists VANCOUVER	ALEXCO	**Divide Site #40**
Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007 / Approved: / Figure: **122**
Filename: Site40_Divide_20070131.ppt		

3.34.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.35 SILVER BASIN

3.35.1 Description

The site is on the north side of Keno Hill, approximately 1 km north of the Monument Hill summit. Four-wheel drive access is possible by the Silver Basin Gulch Trail, some 2.5 km from Keno Hill Signpost.

The area slopes gently to moderately to the north and east. The site is located at an elevation of 5,400 ft (1,640 m) and is above the treeline. The vegetation is mostly grass, moss and some small shrubs. Surface runoff from the site drains 500 m to the west into Silver Basin Gulch, a tributary of the Keno Ladue River. Given the elevation and aspect, the area is presumably underlain by continuous permafrost.

Between 1919 and 1927 a short shaft, open cuts and trenches were excavated. Some bulldozer trenching was undertaken in 1986.

Three trenches and one collapsed shallow shaft were visited. There is a small waste rock pile outside of the shaft. No ore was processed at the site and no tailings were encountered. There is no wastewater treatment facility at the site (PWGSC, 2000).

3.35.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 38.

An ortho-map for the site is shown in Figure 123, while a site map for this area created by the PWGSC is presented as Figures 124.

Table 38 Silver Basin Closure Issues Matrix

Common Site Name: **Silver Basin**
PWGSC site #: 45

Site coordinates:	easting	northing	
	490951.00	7091641.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Excavation - east of Silver Basin Gulch Trail			✔			

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CLOSURE ISSUES

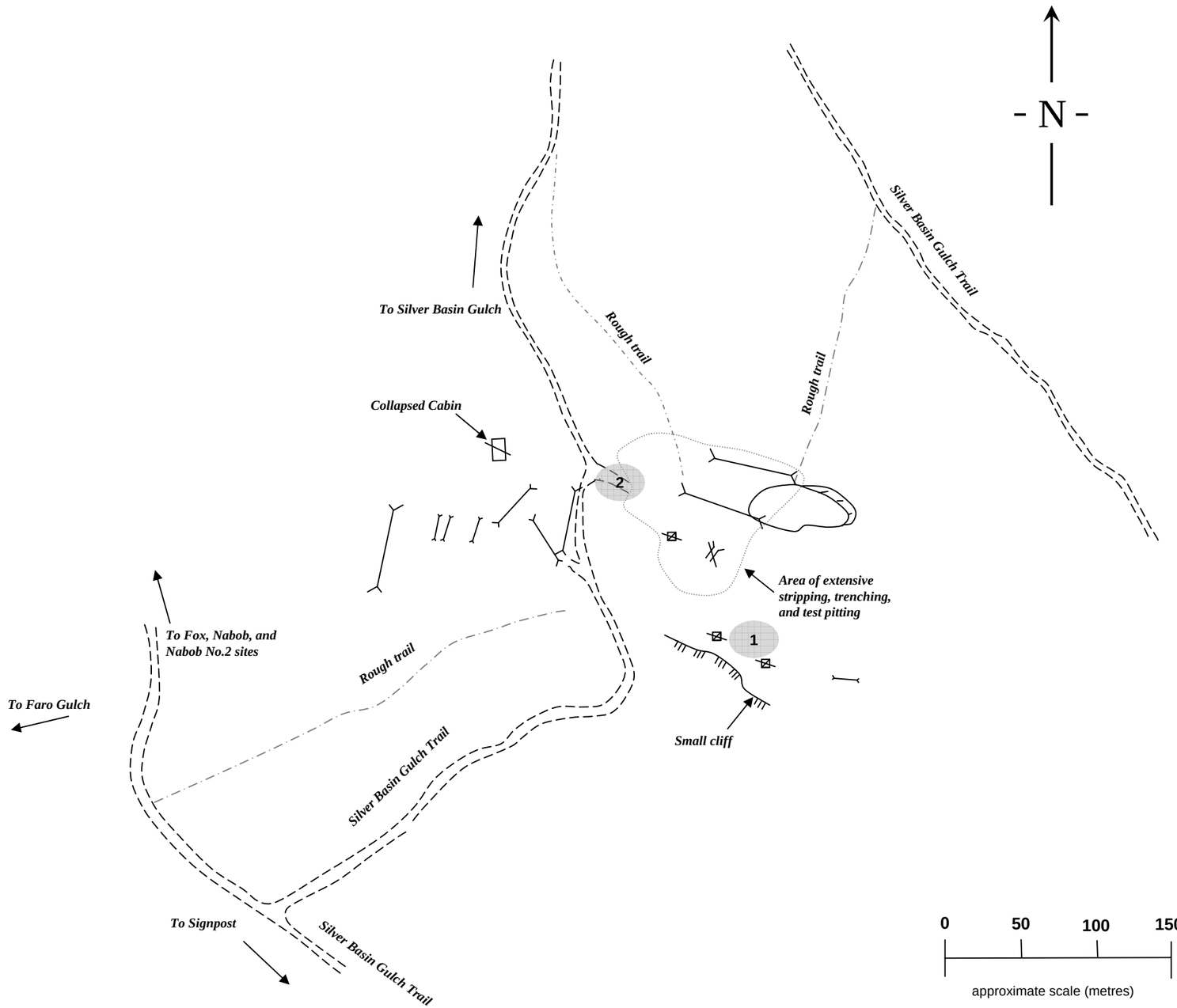
FIGURE 123 - SILVER BASIN

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,803
FILE: Untitled.mxd		

#1 *- Two hand shafts at base of small cliff have minor waste piles downslope. Waste pile for southeast shaft extends down shallow surface gully; material is vein quartz, quartz sericite schist, greenstone, carbonaceous phyllite and siderite vein material with purplish black staining.*

#2 *- Surface runoff from Silver Basin Gulch Trail channels down surface excavation. Oxidized vein material is exposed in the eroded channel.*



2006 aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Job No:	ALEX-06-ESP-05
Filename:	Site45_Silver_Basin_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Silver Basin Site #45

Date:	Approved:	Figure:
Jan. 2007		**124**

3.35.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment.

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.36 MONUMENT AND LADUE 600

3.36.1 Description

The site is located on Keno Hill, on the northwest-facing slope of Monument Hill summit, at an elevation of 5600ft. Access is by the Silver Basin Gulch trail suitable for 4x4 vehicle traffic and the site is located roughly 1.5 km past the Signpost.

The site is located in a broad and gently sloped northwest face of Monument Hill. Given the elevation and aspect, the site is presumably underlain by continuous permafrost conditions. The area is well above treeline and is well vegetated with sub-alpine species, predominantly grasses. A variety of moss and lichens grow on the talus and there are some small shrubs growing in protected pockets. Surface runoff from the site drains 500m to the north into Faro Gulch, a tributary of Keno Ladue.

Exploration work consists of shallow prospect shafts and hand trenching dating back to 1919. In 1958 and 1959 bulldozer trenches were excavated on the Venus 1F claim. An old adit of unknown age was developed on the Ladue Fraction claim. In 1999, six bulldozer trenches, in the area of the showing, were examined. No old shallow shafts, hand trenches or adits were found. It is possible that these were destroyed by later bulldozer trenching.

There are six bulldozer trenches. No ore was processed at the site and no tailings were encountered. There is no wastewater treatment facility at this site (PWGSC, 2000).

3.36.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 39.

An ortho-map for the site is shown in Figure 125, while a site map for this area created by the PWGSC is presented as Figures 126.

Table 39 Monument and Ladue Closure Issues Matrix

Common Site Name: **Monument and Ladue**
PWGSC site #: 47

Site coordinates:	easting	northing	
	491065.00	7091109.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Monument and LaDue Fraction Adit	✔	✔		✔		
Trench #3			✔			

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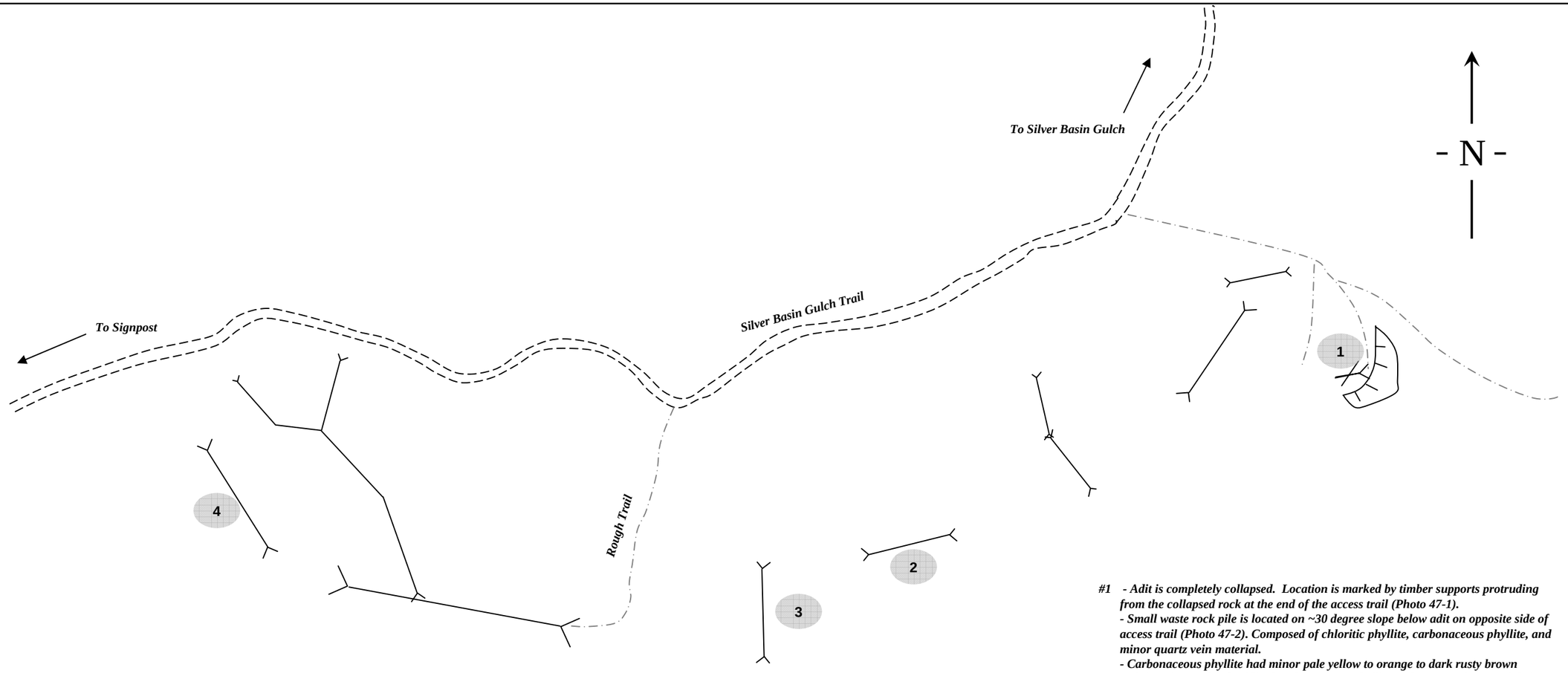
CLOSURE ISSUES

FIGURE 125 - MONUMENT & LADUE

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,946
FILE: Untitled.mxd		



0 50 100 150

approximate scale (metres)

#1 - Adit is completely collapsed. Location is marked by timber supports protruding from the collapsed rock at the end of the access trail (Photo 47-1).
- Small waste rock pile is located on ~30 degree slope below adit on opposite side of access trail (Photo 47-2). Composed of chloritic phyllite, carbonaceous phyllite, and minor quartz vein material.
- Carbonaceous phyllite had minor pale yellow to orange to dark rusty brown staining. A sample of oxidized carbonaceous phyllite and quartz vein material (<2 mm fraction) returned a rinse pH of 3.43 and rinse conductivity of 0.27 mS/cm.
- Acid weathering indicated by presence of clasts weathered to quartz sand with orange staining (Photo 47-3).
- Within Silver Basin Gulch surface catchment.

#2 - Noted as Trench #2 in PWGSC 2000. No ponded water observed at time of 2006 inspection; trace flow observed across west end of trench, with healthy grass marking flow path (Photo 47-4).

#3 - Noted as Trench #3 in PWGSC 2000. Trench slopes downhill to north, and a 3 m x 3 m granular fan has formed on the flat portion at the north end, with fine sediments and a 1 m ponded area at the base of the fan indicating channelling of runoff by trench. Other trenches show similar signs of channelling runoff at a small scale (Photo 47-5).

#4 - Noted as Trench #6 in PWGSC 2000. Excavated into blocky quartzite talus-fracture surfaces show dark rusty brown staining.

2006 aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Monument & Ladue Site #47

Job No:	ALEX-06-ESP-05
Filename:	Site47_Monument_Ladue_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		126

3.36.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available.

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

3.37 APEX

3.37.1 Description

Access to the Apex site is from Signpost Road. A small cabin (Building 48A) is located approximately 250 m south of the 4th switchback past the intersection of Signpost Road and Keno 700 Road. The coordinates of the cabin are approximately 60° 55' 18" N by 135O 18' 22" W. Six trenches are located to the west of the cabin. The elevation of the site is approximately 1465 m.

The Apex site is located on a flattened ridge on the south slope of Keno H111, west of Charity Gulch. The site lies above the tree line in an area dominated by typical alpine vegetation. The surface water in the area drains toward Lightening Creek.

Only 1 shaft was observed at the site. The minfile (MINFILE# 105M 009) reports that 2 shafts, a 10.6 m adit and a 5.5 m winze were developed at the Apex site between 1925 and 1936, however, the second shaft could not be located.

There were 6 trenches observed at the Apex site running parallel to each other. They are located to the west of Building 48A. A shaft was observed in Trench 3. Trenches 1 to 6 and Shaft 1 are described below in order from the east to west (PWGSC, 2000).

3.37.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 40.

An ortho-map for the site is shown in Figure 127, while a site map for this area created by the PWGSC is presented as Figures 128.

Table 40 Apex Closure Issues Matrix

Common Site Name: **Apex**
PWGSC site #: 48

Site coordinates:	easting	northing	
	488531.00	7088988.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Collapsed shaft			✔	✔		

Vanguard

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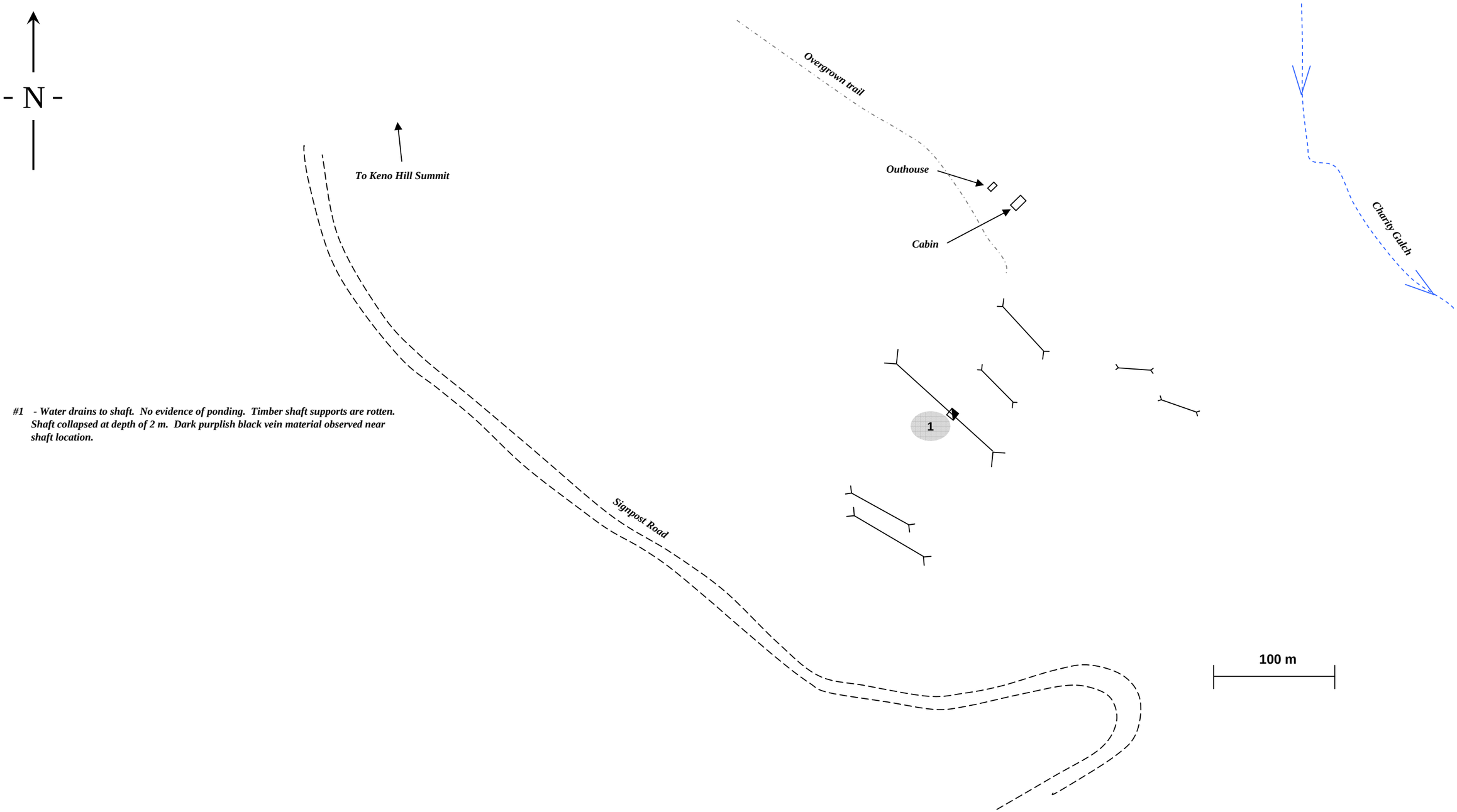
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 127 - APEX

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:3,527
FILE: Untitled.mxd		



#1 - Water drains to shaft. No evidence of ponding. Timber shaft supports are rotten. Shaft collapsed at depth of 2 m. Dark purplish black vein material observed near shaft location.

Aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Job No: ALEX-06-ESP-05

Filename: Site48_Apex_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Apex Site #48

Date: Jan. 2007

Approved:

Figure: **128**

3.37.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

  Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)
Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.
Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).
Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.
Report:
ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy.
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.38 EAGLE

3.38.1 Description

The Eagle site is on the east side of Galena Hill, near the top, at an elevation of 4300 feet (1300m). Access is through the Hector-Calumet Mine along the road that leads to the microwave towers. A partially overgrown cat track, the Eagle Trail, leads south at the Jock shaft. Approximately 85 m from the shaft, the Eagle Trail forks, and the eastern fork crosses the shoulder of Galena Hill to the Eagle site. All roads are passable by 4WD vehicle.

The site is located just below the top of Galena Hill on a gentle southeast-facing slope. The site drains into Lightning Creek, which is located more than a kilometre down slope. The area around the mine is well vegetated with spruce trees and shrubs and the soils are thin.

According to the Minfile (MINFILE# 105M 012) report, work commenced on the site in the 1920's, when 3 shafts and several pits were excavated. Additional work included

bulldozer trenching through the 1950's and 1960's. The most recent work on the site was drilling in 1978-79.

Workings at the Eagle site consist of a single, large trench, a collapsed shaft, and several shallow, older trenches (PWGSC, 2000).

3.38.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 41.

An ortho-map for the site is shown in Figure 129, while a site map for this area created by the PWGSC is presented as Figures 130.

Table 41 Eagle Closure Issues Matrix

Common Site Name: **Eagle**
PWGSC site #: 59

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	481900	7086900	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Eagle Trench - upper end			✔			
Waste dump		✔	✔	✔		
Erosion from road run-off - trench east of road, just north of intersection with road to Hector-Calumet			✔			
Waste pile - downhill face			✔	✔		

Workings

Eagle

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CLOSURE ISSUES

FIGURE 129 - EAGLE

SITE PLAN

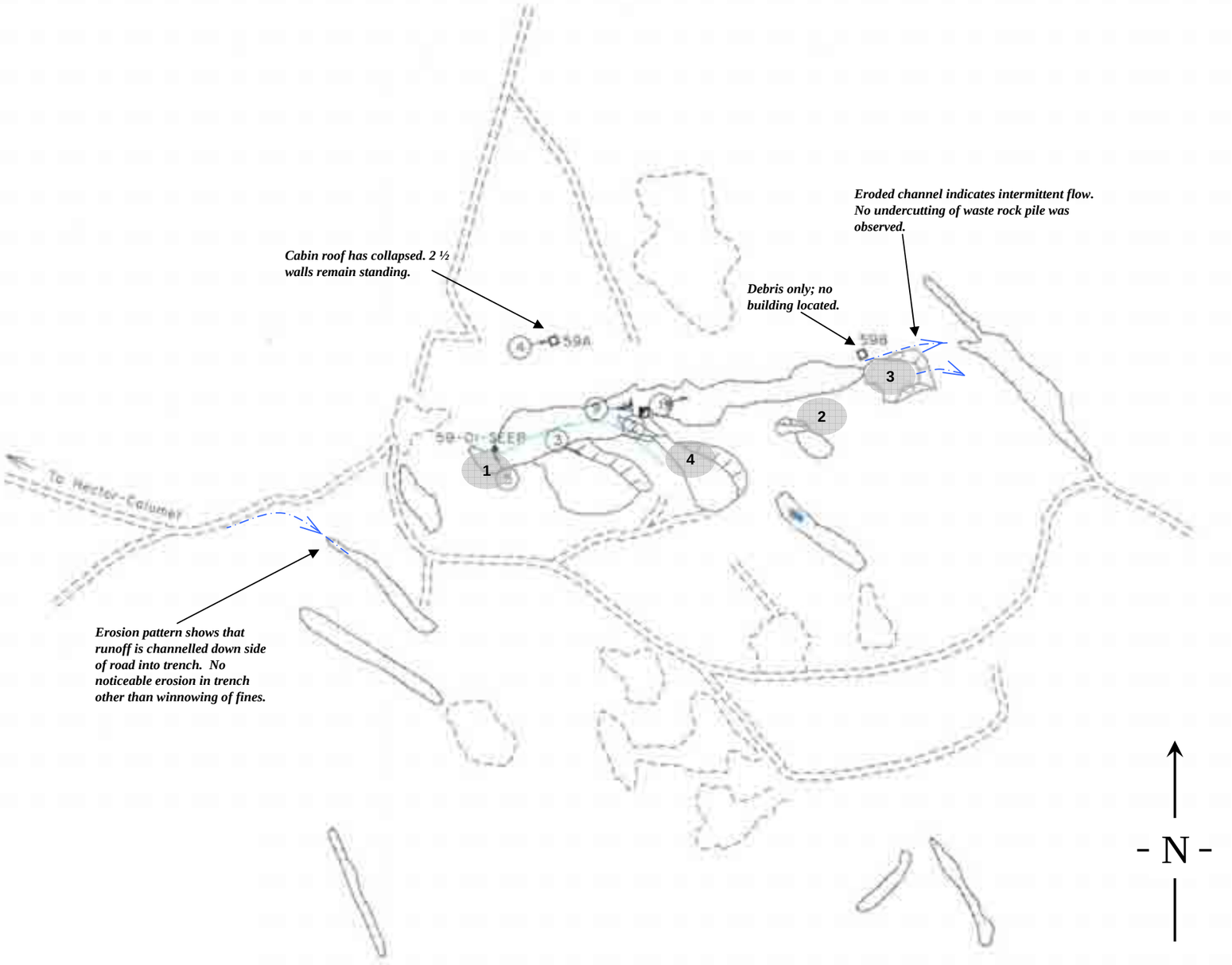
DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,092
FILE: Untitled.mxd		

#1 - Permanent pond at upper limit of trench (Photo 59-1). Water is dammed behind material pushed into trench to form roadway. Fill is low, broad, and appears stable.
- Water trickles from pond spill point into trench below. Trench bottom has well-developed mini-wetland community of horsetails, willows and algal mats; extends entire length of trench (Photos 59-2, 59-3).
- Sides of trench range from bare to partially-vegetated.

#2 - Dump composed of acid-generating waste- dark grey schist, quartz vein material and rare quartzite- with rinse pH of 2.6 from the <2mm fraction of a single sample. Light orange staining is common, with less frequent bleached regions (Photos 59-4, 59-5). Keno Hill Quartzite clasts in bleached areas have no stain near contact with underlying material, but have dark purplish brown staining on the tops of the clasts, away from contact with the substrate. Minor limonite observed.
- Local surface runoff flowpaths are stained yellowish brown.
- No revegetation occurring on this waste pile.
- Flow lobes, minor crest cracking, and oversteepened toe on north side indicate active instability (Photo 59-6).

#3 - Flow lobes observed on downhill face of waste pile (Photo 59-7), over area approximately 15 m wide x 30 m long x 4 m high. Minor cracking at crest of pile indicates minor instability; minor erosion channel down dump face and sediment fan extending from toe indicates that waste is transported during runoff events (Photo 59-8). Dump toe is oversteepened. Minor revegetation of dump face- spruce seedlings up to 1 m, grasses, willows.

#4 - Abundant medium-grained pyrite observed in waste rock (Photos 59-9, 59-10). Staining varied from no staining to light orange to rusty black (Photo 59-11). Revegetation of waste rock piles is generally limited to isolated plants- overall coverage is poor.



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Job No:	ALEX-06-ESP-05
Filename:	Site59_Eagle_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Eagle Site #59

Date:	Approved:	Figure:
Jan. 2007		**130**

3.38.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.39 GERLITSKI

3.39.1 Description

Gerlitski is located just north of a prominent knob on the south side of the McQuesten River valley between Galena Creek and Thompson Creek. The Site si 0.5 km north of Hwy #2, 1.2 km west of the turnoff to the Silver King site. There are no roads to the site; foot access is possible by hiking through thick bush.

The site is located on level ground vegetated with second-growth alders; willows and small bushes grow at and around the site. Site drainage reports to Flat Creek, located 1.25 km to the north. There was no surface water encountered at the site (PWGSC, 2000).

During five periods of exploration, extensive drilling and some bulldozer trenching were completed at this site. The first phase of drilling and bulldozer trenching were undertaken between 1956 and 1958. Over 750 more drill holes were drilled in the years 1962, 1966, 1972-76 and 1980.

Two trenches were located during the 2000 PWGSC site visit. The main trench (Trench 1) runs north-south with a small trench (Trench 2) starting at its north end. There is evidence of drilling on the northern section of Trench 1. Waste rock has been deposited on the western side of Trench 1 (PWGSC, 2000).

3.39.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 42.

An ortho-map for the site is shown in Figure 131, while a site map for this area created by the PWGSC is presented as Figures 132.

Table 42 Gerlitski Closure Issues Matrix

Common Site Name: **Gerlitski**			
PWGSC site #: 63			
	easting	northing	
Site coordinates:	470730.73	7085637.51	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Waste roack pile - northeast end of Trench #1		✔		✔		

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ACCESS

KENO HILL SILVER DISTRICT

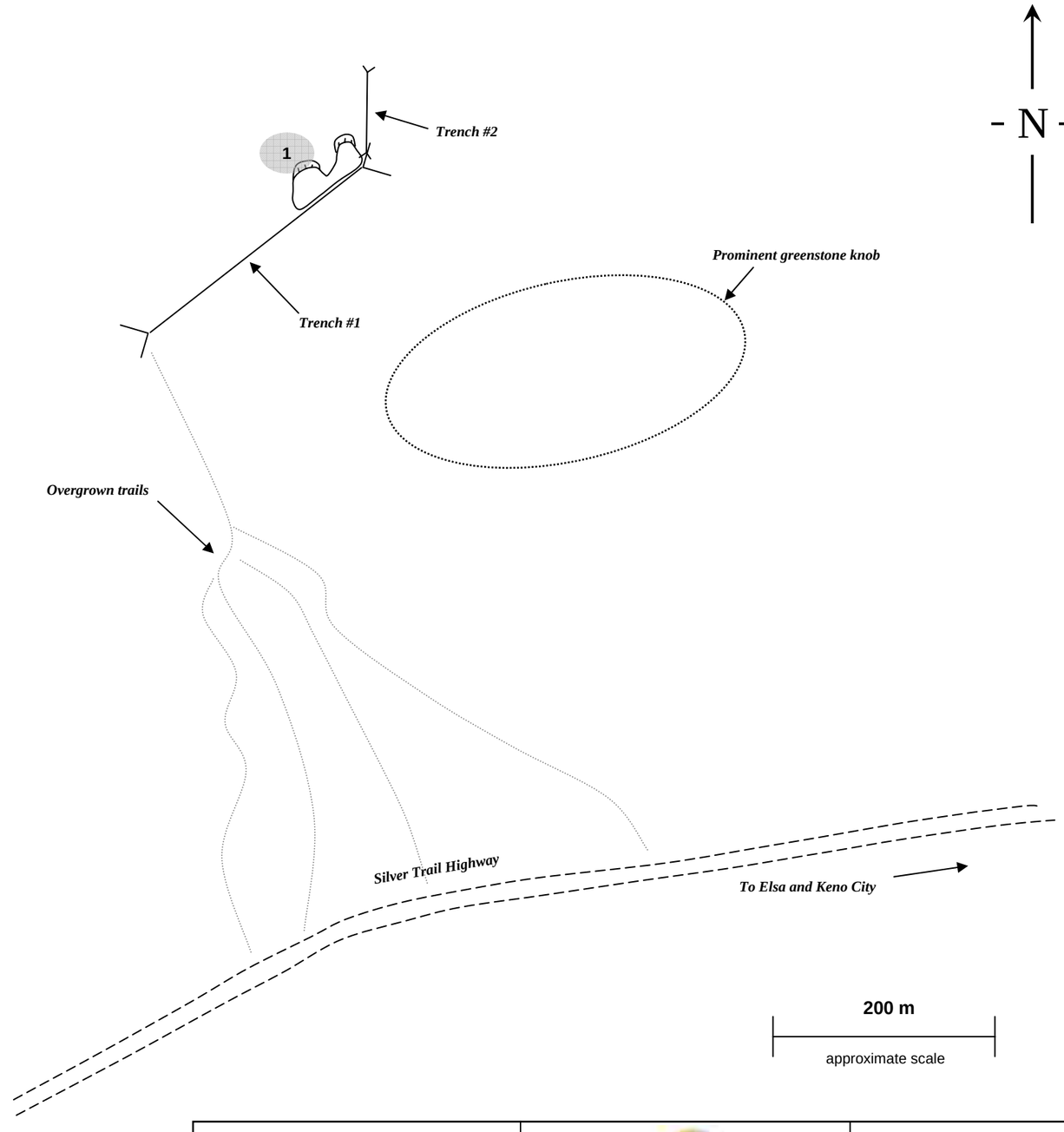
CLOSURE ISSUES

FIGURE 131 - GERLITSKI

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:3,677
FILE: Untitled.mxd		

#1 - Waste rock pile at northwest end of Trench #1 has widespread staining (yellowish, yellowish-brown, and rusty orange to rusty brown), as well as areas that appear to be leached (Photos 63-1, 63-3). Abundant medium- to coarse-grained pyrite (up to 5% locally) noted as massive pods and veinlets, as well as disseminated in waste rock.
- Grain relief within clasts and fresh, untarnished appearance of pyrite suggests galvanic protection of pyrite and selective weathering of other sulphides.
- An area of heavily stressed vegetation (2 m wide) was noted north of waste rock pile toe (Photo 63-3).
- Two flow lobes were observed, and an unvegetated flow deposit of waste rock extended to north from toe of pile (Photo 63-4). Small headwall in source region indicates that instability is ongoing (Photo 63-5). Dump height approximately 2 m.



2006 aerial photograph used as base map.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Gerlitski Site #63

Job No: ALEX-06-ESP-05	Baseline Environmental Report, United Keno Hill Mines Property	Date: Jan. 2007	Approved:
Filename: Site63_Gerlitski_20070131.ppt			Figure: **132**

3.39.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

3.40 CHRISTAL (DOROTHY)

3.40.1 Description

The Christal site lies on the western slope of Keno Hill south of Erickson Gulch. It can be accessed on foot by a trail departing from Keno 700 Road about 2.5 km out of Keno City. A camp site is located at the end of the trail. Shafts 1 and 2 lie at the base of a steep slope at the north end of the camp site. The elevation of the shafts is approximately 1250 m. Shaft 3 is located about 0.5 km southwest of Shaft 1 down the slope of Keno Hill. Several groups of trenches are locates uphill from Shaft 1 about 0.5 km to the east.

The site slopes from the uphill trenches down to Shafts 1 and 2 and further down to Shaft 3. The drop in elevation from the trenches to Shaft 3 is about 200 m. The terrain

consists of dense forests and fields of miss covered boulders. Surface water drainage from the area drains towards Erickson Creek.

According to the minfile (MINFILE# 105M026) a 15 m shaft was developed at the Christal site in 1940. Bulldozer trenching took place in 1965. A total of three shafts and several groups of trenches were found at the site (PWGSC, 2000).

3.40.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues noted in the 2007 Draft Preliminary Environmental Baseline Assessment by SRK Consulting can be found below in Table 43.

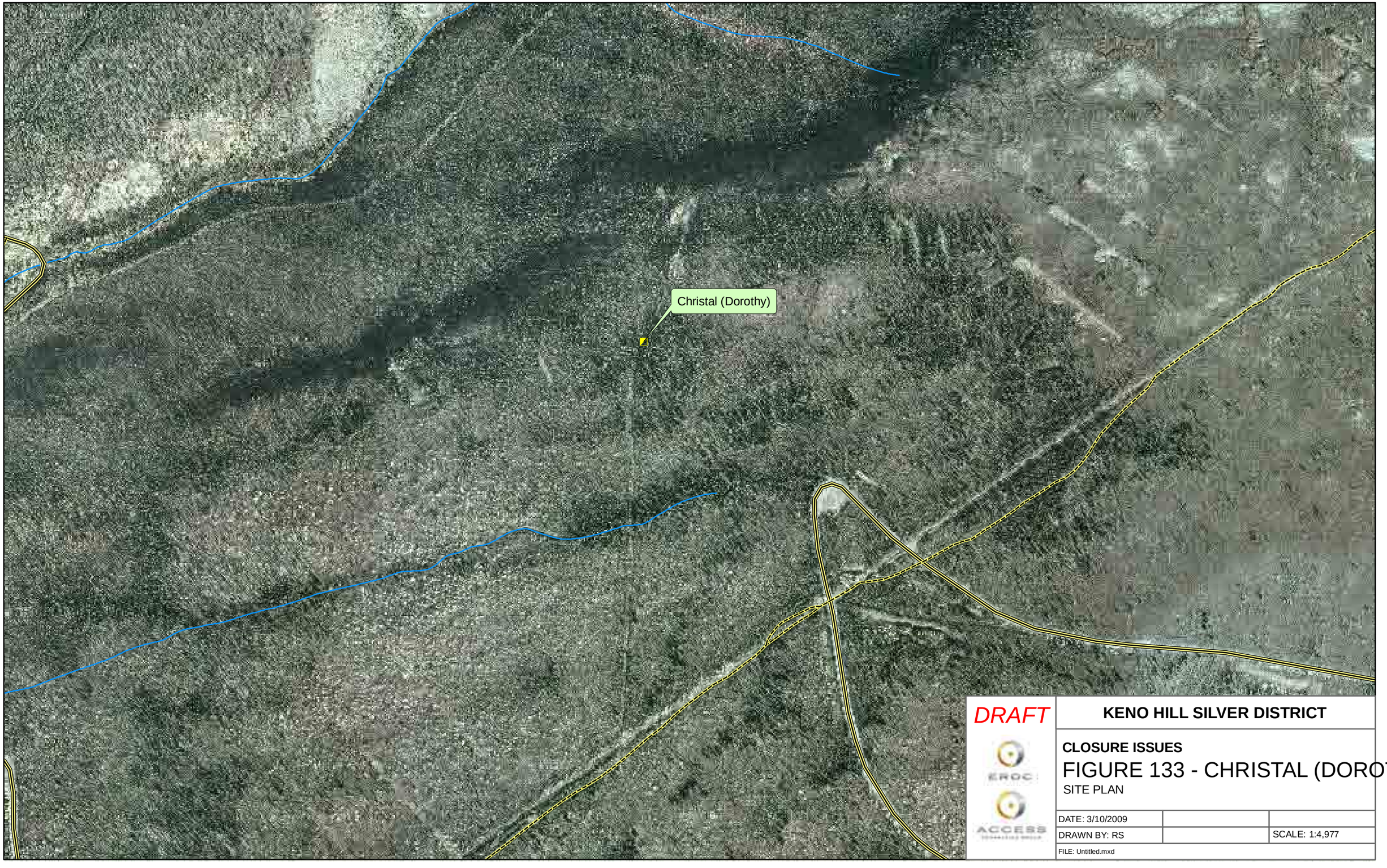
An ortho-map for the site is shown in Figure 133, while a site map for this area created by the PWGSC is presented as Figures 134.

Table 43 Christal Closure Issues Matrix

Common Site Name: **Christal**
PWGSC site #: 71

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	486721.23	7088879.58	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Shaft #3				✔		
Waste rock pile - west of Shaft #3				✔		
Second shaft - just north of Shaft #3	✔			✔		



DRAFT

KENO HILL SILVER DISTRICT

CLOSURE ISSUES

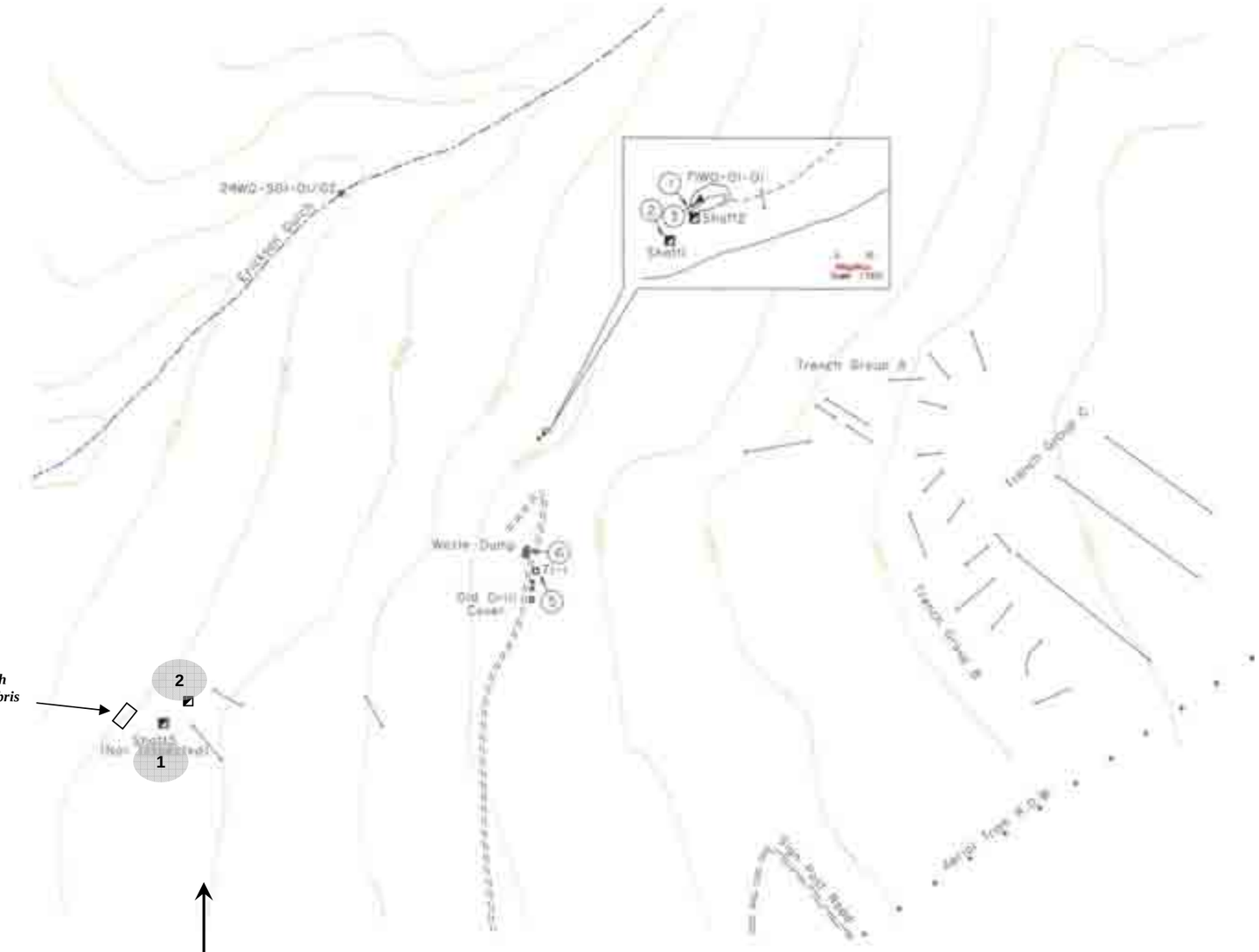
FIGURE 133 - CHRISTAL (DOROTHY

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:4,977
FILE: Untitled.mxd		

#1 - Shaft #3: timber cribbed shaft, timbers rotting and beginning to collapse. Depth 2 m, water in bottom of shaft. Located in excavation in colluvium, with 4 m headwall in quartzite.
- Waste rock pile to west of shaft, 6 m x 10 m x 2 m, at angle of repose on slope below shaft. Composed of quartzite with minor black staining. Pile is 95% covered in moss and lichen, with willow and spruce colonizing the top and margins of pile.
- Wood and metal debris in local area.

#2 - Second shaft (1 m x 1.5 m x 2.5 m deep) identified 20 m NE of Shaft 3. Excavation (4 m x 4 m x 6 m) into colluvium on moderate slope to access solid bedrock, with timber-cribbed shaft in base of excavation. Shaft is caved at 2.5 m, with clear water in bottom.
- Headwall of excavation is quartzite. Waste rock forms pile immediately downslope to west. 100% covered by moss, also recolonized by willows and spruce. Waste rock appears to be equal volume to the excavation- suggests little underground development at this location.
- No staining or oxidation at depth in waste rock. Composition is quartzite, chloritic phyllite, minor siderite and quartz.



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Christal Site #71

Job No:	ALEX-06-ESP-05
Filename:	Site71_Christal_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**134**

3.40.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.41 TOWNSITE

3.41.1 Description

The Townsite Mine is primarily underground, although an open pit was proposed for the area. Some preliminary stripping was done.

The Townsite 500 adit is located on the road to Hector-Calumet. The portal is completely caved and covered by broken rock to seal it. The timber cribbing of the foundation for the loadout remains, located on the other side of the road from the adit. Some waste rock from the adit development was used to build the loadout area, with the remainder of the waste deposited adjacent to the loadout area.

It is reported that there was also a raise from the adit to surface which was also caved and sealed (AMC, 1996a).

3.41.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

No additional closure issues for this site were noted in the 2007 report from SRK (SRK, 2007) as shown in Table 44.

An ortho-map for the site is shown in Figure 135, while a site map for this area created by the PWGSC is presented as Figures 136.

Table 44 Christal Closure Issues Matrix

Common Site Name: **Townsite Mine**
PWGSC site #: 76

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	479563.90	7087982.74	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
No new closure issues noted						

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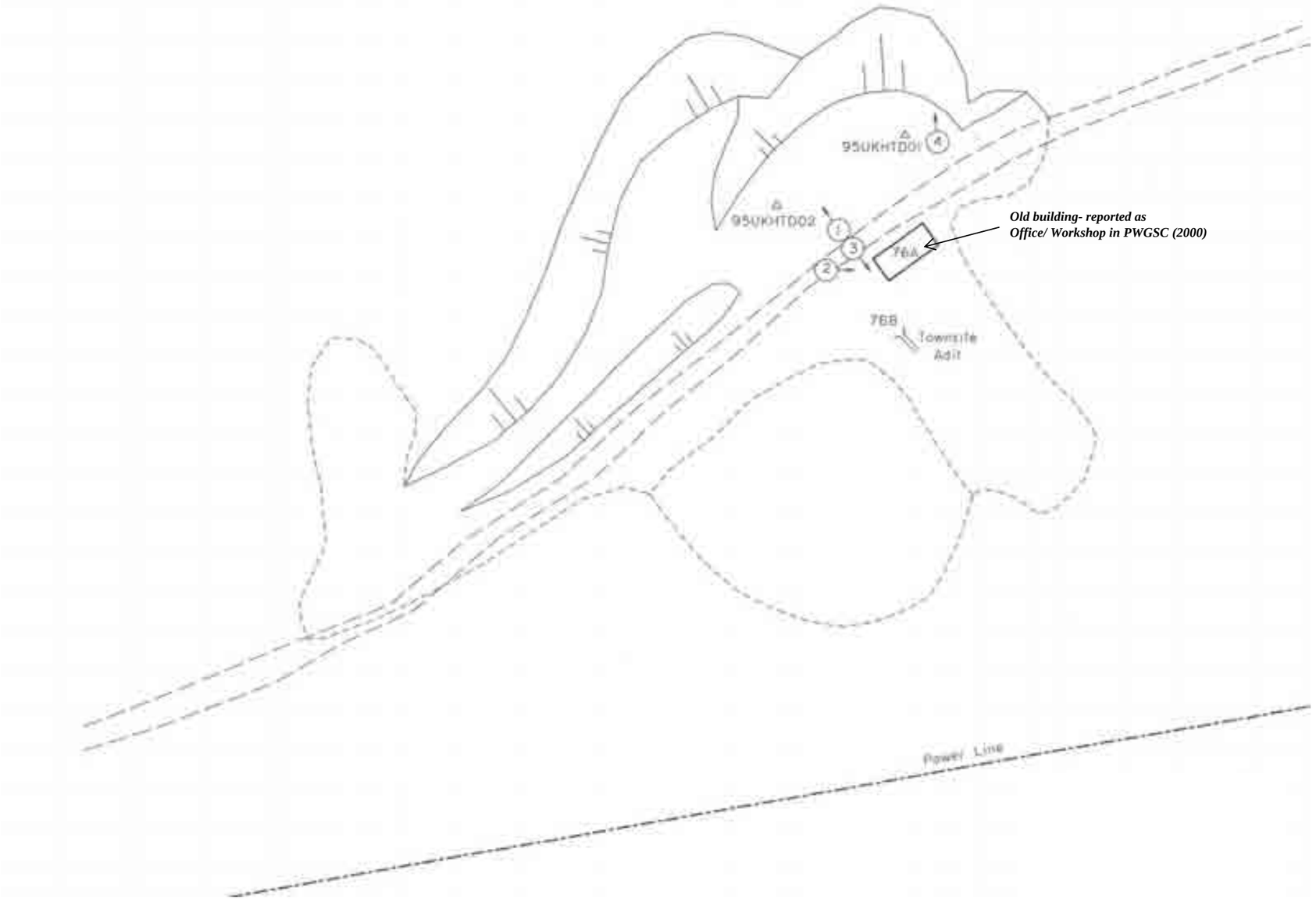
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 135 - TOWNSITE

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,739
FILE: Untitled.mxd		



Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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ALEXCO

Townsite Mine Site #76

Job No:	ALEX-06-ESP-05
Filename:	Site74_Townsite_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date:	Approved:	Figure:
Jan. 2007		**136**

3.41.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.42 SADIE LADUE 600

3.42.1 Description

The Sadie Ladue underground workings are some of the oldest workings in the Keno Hill area, mined in the 1920's and 1930's. There were four shafts, two on the Sadie portion of the vein to the 400 level and two on the Ladue portion to the 600 level. The Sadie mine was developed on five levels (100 level to 400 level) and the Ladue and six levels (50 level to 600 level). The Sadie 600 level adit was driven for dewatering and access of en and materiel. Some rehabilitation work was done at the 600 adit in the late 60's and early 70's to remove the ice and allow access to the upper old workings. Frozen ground was noted to extend below 260 feet depth (Wernecke quoted in McTaggart, K.C., 1960).

There is still a small, shallow open pit at the Wernecke Camp. The Sadie-Ladue 600 adit has partially collapsed since it was last used in the 1960's, but does still drain water for some of the year.

The Sadie-Ladue surface disturbance was done by UKHM surface exploration trenching and Archer Cathro's hand mining operation. Before their work, a thick cover of alder up to 5 feet high covered the area. It is reported that all the shafts, as well as the two slopes and raises to surface, were filled in as of the 1980's (AMC, 1996a).

3.42.2 Closure Issues

A mill was located at Wernecke near the Sadie Ladue vein in the 1920's and 1930's. Tailings were apparently draped over the hillside and ran down a gully past the Sadie 600 adit. They may have eventually accumulated in a small lake at the base of the hill.

None of this activity was by UKHM. Underground mining was accessed by shaft and later by a free draining adit at the 600 level. Much of the ground in this area is permanently frozen. The crown pillar of the vein was mined in a small open pit. Closure issues include contouring the surface mined area and ensuring shafts are safe but chemical issues are not significant. Frozen conditions may limit drainage water contamination. Water quality in the gully and the lake are unknown.

This area has already been discovered by hikers and tourists, and there is potential to enhance tourism opportunities. The closure priority therefore is public health and safety (AMC, 1996b).

Current closure issues for this site are summarized in Table 45.

An ortho-map for the site is shown in Figure 137, while a site map for this area created by the PWGSC is presented as Figures 138.

Table 45 Sadie Ladue 600 Closure Issues Matrix

Common Site Name: **Sadie LaDue 600**
PWGSC site #: 77

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	486950	7092700	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Sadie LaDue 600 Adit			✔	✔		
Collection box to underground colvert			✔			
Load-out structure	✔			✔		

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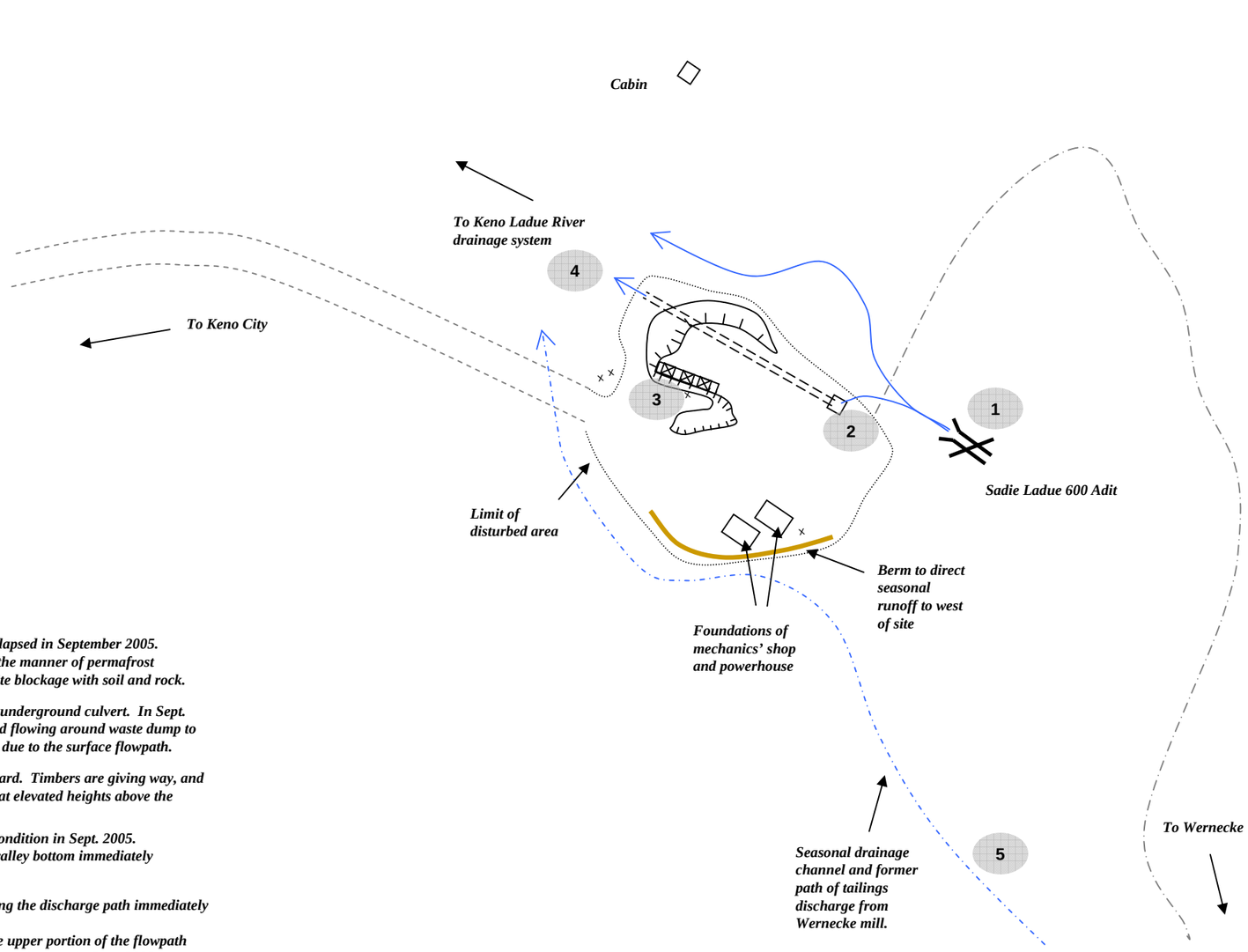
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 137 - SADIE LADUE 600

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:1,957
FILE: Untitled.mxd		



- N -

#1 - Adit and collar overburden were completely collapsed in September 2005. Overburden and vegetative mat were receding in the manner of permafrost regression. Large flow of water exiting adit despite blockage with soil and rock.

#2 - Collection box intended to channel adit flow to underground culvert. In Sept. 2005, 2/3 of flow was bypassing collection box and flowing around waste dump to east. There was no large-scale erosion occurring due to the surface flowpath.

#3 - Load-out structure is deteriorating and is a hazard. Timbers are giving way, and rails and portions of the structure are suspended at elevated heights above the underlying waste rock foundation.

#4 - Culvert and discharge appeared to be in good condition in Sept. 2005.
- No surface tailings were observed in the broad valley bottom immediately downstream of the Sadie Ladue 600 site.

#5 - Deposits of tailings were absent or minimal along the discharge path immediately upstream of the Sadie Ladue 600 site.
- Surface deposits of tailings were observed on the upper portion of the flowpath near the Sadie Ladue (Wernecke) site during reconnaissance in Sept. 2005.

0 10 20 30 40 50

approximate scale (metres)

2006 aerial photograph used as base map. PWGSC 2000 base map not located.
See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting and Access Consulting Group, 2007

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Sadie Ladue 600 Site #77

Job No: ALEX-06-ESP-05

Filename: Site77_Sadie_Ladue_600_20070131.ppt

Baseline Environmental Report,
United Keno Hill Mines Property

Date: Jan. 2007

Approved:

Figure: **138**

3.42.3 Information Gaps

This site is indicated as having information gaps in the following areas pertaining to closure activities (ERDC, 2007):

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Underground Adits:

- **Water Management:**

  Information Gap: Hydraulic engineering designs not available

  Research Study: Adit Plug Design (Summer 2007 – Priority: High)

  Engineering design work to develop design for permanent plugs for all mine openings, if necessary, or alternatively engineered structures for water management, transport and sealing off access. Includes specialist site visit, surveying, mapping and figure production. Evaluate if there is an incremental benefit from gas-tracer and sealing technologies to minimize oxidation above mine pools in unsaturated workings.

  Report:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

SRK, 2008 – Geochemical Closure Studies Report complete

Alexco, 2009 – Hydrogeological Assessment Report complete

- **Water Management:**

  Information Gaps: Refine hydrogeological understanding of old mine workings and hydraulic connections for closure planning.

  Research Study: Hydrogeological Modeling (Fall 2007- Priority: Medium)

  Comprehensive hydrogeology model for underground mine water and closure option assessment

  Report:

  Alexco, 2009 – Hydrogeological Assessment Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**

  Information Gap: Closure strategy

  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)

  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

3.43 VALLEY TAILINGS

3.43.1 Description

In 1932, the old Sadie Ladue Mill from Wernecke Camp was moved to Elsa and used there until 1942. Tailings from this mill reported to the hillside adjacent to Porcupine Creek.

The new Elsa Mill was commissioned in 1949, and ran with some modifications and temporary shut downs, until the mine's cessation in 1988. During this period over four million tons of tailings were deposited in the valley.

Dam No. 1 was originally constructed in 1968, and fortified after a failure in 1972. Dam No. 2 was also constructed in 1972. Dam No. 3 was constructed from local sand and gravel till in 1979. Porcupine Creek was diverted from the valley tailings area via the Porcupine Diversion ditch.

The EIsa tailings are located in the Flat Creek valley bottom below the Elsa mill site. The major accumulation of tailings is upstream from the main stem of Flat Creek in a swampy area draining into Flat Creek. Porcupine Creek passes through the tailings area. An additional area of older tailings is perched on the hillside above the valley bottom south of Porcupine Creek and just below the highway to Keno City. The areal extent of tailings is relatively well known from recent air photography. The total surface area of the impoundment is approximately 185 acres (75 ha). However, the depth of the material is uncertain.

Considerable drilling was done in the tailings area by UKHM in a number of campaigns.

The tailings form in two lobes, the northern one, behind the #1 dam, is more recent than the other, more southerly one near Porcupine Creek, which expands down to the #3 pond. An isolated area of old tailings occurs just below the highway near Porcupine Creek. A capsule history of tailings deposition can be found in the 1990 plan. Some tailings were from cyanide leach operations whereas other years no cyanidation was

carried out. It appears that the tailings from open pit operations are largely behind the No.1 dam and uphill from there.

Porcupine Creek appears to have jumped its banks occasionally and eroded tailings from the old deposit. These events may have carried tailings into the area of the #3 pond and/or beyond.

The dams have been reviewed by EBA Engineering in a 1983 report "Geotechnical Evaluation of Existing Tailings Dams." Most of the dams are of unzoned construction and were built on frozen peat-rich soils overlying fill. The soils have since thawed causing subsidence of the dams. An engineering investigation of the dams is in progress to evaluate the current stability, and requirements for both future operation and for closure to ensure long-term stability.

UKHM kept up with the subsidence by adding mine rock to the low points every few years. Results of inspections of the dams can be found in a series of reports by EBA Engineering, the most recent of which is dated 2008. These inspection reports note ongoing subsidence of the structures. The difficult foundation conditions of the dam sites have been a complicating factor for the closure plan.

The incomplete diversion of Porcupine Creek around the tailings is another complicating factor for closure. The central 400 m of the creek appears to pass over the south edge of the tailings. Most times of the year Porcupine Creek is dry, but as noted above, occasional floods (before 1984) appear to have entered the tailings area and may have eroded nearly a meter of tailings. Sand and gravel locally deposited on the tailings (by the floods) has developed good vegetative, zinc enriched, seepage emerges from the tailings and flows down lower Porcupine diversion to enter Flat Creek below #3 Pond.

During 1994-95, Dam #1 was commonly observed to decant approximately 5 l/s whereas dam #2 did not decant at all. At the same time Dam #3 decanted 1-2 l/s.

The tailings behind Dam #1, where wet, have developed lush vegetation but the dry, sandy, upper part of the tailings deposit is barren. The dry tailings are subject to wind erosion from time to time.

The tonnage of tailings indicated by drill results apparently reconciled well with the milled tonnage. However, backhoe excavations in the tailings area have thrown some doubt on the thickness indicated by previous drilling, since it was possible to excavate through the tails to the original ground surface. Only a third of the expected thickness was found to be present in some of those areas. The Elsa tailings are discussed further in the Field Investigations Report, Technical Appendix VI (AMC, 1996a).

3.43.2 Closure Issues

The Elsa tailings impoundment presents a host of issues to consider for closure. Foremost among these is the physical stability of dams and diversions. The second major issue is the chemical stability of the tailings, however, many years of history suggests that the tailings are not likely to generate acidity in the future and that metal loads to surface and groundwater will continue to be generated but will remain relatively small. A complex issue such as the tailings has to be approached in a series of steps in order to define the questions to be addressed in the next phase of investigation. Reprocessing of tailings, perhaps with relocation, to a more secure site has been suggested but remains speculative. Considerable work has been done on revegetation of the tailings but with the exception of wet areas, little has taken hold. Wet areas, on the other hand, have developed lush growth.

The geotechnical reviews of the valley tailings over the years by regulatory authorities, site annual inspection consultants, and closure plan consultants indicates that there are three key issues related to physical stability that need to be addressed for closure:

1. Ground thaw beneath the tailings dams resulting in settling and therefore potential for overtopping and breaching of the structure;
2. Presence of culverts and decant structures through the dams which may lead to piping failures around these structures; and,

3. Failure or slumping of the downstream face of each dam due to steep (oversteepened) slopes.

In 1996, a review of the existing data and inspection reports indicated that the first mechanism is the most critical to address for both future operations and for closure. This review also showed that the existing field data are insufficient to predict with confidence the extent to which ground thaw and settlement beneath the dams could be anticipated in the longer term. Thus a program of field investigations is being developed considering:

- Drilling in dams/foundation materials;
- Thermister installation and monitoring;
- Detailed surveys; and,
- Independent geotechnical evaluations of these data.

Considering the three potential failure mechanisms, the measures to address thaw settlement would differ considerably for a scenario of future production, compared to the closure scenario for current conditions; the subject of this report. Thus there are alternative measures which must be considered to address the three potential failure mechanisms, and considering the potential for future operation of the mine. The closure concept for tailings on which the costing is done in this document is discussed in principle, and then presented in some detail in the following subsections. Also described are alternatives under consideration for both operating and closure scenarios.

The basis for the conceptual design is as follows. In addressing thaw settlement, the primary concern is the control of the free water in the tailings pond which could overtop the dam. At this time it does not appear that it is possible to control thaw and settlement by, for example, enhancement of freezing conditions as a closure measure. There are therefore four alternatives to consider:

1. remove standing water by breaching dam and installing a designed spillway;
2. “super-elevate” the dam to compensate for the maximum expected settlement (equivalent to the depth of frozen peat indicated by the design and inspection

investigations) such that settlement would not compromise the design freeboard of the structure;

3. continue during the closure period to maintain the dam by (annual) raisings to compensate for settlement during the intervening period and maintain freeboard; or,
4. place tailings, by spigotting, on the upstream face of the dam to increase the beach, and move the pond back from the face of the dam, to where the spillway could control pond elevation rather than the dam crest.

Costing was done based on a combination of (i) and (iii) for Dam #1. Dam #3 is of lesser concern, that is, lesser consequence of failure as it does not impound tailings, and would only periodically retain water sufficient to pace discharge to the downstream engineered wetland.

To address piping concerns associated with decant structures, all culverts and pipes will be removed and backfilled.

To address concerns with dam wall stability, downstream slopes will be flattened by pushing fill and contouring and by placing a toe berm on the downstream face of Dam #1 (AMC, 1996b).

Current closure issues for this site, indicated in the SRK report, are summarized in Table 46.

An ortho-map for the site is shown in Figure 139, while site maps for this area created by the PWGSC are presented as Figures 140 and 141.

Table 46 Valley Tailings Closure Issues Matrix

Common Site Name: **Elsa Tailings**
PWGSC site #: 79

	easting	northing	
Site coordinates:	475100.00	7088500.00	*coordinates are projected to UTM zone 8 N, Nad 1983

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Porcupine creek flowing through tailings			✔			
Slude disposal cells				✔		
Dam 1 - upstream crest				✔		
Dam 1 - downstream crest				✔		
Dam 1 - toe berm				✔		
Dam 2 - upstream face				✔		
Dam 2 - decant			✔			
Dam 3 - Upstream crest				✔		

Valley Tailings Borrow Pit

Valley Tailings Borrow Pit

Valley Tailings Borrow Pit

0

#1 Dam

#2 Dam

#3 Dam

Galkeno 300 Sludge Storage

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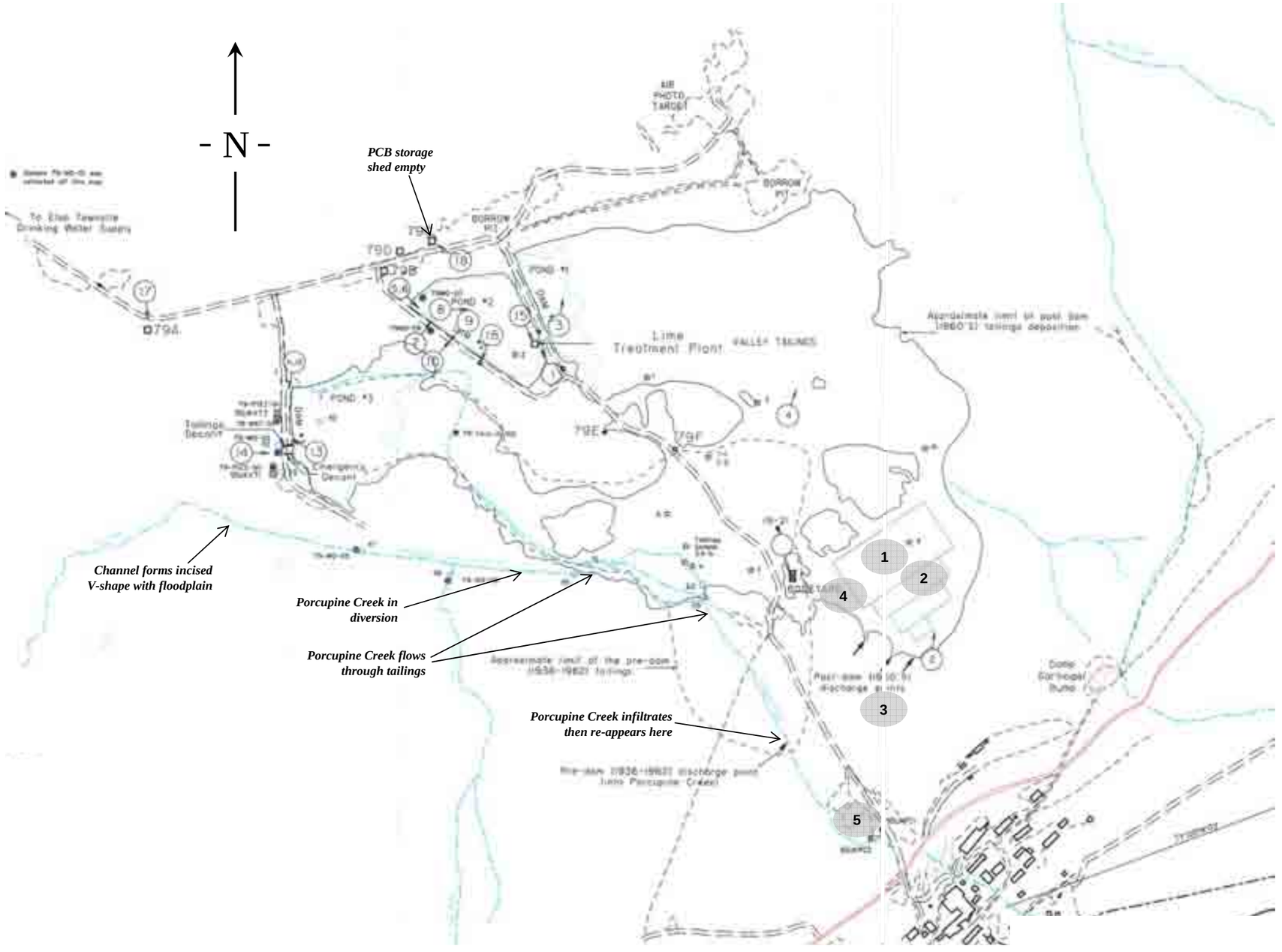
CLOSURE ISSUES

FIGURE 139 - VALLEY TAILINGS

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:5,452
FILE: Untitled.mxd		



#1 Approx. location of sludge disposal cells (Photo 79.1) Tension cracks in berm at the NE corner.

#2 Tailings extensively re-graded in this area (Photos 79.2, 79.3).

#3 Vegetation kills above former tailings discharge points

#4 Diversion ditch in tailings. No flow observed (Photo 79.4) Oxidized tailings in upper 20 cm (Photos 79.5, 79.6)

#5 Tailings present much further upslope than indicated on PWGSC 2000 maps

200 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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ALEXCO

Elsa Tailings Site #79 (Map 1)

Job No: 1CA009.000

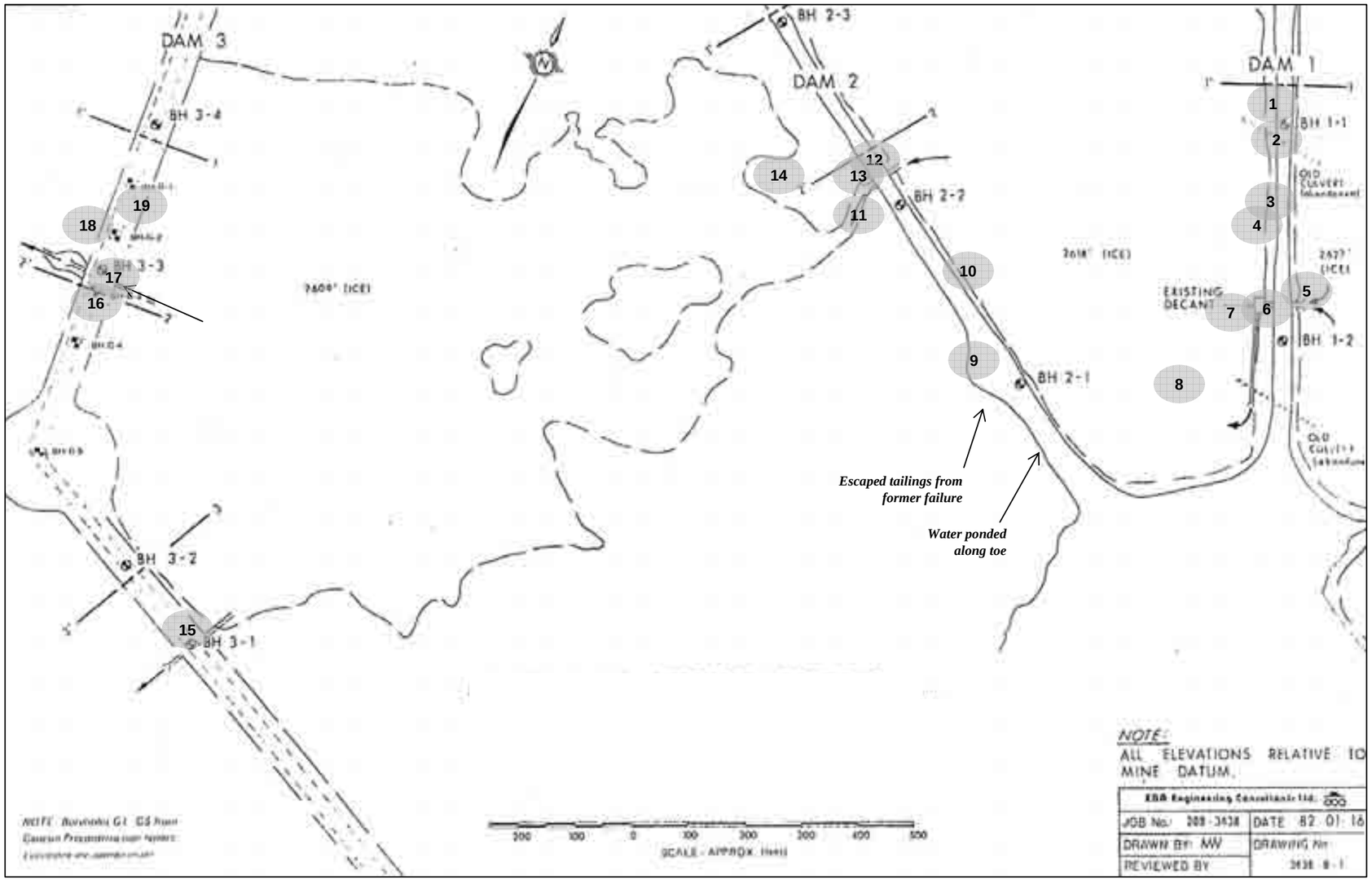
Filename: Site79_Elsa.Tailings_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Date: Jan. 2007

Approved:

Figure: **140**



#1 Dam 1 recently re-surfaced (Photos 79.7, 79.8)

#2 Upstream crest shows tension cracks
- *10 m long at north end*
- *20 m long mid-span*
- *10 m long in south third*

#3 Downstream crest settling along middle and north thirds

#4 Toe berm approx. 8 m wide; has ~ 25 cm undulation indicating settlement and small sinkhole at north end

#5 Decant intake B a steel box with stop-log slots. Good condition

#6 Dam 1 lime addition system (Photo 79.17)
- *lime slurry tank*
- *mixer*
- *lime slurry drips into mixing box at outlet of decant pipe*

#7 Discharge over weir and via launder to channel incised in tailings (Photo 79.16)

#8 Area of escaped tailings above water level

#9 10 m x 10 m buttress below site of former failure

#10 Extensive tension (Photos 79.9, 79.10) cracking on upstream face approx. 200 m south of decant (Photo 79.14)

#11 Treated water drains to Dam 3 pond. Unreacted lime present.

#12 Dam 2 lime addition system
- *lime slurry tank*
- *pump feeds lime slurry into decant outlet*

#13 Decant constructed from lumber and plywood. V-notch weir at outlet has leakage along toe. (Photos 79.11, 79.12, 79.13)

#14 Emergency berm approx. 1 m high. Constructed before Dam 3 was built.

#15 Tension cracks along upstream crest, over approx. 50 m

#16 Lime spills upstream of decant may indicate that lime has been added here.

#17 Decant structure is steel box with grooves for stop logs. Good condition (Photo 79.15)

#18 Wet and soft area at toe

#19 North half of dam 3 appears to bulge our of alignment, but not tension cracks were observed

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

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Job No: 1CA009.000

Filename: Site79_Elsa.Tailings_20070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Elsa Tailings Site #79 (Map 2)

Date:	Approved:	Figure:
Jan. 2007		141

3.43.3 Information Gaps

The information gaps related to closure activities were determined to include the following for the Valley Tailings site (ERDC, 2007):

- **Physical Stability:** An understanding of previous revegetation studies and integration into a new test program;
- **Physical Stability / Water Management:** Physical dam stability and water management;
- **Chemical Control / Human and Wildlife Health and Safety / Water Management:** Refine data inputs for groundwater and seepage estimates for loading model and closure options analyses;
- **Chemical Control / Human and Wildlife Health and Safety / Water Management:** Lack of sub-surface groundwater monitoring data for Valley Tailings Area;
- **Chemical Control / Human and Wildlife Health and Safety / Water Management:** Lack of soils metal data to enable effects assessment from windblown dispersion of old tailings;
- **Chemical Control / Human and Wildlife Health and Safety / Water Management:** Strengthen ARD database to reconfirm historic sampling and further understand tailings geochemistry.

Reports:

SRK, 2008 – Geotechnical Closure Studies complete

SRK, 2008 – Geochemical Closure Studies Report complete

SRK, 2008 – Assessment of Groundwater Regime at the Valley Tailings Facility

EDI, 2008 – Elsa Tailings Terrestrial Effects Assessment – Phase 1 & 2 complete

Withers, 2008 – Valley Tailings Revegetation Assessment complete

3.44 MACKENO

3.44.1 Description

The site is accessible along a gravel road stemming off of the main highway approximately 2 km north west of Keno City. The gravel road enters the south portion of the millsite from the east and the north portion is accessible via one of two access points from the south portion of the site. The tailings area is not accessible by vehicle but can be visited through the primary forest from the millsite or by walking east along the lakeshore from the Galkeno mine site.

The site is located on the east and north east shore of Christal Lake. The site slopes gradually to the west and south west down to the lake. The millsite itself consists of two adjacent cleared areas separated by a steep embankment approximately 3 m high running east-west and the tailings area, approximately 200 m to the north of the main site through a primary forest. South and south west of the mill site, much of the property is forested with considerable areas of second growth willow saplings. Further south, the forest is dominated by mature spruce forest and the area is relatively flat, sloping down towards Christal Lake to the west.

The tailings area abuts directly on the lakeshore, with some tailings noted in the lake. A portion of the tailings also forms a fan at the mouth of Christal Creek at the north end of the site. The site slopes gradually down to the lakeshore to the west. East and south of the tailings area is a mature spruce forest. A seasonal creek flows through the forest, entering the lake immediately south of the tailings area.

Milling began in the spring of 1952 at the site, with most of the ore from the Galkeno mine, and about 10% from the Bellekeno mine. From the spring of 1952 until at least July 1954 the tailings were deposited directly into Christal Creek (McLaren & Lucas, 1954). The mill produced an average of about 55 tonnes per day of tailings during this period, which would indicate a total of over 40,000 tonnes deposited here. About 2700 to 4500 tonnes were deposited in an undarnmed pile beside the lake (United Keno Hill Mines Limited, 1996). Additional tailings are thought to have been deposited into the

lake. Total production is roughly estimated at about 102,000 tonnes milled (Yukon MINFILE).

3.44.2 Closure Issues

Closure issues for this site were not noted in the Closure Plan for Current Conditions (AMC, 1996b).

Current closure issues for this site are summarized in Table 47.

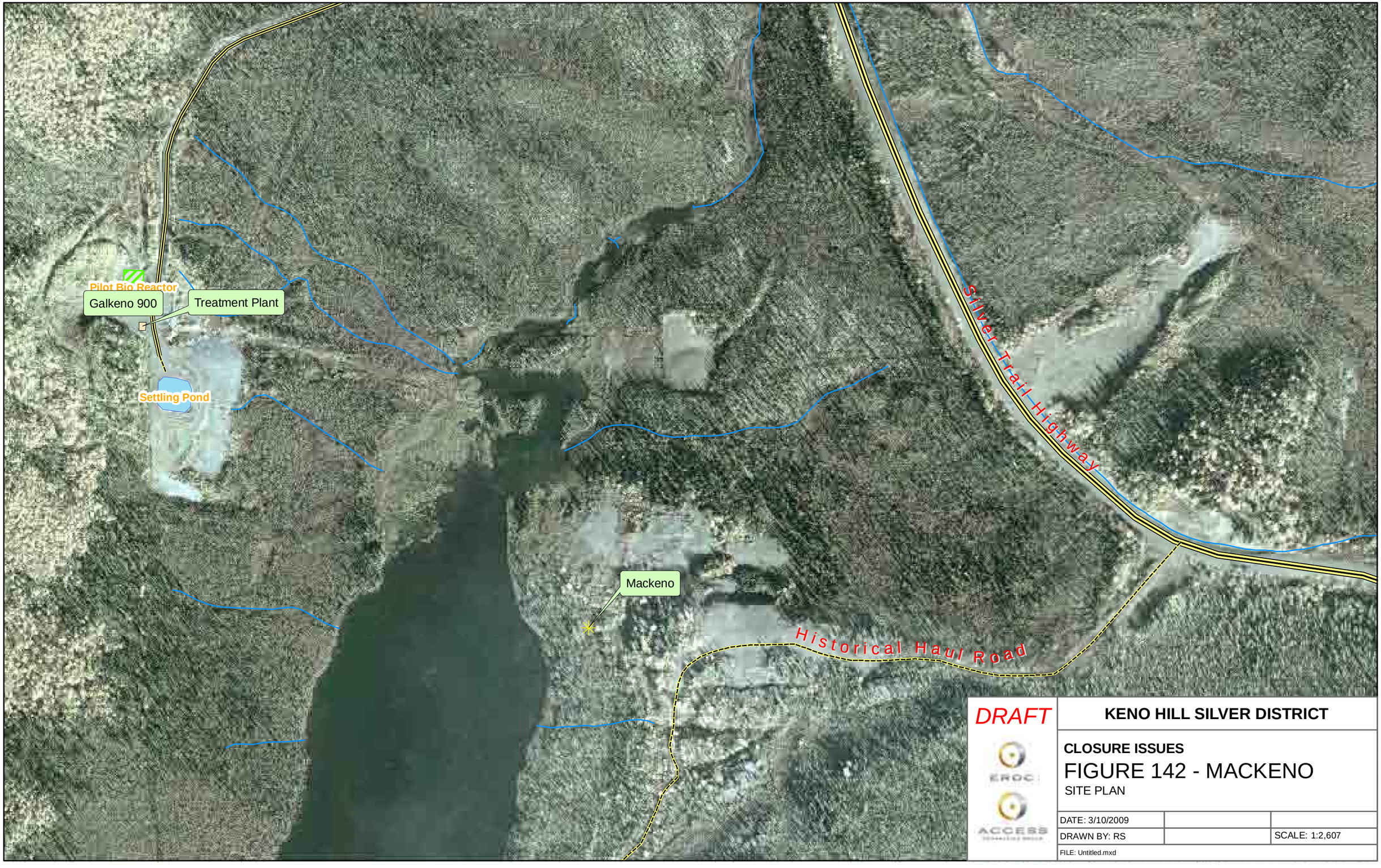
An ortho-map for the site is shown in Figure 142, while a site map for this area created by the PWGSC is presented as Figures 143.

Table 47 Mackeno Closure Issues Matrix

Common Site Name: **Mackeno**
PWGSC site #: 81

Site coordinates:	easting	northing	*coordinates are projected to UTM zone 8 N, Nad 1983
	483803.11	7087670.72	

General Location Description	Closure Issue Categories					
	Human & Wildlife Health and Safety	Chemical Control	Water Management	Physical Stability	Community Concerns	Other
Lower Cristal Lake		✔				
Tailings benc - at Cristal Creek			✔	✔		
Christal Creek - from Mackeno tailings down to pool, pool is 20 m upstream of Silver Trail Highway culvert						
Tailings bench - east side beaver dam flooded ground			✔			



DRAFT

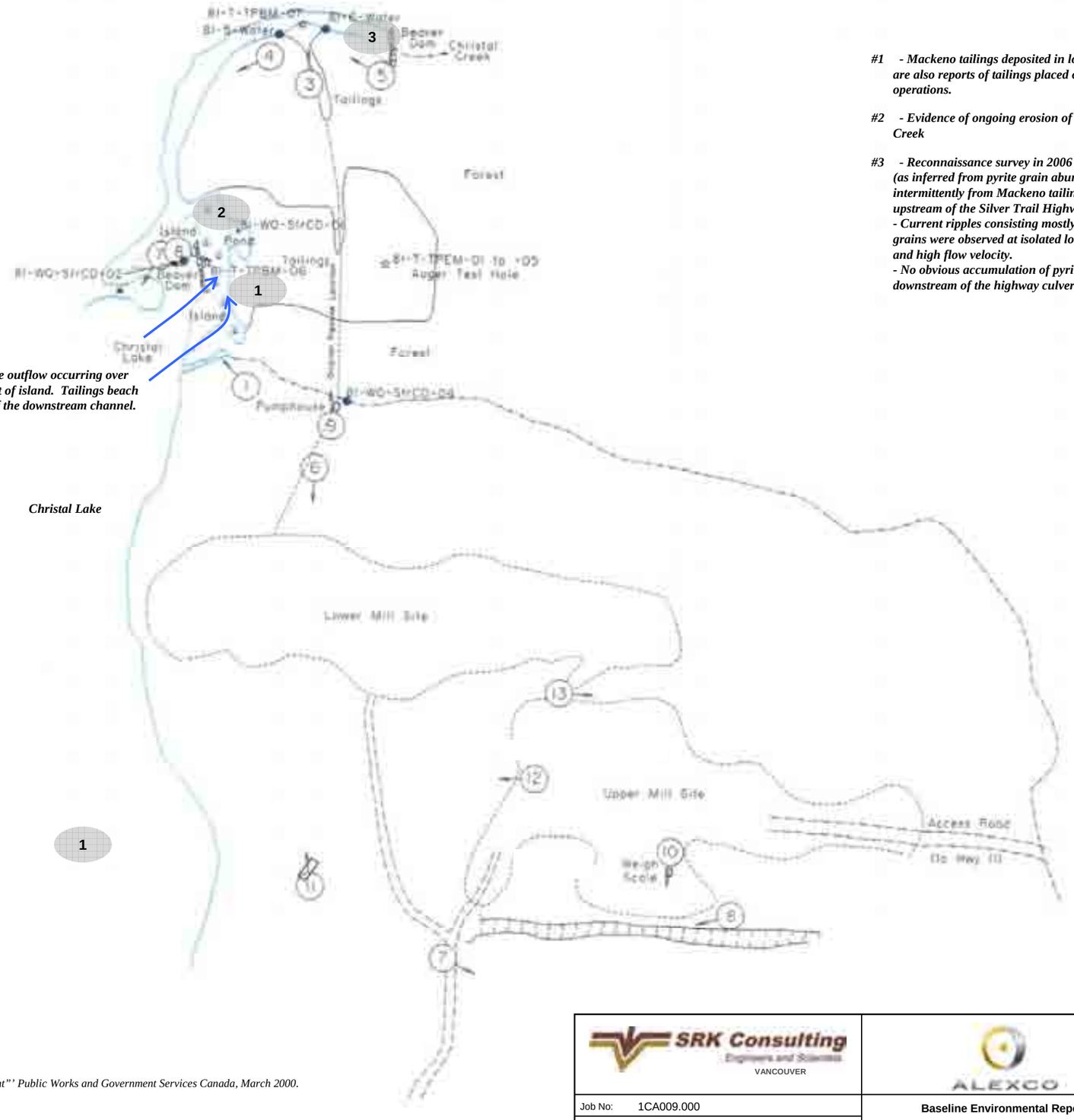
KENO HILL SILVER DISTRICT

CLOSURE ISSUES

FIGURE 142 - MACKENO

SITE PLAN

DATE: 3/10/2009		
DRAWN BY: RS		SCALE: 1:2,607
FILE: Untitled.mxd		



Significant portion of lake outflow occurring over beaver dam and southeast of island. Tailings beach occupies the right limit of the downstream channel.

Christal Lake

***#1** - Mackeno tailings deposited in lower Christal Lake. There are also reports of tailings placed on the lake ice during winter operations.*

***#2** - Evidence of ongoing erosion of tailings beach into Christal Creek*

***#3** - Reconnaissance survey in 2006 identified tailings deposits (as inferred from pyrite grain abundance) in active stream bed intermittently from Mackeno tailings down to pool 20 m upstream of the Silver Trail Highway culvert.*
- Current ripples consisting mostly of fine to medium pyrite grains were observed at isolated locations with shallow depth and high flow velocity.
- No obvious accumulation of pyrite grains was identified downstream of the highway culvert.

- N -

80 Meters

Base map from "Keno Valley/Dublin Gulch Environmental Baseline Assessment"' Public Works and Government Services Canada, March 2000. See PWGSC (2000) for additional baseline information.

Revised: SRK Consulting 2006

SRK Consulting
Engineers and Scientists
VANCOUVER

ALEXCO

Job No:	1CA009.000
Filename:	Site81_Mackeno_200070131.ppt

Baseline Environmental Report, United Keno Hill Mines Property

Mackeno Site #81

Date:	Approved:	Figure:
Jan. 2007		**143**

3.44.3 Information Gaps

Waste Rock Storage Area(s):

- **Water Management:**

  Information Gap: Refine geochemical understanding of old mine components for closure planning.

  Research Study: ABA Assessment – Pits and Waste Rock Dumps (Summer 2007 - Priority: High)

  Incorporate ABA testing results from 2006 samples into existing site wide database.

  Determine necessity for additional sampling and static ABA testing and follow-up kinetic testing based on results of static testing. Geochemical specialist review of data and recommend follow up and mitigation.

  Reports:

  SRK, 2008 – Geotechnical Closure Studies complete

  SRK, 2008 – Adit Closure Study complete

  SRK, 2008 – Geochemical Closure Studies Report complete

Building Infrastructure:

- **Chemical Control / Human Health and Wildlife Safety:**

  Information Gap: Lack of volumetric data and hazardous materials for individual buildings.

  Research Study: Landfill Requirements (Fall 2007 – Priority: Medium)

  Develop estimated quantities of materials including volumes and types necessary to be land filled or handled as hazardous wastes during decommissioning.

  Identify suitable location for closure landfill or alternative closure approaches (i.e. landfill at each separate location).

  Develop closure alternatives and recommendations for managing hazardous materials including PCB transformers, lead paint siding, asbestos siding, etc.

  Report:

  ACG, 2009 – Building Assessment Report

- **Community Concerns:**
  Information Gap: Closure strategy
  Research Study: Decommissioning Requirements (Summer 2007 – Priority: High)
  Develop inventory list with recommended decommissioning approach for each site such as demolition, salvage, heritage, etc.

4.0 SUMMARY OF GOLBAL DISTRICT ISSUES/ SUMMARY OF INFORMATION GAPS

The following text is presented as a summary of the issues present over the entire Keno Hill Silver District taken from the Keno Hill Mines Existing State of Mine Reclamation Plan Scoping Document (ERDC, 2007). A more recent summary table of closure issues follows in Table 48, while Figure 144 shows a summary of closure planning issues.

- **Human and Wildlife / Health and Safety / Water Management:**
  Information Gap: Need to update and refine model. Incorporate additional WQ sites.
  Research Study: Mass Balance Model Update (Fall 2007 – Priority: Medium)
  A comprehensive mass metal loadings balance for all drainages within entire mine site.
  Results: Contaminant loads updated in 2008. Attenuating properties of the site to be investigated in summer 2009.

- **Physical Stability:**
  Information Gap: Confirmation of physical stability of mine components.
  Research Study: Geotechnical Investigations – site wide (Fall 2007 – Priority: Medium)
  Site-wide geotechnical stability inspection and reporting on all pits, dumps, dams etc. Based on the inspection, develop recommended course of action for each pits and dump (i.e. recontoured to 2.5:1, berm around pits, etc.)

Soil/Gravel Investigations - Follow-up investigations to summer 2006 drill program to determine location, approximate volumes & suitability of organic rich soils and gravel substrate for use in soil covers, bioreactor/injection closure alternative. Program will utilize photogrammetry from 2006 aerial photographs, and follow up physical testing.

Results: SRK, 2008 – Geotechnical Closure Studies complete

- **Chemical Control / Human and Wildlife Health and Safety / Water Management:**

  Information Gap: Lack of understanding of adit down gradient flows and receiving environ and effects.

  Research Study: Adit Discharge Study (Spring and Summer 2007 – Priority: High)

  Survey and document the flowpath, contaminant loading and fate of adit waters emanating from each of the underground adits. Contaminant loading model should include zinc, sulphate, conductivity and at least one tie element to determine ultimate fate of contaminants and recommended final closure alternatives to manage adit waters. Based on the results, update the site-wide mass balance model.

  Results: ACG, 2007 – Adit Discharge Survey complete

- **Human and Wildlife Health and Safety / Water Management:**

  Information Gap: Present receiving waters exceed CCME criteria. Development of criteria for closure evaluation.

  Research Study: Site Specific Criteria for Zinc (Summer 2007) – Priority: High)

  Retain specialist water quality consultant to undertake necessary studies, WQ data review and develop technically sound specific water quality criteria, especially for Zinc.

  Results: Minnow, 2008 – Water Quality Assessment Report completed

  Minnow, 2009 – Aquatic Resource Assessment Report completed

- **Water Management / Chemical Control:**

  Information Gap: Lack of detailed plans and options for water management and treatment for all sites. Lack of test work to support viability of treatment option.

Research Study: Water Treatment (Fall 2007 – Priority: Medium)

A strategy including routing and transport alternatives, conventional (i.e. HDS) water treatment technologies, capital and operating cost estimates and preliminary design parameters should be prepared for "conventional" treatment approaches for comparison with in-situ, mine pool and ex-situ treatment technologies.

Research Study: Water Treatment (Spring 2007 – Priority: High)

Design and implement suitably sized pilot test for demonstration of in-situ and ex-situ biological treatment technology for managing and treating adit discharge waters and Valley Tailings groundwater/surface water.

Results: G900 Bioreactor

- **Water Management / Chemical Control:**

  Information Gap: Lack of test work to support viable treatment options.

  Research Study: Closure Pilot Studies (Spring 2007 – Priority: High)

  Insitu biological treatment test program – Silver King 100 adit. Design pilot test program to test in ground disposal and remediation of adit effluent. Test biological treatment cell and remediation of adit effluent.

  Research Study: Closure Pilot Studies (Summer 2007 – Priority: High)

  Review historic wetlands treatment studies and tests completed at site to date and if warranted conduct additional wetlands treatment pilot demonstration at Silver King or Galkeno 900.

  Research Study: Closure Pilot Studies (Spring 2007 – Priority: High)

  In mine pool biological treatment – Bellekeno 600 adit mine pool. Design pilot test program to conduct insitu mine pool treatment using redox and / or pH modification (nutrient addition) in controlled dynamic modes (pumping down, recycling and filling).

  Results: G900 Bioreactor

- **Water Management:**

  Information Gap: Refinement of existing site hydrological and meteorological parameters for use and input into mass balance loading model.

  Research Study: Hydrological/ Meteorological Update and Assessment (Spring 2007 – Priority: High)

Retain specialist hydrological consultant to undertake necessary studies to review and update site hydrological and meteorological parameters. Assess existing hydrological inputs to mass balance loading model and update loading model.

Results: Clearwater 2007 – Hydrological Update and Assessment

- **Human and Wildlife Health and Safety / Water Management:**

  Information Gap: Lack of current data for mass balance loading inputs. Monitor and sample additional WQ sites for model input.

  Research Study: Additional Receiving Water Quality Monitoring (Spring 2007 – Priority: High)

  Expand existing receiving water quality monitoring program and sample historic and new sites for WQ and flow to help refine comprehensive mass metal loadings balance model for all drainages within entire mine site.

  Results: New WQ sites monitored.

- **Human and Wildlife Health and Safety / Water Management:**

  Information Gap: Lack of current aquatic resources monitoring data to enable assessment of receiving water impacts.

  Research Study: Aquatic Resource Assessment (Fall 2007 – Priority: Medium)

  Existing sediment and benthos monitoring programs in local receiving water drainages will be sampled in conjunction with receiving water quality program and historical results compiled for assessment.

  Research Study: Aquatic Resource Assessment (Winter 2007 – Priority: Low)

  Historical aquatic resources dataset will be reviewed by aquatic specialist for effects assessment.

  Results: Minnow, 2009 – Aquatic Resource Assessment Report completed

- **Human and Wildlife Health and Safety / Water Management:**

  Information Gap: Lack of physical habitat data on Christal and Flat Creek. No chronic or sub acute toxicity testing on effluents or receiving streams.

  Research Study: Fisheries Assessment and Update (Fall 2007 – Priority: Medium)

Undertake follow up fisheries physical habitat assessment studies on Christal and Flat Creek to identify physical barriers.

Develop and conduct chronic toxicity testing program – in conjunction with SSWQO – to assess chronic effects to local receiving waters for risk and aquatic effects assessment.

Results: 2008 Fisheries Assessment conducted

- **Community Concerns / Human and Wildlife Health and Safety:**

  Information Gap: Systematic human health and ecological risk assessment no available for entire property

  Research Study: Human Health and Ecological Risk Assessment (Winter 2007 – Priority: Low)

  Develop study design for human health and ecological risk assessment and conduct preliminary assessment and possible data gaps.

- **Human and Wildlife Health and Safety / Water Management:**

  Information Gap: Extents of old mine tailings effects to local terrestrial and aquatic environment in Christal Creek has not been undertaken.

  Research Study: Mackeno Tailings Assessment (Summer and Fall 2007 – Priority: Medium to High)

  Develop assessment methodology and undertaken program to document extent of historic tailings and effects to local environment.

- **Community Concerns / Human and Wildlife Health and Safety:**

  Information Gap: Lack of documented local use patterns for the property area.

  Research Study: Traditional Knowledge (Winter 2007 – Priority: Low)

  Local knowledge and land use information will be collected by NND and used for closure planning and assessment purposes. Integration of local knowledge and land use by NND for the site.

- **Community Concerns:**

  Information Gap: Lack of updated socio-economic information for the area.

  Research Study: Socio-economic Update (Winter 2007 – Priority: Low)

Update socio-economic base conditions and effects from project and used for closure planning and assessment purposes. Retain specialist socio-economic consultant to undertake necessary study.

- **Community Concerns:**

  Information Gap: Community input into closure planning process and option evaluation.

  Research Study: Community Consultation (Spring 2007- Priority: High)

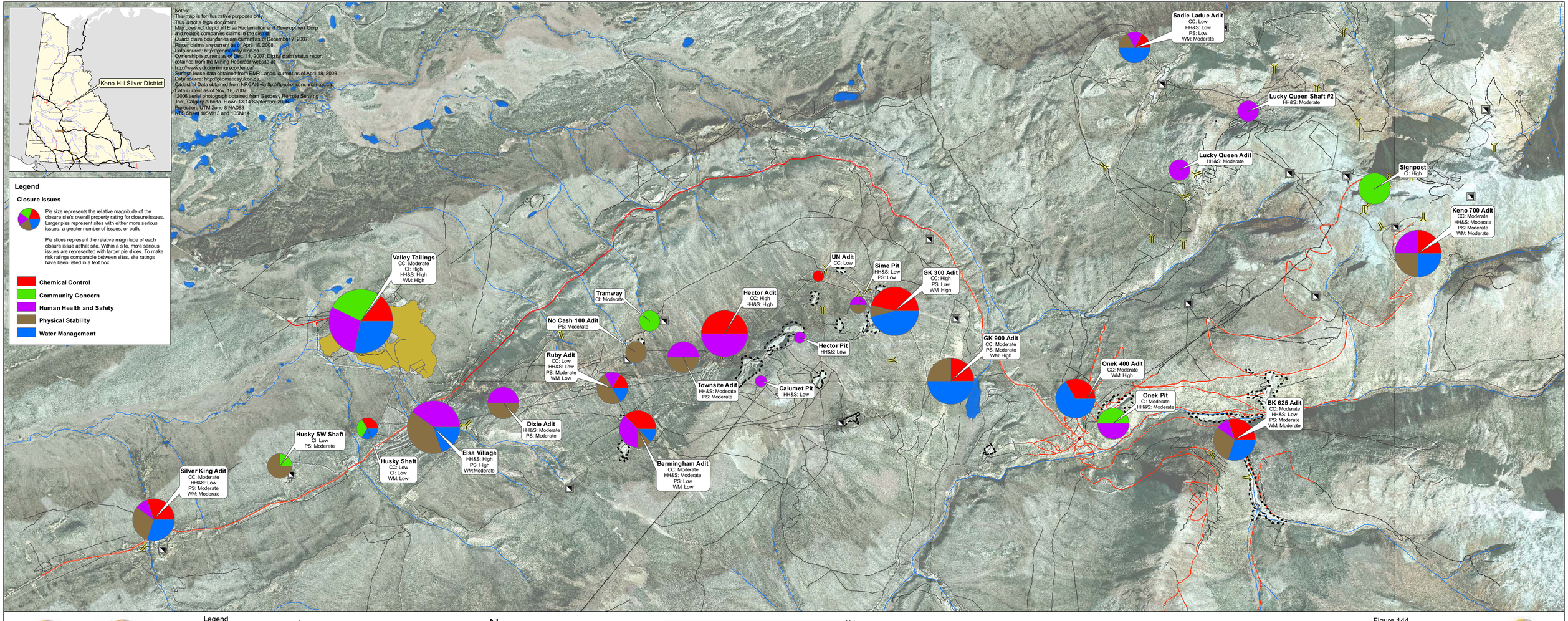
  Implementation Community Consultation Strategy to ensure that communities are consulting on closure planning process, objectives identification, alternative evaluations and closure plan selection.

Table 48 Closure Issues Summary Table

Site Component	Closure Issue Category	Description of Issues	Source of Data
Valley Tailings Area	Hydrogeological/ Geochemical	Groundwater pathways presently exist beneath the Elas tailings. Based on preliminary investigations undertaken in 2006, investigators inferred that the Elsa tailings are a source of contaminant loading. Analysis results support the conclusion that arsenic, sulfate, and zinc are all mobile in the saturated interface between beneath and down gradient of the Valley Tailings, and the mass load of contaminants from the un-reclaimed Valley Tailings are a source of contaminant loading in the McQuesten River Valley. A drilling program carried out in 2007 estimates that there is a net flux of 18m^3/day leaving the VTF via groundwater flow beneath Dam #3.	
	Water Management	There are two sets of diversion ditches in place as a part of water management at the VTF. The upper diversion system is in good condition, and is inspected regularly and maintained as required. The Lower Porcupine Diversion Ditch has not received regular inspection or maintenance and is expected to be in poor condition.Uncontrolled releases of water from one or more of the ditches could result in significant increases in the water level behind Dam #3, possibly leading to a dam breach.	
	Geotechnical	The three tailings dams at the Valley Tailings Facility (VTF) are thought to be founded on permafrost rich siols. The permafrost appears to be thawing and the soils consolidating, leading to settlement of the dams. Annual inspections are undertaken to determine maintenance requirements, if any, to keep the dam crests at the desired height and thereby prevent overtopping. It is thought at the present time that the tailings retention dams do not pose any hazard.	
Adits	Geochemical	Several adits produce high levels of water-borne contaminants. Some of these adits discharge directly to watercourses, and in these cases will require long-term water treatment. The primary contaminant of concern is Zn, although other contaminants of concern are being assessed.	
	Water Management	Some adits will require long-term water treatment, and in some cases this will involve consideration of physical water management applications. This encompasses cases where physical pooling or water, or piping will be required. For example, the volume of water treated at a low-volume site may not be enough to warrant long-term treatment at that site and there is a case for conveying contaminated water to a new location.	Outcomes from 2007/08 Keno Hill Adit Closure Studies, Technical Memorandum (in: Technical Closure Studies 2007/08)
	Geotechnical	The stability of some adits is a concern as they are in an advanced state of deterioration or semi-collapse. In the case where adits will potentially be reentered, stabilization will be required. In other cases it will be necessary to adequately fill and block the adit entrance.	
	Human Health and Safety	The nature of risks/issues varies from adit to adit, thus it is necessary to identify adit-specific closure requirements in order to select appropriate closure measures. Restricting public access is a requirement for all adits. Certain adits will require long-term drainage control, and in these cases a closure measure must be identified that will restrict public access, yet allow the operational access necessary to service and maintain water control systems. Other adits are presently in a fully collapsed state and require no additional work to prevent public access.	Outcomes from 2007/08 Keno Hill Adit Closure Studies, Technical Memorandum (in: Technical Closure Studies 2007/08)

Table 48 Closure Issues Summary Table (Cont'd)

Site Component	Closure Issue Category	Description of Issues	Source of Data
Waste Rock and Pits	Geochemical	The potential for acid rock drainange (ARD) and metals leaching (ML) is a concern for some of the waste rock piles. ARD is a concern for the waste material at the Dixie, Hector, Husky SW, and SK 100 waste rock dumps. Metals leaching concerns are more widespread, with the primary metal of concern being Zn. High metal loads are witnessed at the Bermingham, Calumet, Dixie, Galkeno 900, Hector, Husky SW, Ruby, Silver King and Townsite waste rock dumps. While waste rock materials in the dumps present an ARD or ML concern, pit walls are decidedly less reactive due to their decresed proximity to mineralization.	Review of Historic Keno Static Test Data to Define ARD/ML - Controlling and Correlating factors (Altrua Environmental Consulting)
	Geotechnical	The history of the waste rock piles in general indicates that, for most sites, the long-term geotechnical stability of waste rock piles is of little concern as the potential consequences of failure are likely to be minor and quite localized. For stable waste rock piles, the selection of a waste rock pile closure measure will be driven by geochemical loading, aesthetic objectives, or revegetation goals. For the Hector #1 vein waste rock pile, the ongoing erosion and recent evidence of slope movement indicate that there is a high likelihood of failure of this dump over the long term; however, consequences of failure would be very low, and limited to downslope movement of waste rock covering a limited area that is presently vegetated. For the Keno 700, No cash 500, Silver King 100 and Bellekeno 625 adit waste rock piles, permanent streams at the base of the piles will necessitate relocation of some waste rock if a closure measure other than 'Do Nothing' is selected. These waste rock piles are at risk of future undercutting during periods of high stream discharge. No Cash 500 and Keno 700 have the added risk of erosion arising from uncontrolled discharge from the respective adits.	2007 Geotechnical Closure Studies, Keno Hill, YT (in: Technical Closure Studies 2007/08)
		All of the open pit excavations will continue to unravel to some degree. Within the Bermingham, Calumet and Sime #6 Pits this instability is expected to be more significant, with some larger sections of the slope walls becoming unstable over time.	
	Human Health and Safety	Access to open pits is presently unimpeded. Public access, whether dileberate or inadvertent will have to be addressed in closure plannnig.	
Buildings/ Infrastructure	Human Health and Safety	Most transportable contaminants have been removed from buildings. However, fixed contamination such as asbestos siding and lead paint has not been removed. ACG has compiled an inventory of suspected asbestos and lead paint. The Elsa Village has by far the largest known amount of contaminated building materials, predominantly in the form of exterior cladding containing asbestos. Several buildings at the Elsa Village have also been identified as structural hazards. Buildings in service under current site operations have been inspected and are considered safe.	Baseline Environmental Report - UKHM (SRK Consulting)



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Dec 2008 version

Figure 144

Summary of Closure Planning Issues

ACCESS Consulting Group

5.0 CONCLUSIONS

(Needs group input and discussion)

6.0 REFERENCES

Access Mining Consultants Ltd., 1996a. United Keno Hill Mines Limited Report No. UKH/96/01 Site Characterization.

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