KENO VALLEY/DUBLIN GULCH ENVIRONMENTAL BASELINE ASSESSMENT

VOLUME II: Keno Valley Sites #1 to #20

Prepared for
Waste Management Program
Indian and Northern Affairs Canada

By
Environmental Services
Public Works and Government Services Canada

March, 2000

At the request of the client, there has been no interpretation of data compiled and gathered for this assessment. Therefore, this report does not draw comparisons or make references to environmental quality criteria, guidelines, or codes of practice, and makes no recommendations for future action.

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SILVER KING
SITE #1
MINFILE 105M 001ba

1. LOCATION AND ACCESS

The Silver King mine site straddles the Silver Trail Highway (Hwy. 11) at Galena Creek, about 4 kilometres southwest of Elsa Village. Silver King is the westernmost mine in the Keno Hill mining camp. It is located at UTM coordinates 473,050m east and 7,085,275m north. The site extends between elevations of 650m and 800m. The mine was recently active and is scheduled for future mining. It is currently under care and maintenance by UKHM employees.

2. SITE PHYSIOGRAPHY (photo 1-1)

The site is on the lower northwest-facing slope of Galena Hill. The site is drained by Galena Creek, part of the Flat Creek drainage. The area is well forested with fir, spruce and alder trees.

3. GEOLOGY AND MINERALIZATION

The silver veins are hosted in quartzite and graphitic schist rocks. The mine is near the top of the Keno Hill quartzite, which is relatively thin-bedded at this location. The veins consist of quartz, pyrite, siderite, calcite and galena, with minor sphalerite, ruby silver, and tetrahedrite. The veins are often low in sulphide minerals, though high in silver.

4. SITE HISTORY

The Silver King was the first silver mine in the Keno Hill area. The mine is really two separate mines, consisting of two separate groups of adits, raises, levels and stopes. The first mine was, and mined underground between 1912 and 1939. The open pit was mined on these veins in 1983. The second mine am accessed by the 100 level adit, and mines. It was mined between 1984 and 1997. The two mines are not connected by underground workings, although the two sets of workings come within about 10 metres of each other in one location.

The mine was initially developed from 1912 to 1918 with a shaft and two adits on the No. 1 and 2 veins. The ore was hand-sorted for direct shipment. In the period 1928 to 1939 there was production from additional shallow shafts and adits, with lateral development on the 100, 200 and 300 levels. There is indication that there were nine shafts and seven raises present on No. 1 and 2 veins from work in this period. The ore was processed at the Elsa mill during this time. An open pit was established in 1983 to remove the #3 shaft pillar on the No. 1 vein.

In 1984 to 1988 the 100 level portal was developed to access the No. 4, 5, 6 and 7 veins. These underground workings are not directly connected to the older workings. The workings were extended in 1994 to 1996. The vent raise was constructed and the backfill hole was drilled at this time.

Total production from the Silver King was 188,345 tonnes grading 1817 g/t Ag, 7.7% Pb, 0.9% Zn.

A few old pits and shallow shafts are present on the Mabel and Adam claims to the southwest of the mine.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

Adits/Shafts/Portals

Silver King 100 Level Adit – Under Care and Maintenance (photo 1-1)

Description: This portal is currently under care and maintenance; access is maintained for pumping and treatment of mine water. There is a long (about 100m) galvanized shed that extends from the portal, covering the ore dump tracks.

Location: The portal is west of Galena Creek, a few hundred metres north of the Silver Trail highway.

Dimensions (L x W x H): The adit is about 2.5m by 2.5m, and extends for about 1km underground.

Supports: Wooden timbers, screens and bolts, some shotcrete.

Condition: Appears to be stable.

Accessibility: A locked door blocks access to underground. A locked gate at the highway blocks vehicle access.

Ventilation Raise – Under care and maintenance (photo 1-2)

Description: A ventilation raise is covered by a wooden shed.

Location: About 100m southeast of the open pit.

Dimensions (L x W x H): About 2m by 2m.

Supports: Unknown.

Condition: Appears to be stable.

Accessibility: The shed is kept locked, and steel mesh covers the raise entrance.

75 Level Adit

Description: A small adit is present just above creek level in the canyon. It is connected to the recent workings for ventilation, and is suitable for access on foot only.

Location: This portal is cut into the Galena Creek canyon wall on the west side, just upstream from the highway.

Dimensions: The portal is about 1.5m high by 2m wide.

Supports: Timber supports are present, in fair to good condition.

Condition: Appears to be stable.

Accessibility: Access underground is blocked by steel mesh, site access is easy along the creek. The portal is visible from the highway.

Shaft #1 - Open Pit Shaft (photo 1-2)

Description: Timbers and pipes exposed in the bottom of the open pit identify former shaft, filled with waste rock. This is likely the number 3 shaft, which was the main production shaft for this part of the mine.

Location: Northwest corner of the open pit.

Dimensions: About 1.5m wide by 1.5m high.

Supports: Milled timber supports.

Condition: Appears to be stable.

Accessibility: Access to underground is blocked with fill.

Shaft #2 - Old Round-Timbered Raise or Shaft

Description: An old raise lined with log timbers that had been sunk in overburden has been left standing at the edge of the open pit.

Location: South-central side of the open pit.

Dimensions: About 1.5m high by 1.5m wide.

Supports: Round log timbers (about 10 to 20cm diameter) line the shaft horizontally, in the style of old-time placer miners. The shaft has had overburden removed from around it so that it stands as a tower, leaning.

Condition: The wooden timbers are leaning, but moderately stable. The raise is filled with overburden.

Accessibility: There is no access to underground.

Raise #1 - Small Raise West of Galena Creek

Description: A small raise was located above Galena Creek canyon on the west side. The site is overgrown with dense vegetation. A pipe extends to surface. The raise is collapsed.

Location: In dense bush about 30m west of Galena Creek (at the top of the canyon), about 30m south of the old bridge site.

Dimensions (L x W x H): About 1m by1m, collapsed at about 1m depth.

Supports: Some rotten wooden supports are present.

Condition: Raise is collapsed.

Accessibility: No access to underground.

Backfill Pipe (photo 1-4)

Description: Steel pipe that provides access to the recent workings for delivering backfill underground.

Location: Roughly 50m west of the Ventilation Raise.

Dimensions: Roughly 0.3m diameter by 1.0m high.

Condition: In sound condition.

Accessibility: Not capped. Access to site by road.

Shallow Test Pits and Shafts West of the Main Mine

Description: Several shafts are indicated on mine plans in the area about 200m west of the main mine, south of the highway. This area is overgrown with dense second growth. Two old pits were found, with very little waste material present. These are very shallow test pits.

Location: See map.

Dimensions (L x W x H): Both pits were about 2m by 2m, and about 0.5m deep.

Supports: Some rotten timbers.

Condition: Collapsed, overgrown.

Accessibility: No access to underground and no apparent hazard.

Note: There is no sign of most of the raises and shafts that were originally present at the old Silver King mine. The old shafts and raises were likely filled during open pit mining.

Silver King Open Pit (photo 1-5, 1-6)

Description: The pit was mined to remove a shaft pillar of ore left from the early days of mining. Most of the waste material removed here was overburden (glacial till). The waste was dumped across the highway. Large blocks of concrete that were foundations for shaft hoists are located on the north side of the pit, near the highway. There are reports that one of these blocks covers a shaft, but there was no evidence of subsidence. The pit overlies a zone of underground mining with minimal crown pillar, and there is evidence of subsidence in several places along the vein trend to the northeast of the pit towards the highway (see map). An open slump hole is present along the north-central wall of the pit, at the pit entrance.

Location: The pit is located immediately south of the Silver Trail highway, immediately east of Galena Creek. The original road to Elsa was re-routed to bypass this pit.

Dimensions (L x W x H): The pit is about 150m long and averages about 50m wide. The maximum depth is about 20m.

Condition: The pit walls are mostly gravel, at a moderate angle of repose, and appear to be stable. There is considerable natural revegetation in and around the pit.

Accessibility: Easy access from the highway, only 50 m away. A locked gate blocks access to vehicles.

Trenches

Much of the area has been disturbed by bulldozing, but mostly for drill access roads. No real exploration trenches were noted.

5.2 Waste Rock Disposal Areas

Waste Rock Pile WR-01 - Open Pit Waste Dump

General Description: A large waste rock dump of open pit material is located across the highway from the open pit. Based on observations in the pit, about half of the waste dump is thought to be overburden, although the material on surface is of bedrock origin. The material has low to moderate water retention capacity, and no drainage was observed on the dump. The rock present is thin-bedded quartzite and schist/ phyllite. Local rusty staining of the waste rock appears to be due to pre-mining oxidation. Minor pyrite was noted in the waste rock. There are stockpiles of sand and gravel on top of the dump for use by the Highways department, so there is ongoing disturbance of the site. There is local natural revegetation on the top and sides of the dump.

Location: North of and adjacent to the Silver Trail highway, 50m east of Galena Creek.

Dimensions: (L x W x H) About 100m by 75m by 10m, reported to be 109,000 tonnes (Access, 1996).

Sampling: Two samples were collected for ABA from the north and east sides of the dump. Note that all four samples tested in the field were too fine-grained to sieve - the clay content caused lumping of the material. The field tests were performed using unsieved material.

Samples:

Sample #	Location	Paste pH	Conductivity
1-WR-TPBM-03	East	2.80	2,570μS/cm
1-WR-TPBM-04	North	5.30	3,000μS/cm

There is one sample from this waste dump reported in the Access Site Characterization Report.

Waste Rock Pile WR-02 - 100 Level Adit Waste Dump (photo 1-1)

General Description: Quartzite and phyllite from underground development is distributed in front of the portal, and was used to construct the roads and settling ponds. The material is grey, fine-grained and clay-rich. This material retains water due to the fine-grained nature. The waste averages about 1% pyrite. Some calcite and siderite were noted. Natural revegetation is sparse, however there is little staining due to oxidation.

There are two areas where approximately 1,100 tonnes of lowgrade ore from underground has been stockpiled on surface in the portal area.

Location: See map. This waste underlies and surrounds the portal shed and settling ponds.

Dimensions: (L x W x H) 39,000 tonnes of waste have been used for site construction, including the settling ponds. The area underlain by waste rock is about 200m long and 75m wide; thickness is variable.

Samples: Two samples of underground waste rock were collected from the north end of the dump, near the settling ponds.

Sample #	Location	Paste pH	Conductivity
1-WR-TPBM-01	Northeast end	1.6	2,670µS/cm
1-WR-TPBM-02	Northwest end	1.9	1,840µS/cm

5.3 Tailings Impoundments

No tailings impoundments were observed at this site.

5.4 Minesite Water Treatment (photo 1-1)

Description and type: Mine wastewater from the 100 Level portal is treated by mixing with lime, and settling in two ponds connected in series. The lime mixer is in an insulated part of the portal shed at the end of the tracks.

Location: The ponds are immediately below the portal shed, on the west side of Galena Creek, below the Silver Trail highway.

Dimensions (L x W x H): The pond area measures about 50m long by 15m wide by 1.5m deep.

Drainage: The ponds flow into Galena Creek, part of the Flat Creek drainage basin.

Piping: Unknown.

Impacted vegetation: There is some rusty precipitate deposited in the outflow area. Vegetation may be impacted in an area about 10m by 20m.

Sampling: See Section 9 of this report.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

The Silver King buildings were not investigated in detail. No samples were collected from any of the buildings at this site.

1A - Silver King 100 Level Portal Shed (photo 1-1)

Description: A water treatment facility is located in an insulated room at the far end of the shed from the portal.

Dimensions (L x W x H): About 100m long, 4m high, 4m wide, with a higher, wider shop section near the portal.

Location: Located immediately west of Galena Creek about 150m north (downstream) from the highway.

Construction: The shed is constructed of galvanized steel siding and roof on a wood frame.

Paint: Not painted.

Asbestos: None observed.

Foundation: Unknown.

Non-Hazardous Contents: Assorted mining equipment.

Hazardous Contents: None noted.

1B - Silver King 100 Level Shifters Office/ Lunch Room (photo 1-1)

Dimensions (L x W x H): About 5m by 4m, 4m high.

Location: Located near the main door to the portal shed.

Construction: Wood frame construction. One door, one window.

Paint: Yes.

Asbestos: None noted.

Foundation: Unknown.

Non-Hazardous Contents: Table, benches, desk.

Hazardous Contents: None noted.

1C - Compressor Building (photo 1-1)

Description and type: Large building; pipes lead to portal.

Dimensions (L x W x H): about 8m by 4m by 4m high.

Location: About 30m west of building 1A.

Construction: Metal roof.

Paint: Unknown.

Asbestos: None noted.

Foundation: Unknown.

Non-Hazardous Contents: Unknown.

Hazardous Contents: None noted.

1D - Collapsed Storage Shed (photo 1-7)

Dimensions (L x W x H): About 9m by 5m, was about 6m high before collapse.

Location: Beside old road, about 100m south of the Silver Trail highway, 50m west of Galena Creek.

Construction: Wood frame and siding, asphalt roofing.

Paint: Not painted.

Asbestos: None noted.

Foundation: Unknown.

Non-Hazardous Contents: Pipe fittings, exploration samples, sample bags, and miscellaneous materials.

Hazardous Contents: None noted.

1E - Ventilation Raise Building (photo 1-2)

Description: One door, plus screened entrance to raise. No windows

Dimensions (L x W x H): About 4m by 3m by 4m.

Location: About 100m southeast of open pit.

Construction: Wood frame and siding, metal roof.

Paint: Green.

Asbestos: None noted.

Foundation: Metal skids.

Non-Hazardous Contents: None.

Hazardous Contents: None noted.

1F - Old Log Cabin – Collapsed

Description and type: Collapsed log cabin, one door, and two windows.

Dimensions (L x W x H): About 4m by 3m.

Location: In dense woods about 250m west of Galena Creek, 150m south of highway.

Construction: Logs, flattened tins.

Paint: None

Asbestos: None noted.

Foundation: Logs.

Non-Hazardous Contents: None noted.

Hazardous Contents: None noted.

6.2 Fuel Storage

Drum Storage Area: No fuel drums were noted at this site.

Above Ground Storage Tanks: Fuel storage was not reported at this site, however some diesel fuel was likely stored near the 100 Level Portal.

Samples: No samples were collected of fuel.

6.3 Rail and Trestle

Location: 100 Level Adit is the only location with rails at the Silver King site. This site is under care and maintenance.

Fabrication: Steel rails, wood ties.

Amount of materials: About 100m of rail line extends from the portal to the ore loadout.

Condition: Appears to be in stable condition.

6.4 Milling and Processing Infrastructure

No milling or processing infrastructure was observed at this site.

6.5 Electrical Equipment

A transformer station is present immediately south of the highway, immediately west of Galena Creek. It appears to be part of the main powerline to Elsa from Mayo. It was not investigated.

7. SOLID WASTE DUMPS

No solid waste dumps were observed.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No out-of-service transformers were noted on site.

8.2 Metals and Hydrocarbons in Soil

No significant hydrocarbons in soil were noted. A small, very shallow (<0.1m) stain from drilling lubricant or hydraulic oil was noted around the Backfill Pipe.

Samples: None collected.

8.3 Liquid Hazardous Materials

No liquid hazardous materials were observed on site.

8.4 Solid Hazardous Materials

No solid hazardous materials were observed on site.

9. WATER QUALITY

A total of five water samples were collected on the site.

Samples:

Sample #	Location	Field pH	Conductivity	Flow Rate
Site 01-01-Water-Silverking	Water treatment facility outflow	7.8	680 µS/cm	n/a
Site 01-02-Water-Silverking	250m downslope from 01-01	7.4	770 µS/cm	n/a
Site 01-03-Water-Silverking	Galena Creek 250m below portal	7.9	350 µS/cm	n/a
Site 01-04-Adit-Sept.20/99	100 level adit outflow (pre-treatment)	6.6	1,490 µS/cm	4 L/s
Site 01-05-Water-Sept.20/99	Galena Creek 250m above highway	7.4	720 µS/cm	20 L/s

There is an extensive database of water sample results for this area, from the United Keno Hill Mines Ltd. (see Appendices).

10. RECLAMATION

The adits, shafts and raises associated with the early phases of mining have been filled by the mine operators, likely during open pit mining. The open pit walls have been bulldozed into gentle slopes after mining. There does not appear to have been any revegetation efforts.

Natural revegetation consisting of very dense deciduous trees and shrubs is present covering the older disturbed areas (pre-1980's). The open pit area and waste dump have significant patches of grasses, shrubs and small trees growing naturally. The well-drained character and lack of organic matter of most of the material in the open pit and waste dump area appears to limit the extent of revegetation.

11. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

ATTACHMENT 2: 1999 SILVER KING WATER SAMPLES LABORATORY RESULTS					
Sample Number	**Detection Limit**	**Units**	**Site 01 - 01 - Water Silverking 19/9/99**	**Site 01 - 02 - Water Silverking 19/9/99**	**Site 01 - 03 - Water Silverking 19/9/99**
Site Desciption			Water treatment facility outflow	250m downslope below sample 01-01	Galena Creek: 250m below 100 level portal
pH (field)	N/A	pH	7.8	7.4	7.9
Conductivity (field)	N/A	µS/cm	680	770	350
pH (Lab)	0.01	pH	7.71	7.68	7.99
Conductivity (Lab)	0.01	µS/cm	970	970	440
Total Alkalinity	5	mg CaCO3/L	80	82	154
Chloride	0.25	mg/L	0.54	0.77	<0.25
Hardness (CaCO3 equiv)	5	mg/L	507	569	249
Nitrate-N	0.05	mg/L	<0.05	<0.05	<0.05
Nitrite-N	0.003	mg/L	0.011	0.005	0.005
Sulphate	1	mg/L	438	410	76
Total Dissolved Solids	5	mg/L	726	734	288
Analysis by ICP-USN					
Aluminum	0.0008	mg/L	0.144	0.133	0.0201
Antimony	0.005	mg/L	0.021	<0.005	<0.005
Arsenic	0.01	mg/L	0.01	<0.01	<0.01
Barium	0.00004	mg/L	0.00917	0.0502	0.0529
Beryllium	0.00001	mg/L	<0.00001	<0.00001	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004	<0.0004
Boron	0.002	mg/L	<0.002	<0.002	<0.002
Cadmium	0.00006	mg/L	0.00427	0.00004	0.00042
Calcium	0.002	mg/L	150	148	60.3
Chromium	0.00006	mg/L	0.00029	0.00031	<0.00006
Cobalt	0.00003	mg/L	0.00676	0.00011	<0.00003
Copper	0.00003	mg/L	0.0127	0.0018	0.0027
Iron	0.00001	mg/L	4.95	0.375	0.036
Lead	0.0003	mg/L	0.0223	0.0006	<0.0003
Lithium	0.001	mg/L	0.023	0.018	0.005
Magnesium	0.0005	mg/L	34.3	35.1	18.3
Manganese	0.00002	mg/L	1.88	0.00669	0.00434
Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001
Molybdenum	0.00007	mg/L	0.00072	0.00018	0.00091
Nickel	0.00001	mg/L	0.0277	0.0006	0.0026
Phosphorus	0.03	mg/L	<0.03	<0.03	<0.03
Potassium	0.4	mg/L	1.2	1	<0.4
Selenium	0.004	mg/L	<0.004	<0.004	<0.004
Silicon	0.004	mg/L	2.62	2.75	2.58
Silver	0.00005	mg/L	0.00083	<0.00005	0.00068
Sodium	0.004	mg/L	1.9	1.8	1.6
Strontium	0.00002	mg/L	0.262	0.266	0.172
Sulphur	0.008	mg/L	139	135	40.1
Thallium	0.001	mg/L	0.005	<0.001	<0.001
Titanium	0.00002	mg/L	0.00066	0.00367	0.0132
Vanadium	0.00003	mg/L	<0.00003	0.00021	0.00073
Zinc	0.0002	mg/L	0.287	0.0041	0.195
Analysis by Hydride AA					
Arsenic	0.0002	mg/L	0.007	0.001	0.0016
Selenium	0.0001	mg/L	<0.0001	<0.0001	0.0003

ATTACHMENT 2: 1999 SILVER KING WATER SAMPLES LABORATORY RESULTS				
Sample Number	**Detection Limit**	**Units**	**01-04-ADDIT Sept 20**	**01-05-Water Sept 20**
Site Desciption			100 Level Adit outflow (pre-treatment)	Galena Creek, 250m above highway
pH (field)	N/A	pH	6.6	7.4
Conductivity (field)	N/A	µS/cm	1490	720
pH (Lab)	0.01	pH	6.31	7.97
Conductivity (Lab)	0.01	µS/cm	935	290
Total Alkalinity	5	mg CaCO3/L	53	119
Chloride	0.25	mg/L	na	<0.25
Chloride	0.01	mg/L	0.01	na
Hardness (CaCO3 equiv)	5	mg/L	554	165
Nitrate-N	0.05	mg/L	<0.05	<0.05
Nitrite-N	0.003	mg/L	0.006	<0.003
Sulphate	1	mg/L	430	26.3
Total Dissolved Solids	5	mg/L	718	195
Analysis by ICP-USN				
Aluminum	0.0008	mg/L	0.482	0.0221
Antimony	0.005	mg/L	0.034	<0.005
Arsenic	0.01	mg/L	0.06	<0.01
Barium	0.00004	mg/L	0.0158	0.0584
Beryllium	0.00001	mg/L	0.00012	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004
Boron	0.002	mg/L	0.011	<0.002
Cadmium	0.00006	mg/L	0.0179	0.00002
Calcium	0.002	mg/L	151	42.1
Chromium	0.00006	mg/L	0.00092	0.0003
Cobalt	0.00003	mg/L	0.0245	<0.00003
Copper	0.00003	mg/L	0.0776	0.00211
Iron	0.00001	mg/L	39.3	0.071
Lead	0.0003	mg/L	0.0046	0.0005
Lithium	0.001	mg/L	0.023	0.003
Magnesium	0.0005	mg/L	38.6	12
Manganese	0.00002	mg/L	3.45	0.00312
Mercury	0.0001	mg/L	<0.0001	<0.0001
Molybdenum	0.00007	mg/L	0.00076	0.0009
Nickel	0.00001	mg/L	0.0886	0.0018
Phosphorus	0.03	mg/L	0.09	<0.03
Potassium	0.4	mg/L	1.2	<0.4
Selenium	0.004	mg/L	<0.004	<0.004
Silicon	0.004	mg/L	5.59	2.51
Silver	0.00005	mg/L	0.00051	<0.00005
Sodium	0.004	mg/L	2	0.5
Strontium	0.00002	mg/L	0.24	0.127
Sulphur	0.008	mg/L	152	8.85
Thallium	0.001	mg/L	0.005	<0.001
Titanium	0.00002	mg/L	0.00012	0.00033
Vanadium	0.00003	mg/L	0.00011	<0.00003
Zinc	0.0002	mg/L	1.4	0.0069
Analysis by Hydride AA				
Arsenic	0.0002	mg/L	0.062	0.0025
Selenium	0.0001	mg/L	0.0006	0.0005

ATTACHMENT 2: 1999 SILVER KING WASTE ROCK LABORATORY RESULTS						
Site Number	**Detection Limit**	**Units**	**1_WR_TPBM_01 - Rock**	**1_WR_TPBM_02 - Rock**	**1_WR_TPBM_03 - Rock**	**1_WR_TPBM_04 - Rock**
Sample Desciption			Northeast end of Waste rock from the 100 level adit	Northwest end of waste rock from the 100 level adit	East side of waste rock from the open pit waste dump	North side of waste rock from the open pit waste dump
Paste pH (field)	N/A	pH	1.6	1.9	2.8	5.3
Conductivity (field)	N/A	µS/cm	2670	1840	2570	3000
pH in Saturated Paste						
pH	0.1	pH	2.1	2.7	2.5	3.6
pH in Soil (1:2 water)						
pH	0.01	pH	3.1	3.5	3.5	4.2
ICP Semi-Trace Scan						
Aluminum	5	µg/g	27800	26000	17900	18900
Antimony	2	µg/g	26	120	39	40
Arsenic	2	µg/g	108	162	252	261
Barium	0.05	µg/g	525	632	496	510
Beryllium	0.1	µg/g	0.8	1	0.6	0.6
Bismuth	5	µg/g	<5	<5	<5	<5
Cadmium	0.1	µg/g	0.6	4.8	2.3	2.3
Calcium	5	µg/g	2250	3930	615	587
Chromium	0.5	µg/g	39.8	37.7	28.3	29.7
Cobalt	0.1	µg/g	2.5	8	1.1	1.2
Copper	0.5	µg/g	64.4	118	55.2	59.2
Iron	1	µg/g	28000	34000	21000	22000
Lead	1	µg/g	2350	5540	2320	2480
Lithium	0.5	µg/g	14.8	9.2	9.8	11.2
Magnesium	1	µg/g	1330	1400	1210	1480
Manganese	0.5	µg/g	173	1770	101	105
Mercury	0.01	µg/g	0.22	0.48	0.25	0.33
Molybdenum	1	µg/g	1	3	3	3
Nickel	1	µg/g	19	30.2	6.6	7.4
Phosphorus	5	µg/g	604	574	670	697
Potassium	20	µg/g	6400	7800	5000	5300
Selenium	2	µg/g	<2	<2	<2	<2
Silicon	5	µg/g	219	351	253	626
Silver	0.5	µg/g	217	352	58.6	57.6
Sodium	5	µg/g	658	751	447	451
Strontium	1	µg/g	67	60	68	69
Sulphur	10	µg/g	10200	18900	3420	3390
Thorium	1	µg/g	2	3	8	6
Tin	1	µg/g	3	7	5	52.2
Titanium	0.2	µg/g	40.4	58.8	50.1	<0.2
Uranium	5	µg/g	<5	<5	<5	40
Vanadium	1	µg/g	68	49	39	211
Zinc	0.5	µg/g	108	235	223	25.9
Zirconium	0.1	µg/g	17	22.7	24	<0.1

ATTACHMENT 2: 1999 SILVER KING WASTE ROCK LABORATORY RESULTS MODIFIED SOBEK METHOD ACID-BASE ACCOUNTING TEST								
SAMPLE	**SITE DESCRIPTION**	**PASTE pH**	**S(T) %**	**S(SO4) %**	**AP**	**NP**	**NET NP**	**NP/AP**
1_WR_TPBM_01 - Rock	Northeast end of Waste rock from the 100 level adit	2.9	0.52	0.24	8.8	-3.2	-11.9	<0.1
1_WR_TPBM_02 - Rock	Northwest end of waste rock from the 100 level adit	3.7	1.42	0.34	33.8	0.3	-33.4	<0.1
1_WR_TPBM_03 - Rock	East side of waste rock from the open pit waste dump	5.0	0.51	0.20	9.7	-0.8	-10.5	<0.1
1_WR_TPBM_04 - Rock	North side of waste rock from the open pit waste dump	4.8	0.18	0.13	1.6	-0.4	-1.9	<0.1

AP = ACID POTENTIAL IN TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.

NP = NEUTRALIZATION POTENTIAL IN TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.

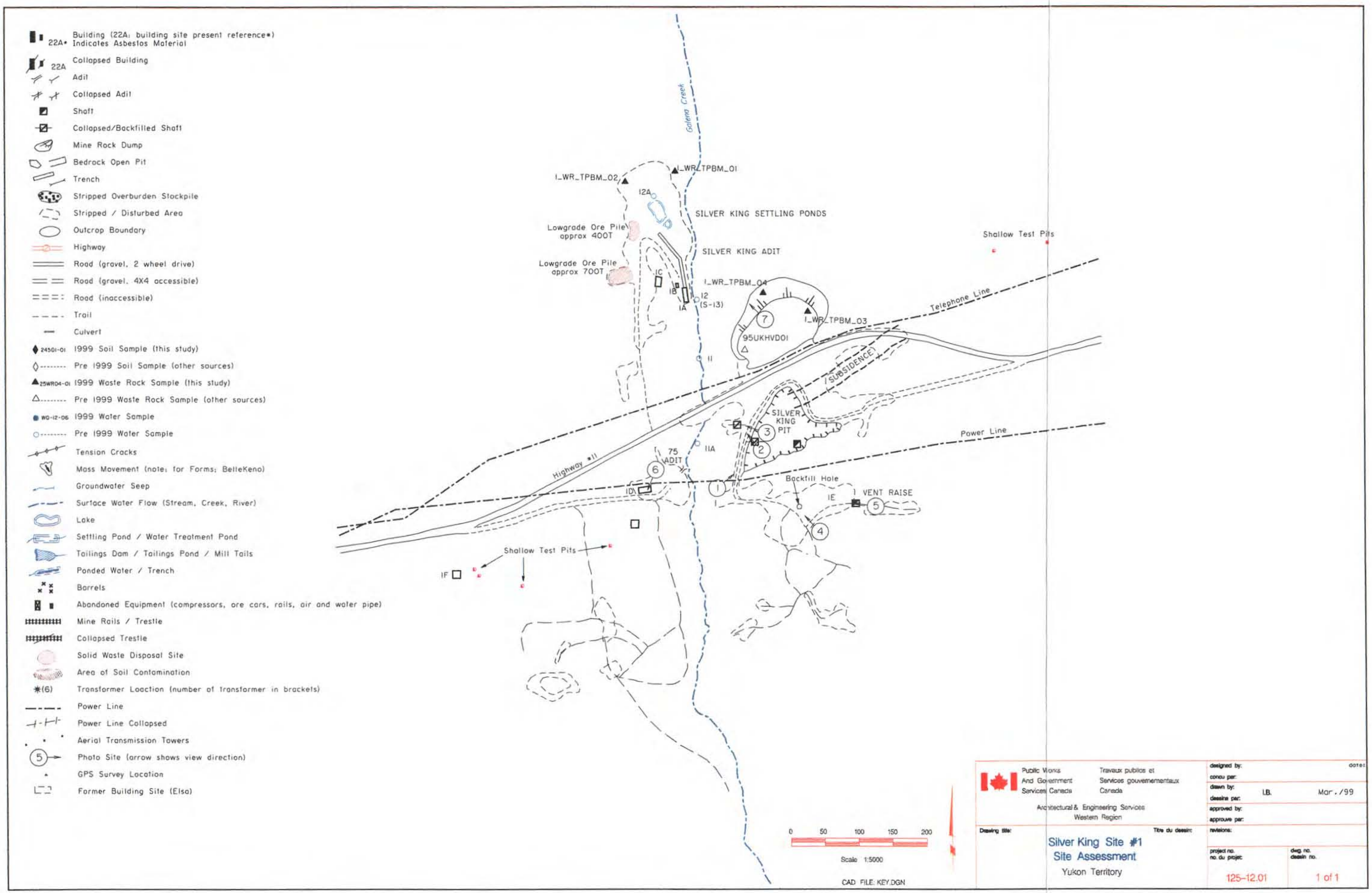
NET NP = NET NEUTRALIZATION POTENTIAL = TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.

NOTE: WHEN S(T) AND/OR S(SO4) IS REPORTED AS <0.01, IT IS ASSUMED TO BE ZERO FOR THE AP CALCULATION.

N/D = NO DUPLICATE ASSAY. CALCULATIONS ARE BASED ON ASSAY RESULTS OF THE INITIAL SAMPLE.

RE = REPLICATE.

NOTE - A HIGH LEVEL OF SOLUBLE METALS (ESPECIALLY IRON) WERE OBSERVED IN MANY SAMPLES DURING THE ABA TITRATIONS.
SAMPLES WITH A NEGATIVE NET NP SHOULD BE TESTED FOR MOBILE METALS USING STANDARD SHAKE FLASK EXTRACTION TESTS.



Building (22A: building site present reference*)
22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Galena Creek
I_WR_TPBM_01
I_WR_TPBM_02
I_WR_TPBM_03
I_WR_TPBM_04
SILVER KING SETTLING PONDS
SILVER KING ADIT
Lowgrade Ore Pile approx 400T
Lowgrade Ore Pile approx 700T
Shallow Test Pits
Telephone Line
Power Line
Highway #11
95UKHVD01
SUBSIDENCE
SILVER KING PIT
75 ADIT
Backfill Hole
VENT RAISE
Scale 1:5000
CAD FILE: KEY.DGN
Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title: / Titre du dessin:
Silver King Site #1
Site Assessment
Yukon Territory
designed by: / concu par:
drawn by: / dessine par: I.B.
date: Mar./99
approved by: / approuve par:
revisions:
project no. / no. du projet: 125-12.01
dwg. no. / dessin no.: 1 of 1

Photo 1-1 : Silver King. Silver King 100 Level Portal site, showing buildings (1A, 1B & 1C) and settling ponds. Looking northwest from the open pit waste dump across Galena Creek.

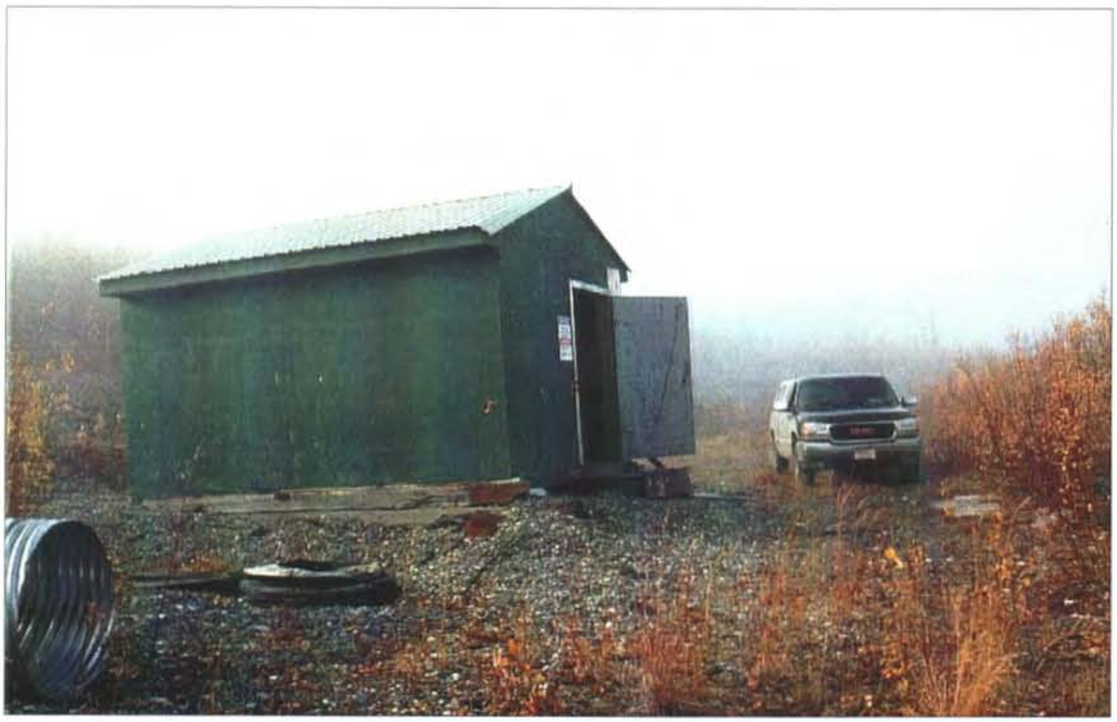


Photo 1-2 : Silver King. Ventilation Raise Building. Looking west, about 100m southeast of the open pit.

Photo 1-3 : Silver King. Timbers and pipe identify a filled-in raise or shaft (Shaft 1). Looking northwest at the bottom northwest corner of the Silver King pit.

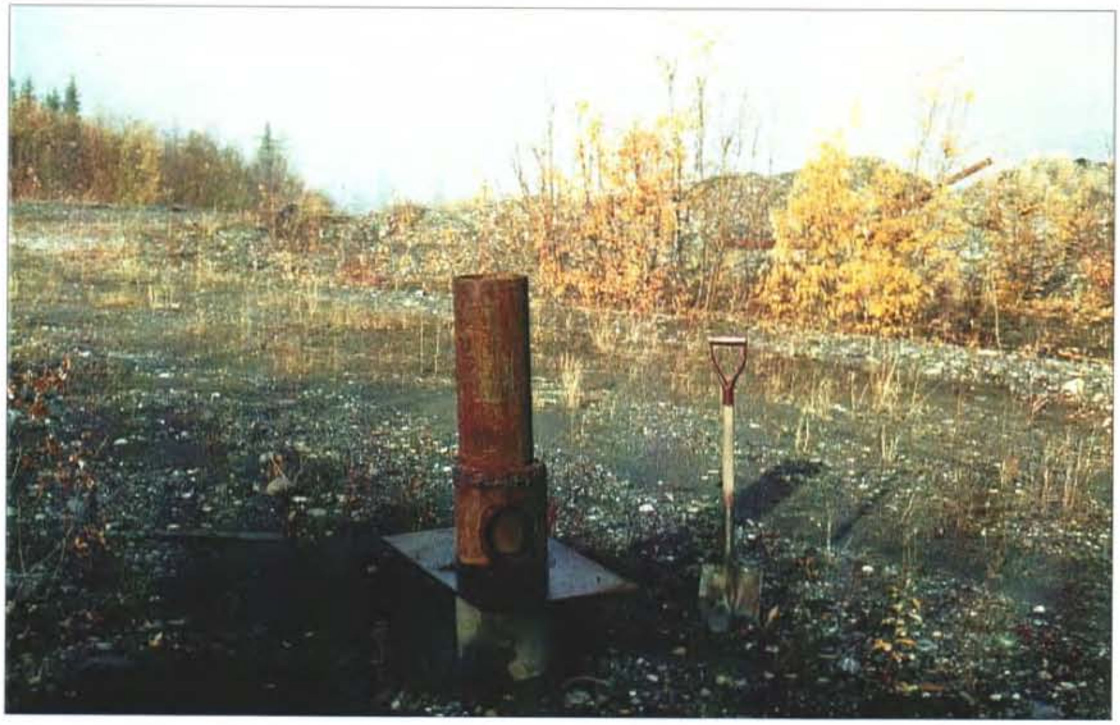


Photo 1-4 : Silver King. Backfill pipe, 100m south of the open pit. Looking northwest. Note hydrocarbon stain at base of pipe (likely drill lubricant or hydraulic fluid).

Photo 1-5 : Silver King. Silver King Pit, looking east-northeast. Note moderate pit wall slope, abundance of overburden versus outcrop, and natural revegetation.

Photo 1-6 : Silver King. Concrete shaft hoist foundations. Looking northwest, northwest of the open pit.

Photo 1-7 : Silver King. Large, collapsed storage shed. Looking south, near transformer station south of highway, west of Galena Creek.

HUSKY #2
(MINFILE#105M 001bb)

1. LOCATION AND ACCESS

The site is located downslope from the Elsa townsite, north of Highway #11, crossed by Flat Creek. Access to the site is by short roads from the highway. The site is accessible from Keno City by a 12 km drive west on Highway #11 to the first Elsa Townsite turnoff, continue past the first turnoff for 0.7 km then turn left (north/downhill) and follow the access road for ~0.5 km NW to the site. There is a locked gate at the entrance to the Husky access road. The Husky turnoff is the third left turnoff past the Elsa townsite junction. The site is located at latitude 63°54'26"N, longitude 135°30'53"W and at an elevation of 760 m. UTM co ordinates for the site are 7 086 77m N 474 740m E.

2. SITE PHYSIOGRAPHY

The site consists of mining structures constructed on a waste rock plateau. There is very little vegetation on the site. Soils that exist in the area are very coarse in texture. Vegetation that exists in the area of the mine site is stunted black spruce, a variety of willow, scrub brush and a variety of mosses and lichens. Site drainage is present southwest towards Flat Creek. The entire site access road is built on waste rock. The site is fairly leveled, with an elevation drop of about 15 m to the west. Drainage is south west towards Flat Creek; whole site access is built on waste rock; site is fairly level with elevation drops of 15m at mine waste dumps.

3. GEOLOGY AND MINERALIZATION

The Husky deposit is located near the base of Galena Hill and any surface exposure is covered by overburden and glacial till. The deposit is hosted in Keno Hill Quartzites with interbedded graphitic and micaceous schists and some greenstone sills. The vein material is reported to consist of siderite, argentiferous galena, quartz, pyrargyrite, calcite, barite, minor stephenite and polybasite, there is little evidence of any oxidation.

4. SITE HISTORY

The deposit was discovered using surface rotary percussion drilling in the mid-1960's. From 1968 to 1988 ore was mined from the 400 foot shaft with 2 raises constructed to the surface. Four main mining levels were located at 125, 250, 375 and 400 feet. A ramp was constructed from the 375 level to the 450 level. Total production was 389,519 tonnes at 1430g/t Ag, 3.9% Pb, and 0.4% Zn (Minfile 105M 001bb).

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

Husky mine is accessed via a shaft. The workings are flooded to surface. There are two raises to the surface. One of the raises was used for ventilation to the underground workings and has a heating furnace and downcast fans at the surface (photo 2-1).

Adits/Shafts/Portals

Raise

Location: Located on Husky mine site map106 m @ 325° from the main shaft headframe structure.
Dimensions (L x W x H): 2m x 2m x 8m.
Supports: The building concealing the raise is of wood frame construction with a painted plywood exterior.
Condition: Structure appears to be in good condition.
Accessibility: Structure was padlocked and no access was available to building.

Shaft

Location: Located on Husky mine site map adjacent to the hoist house.
Dimensions (L x W x H): Headframe building is 17m x 18m x 25m.
Supports: Information on the building can be found in Section 6.0 under Building 2A
Condition: Structure appears to be in good condition.
Accessibility: The shafthouse was padlocked, restricting any access to the interior.

5.2 Waste Rock Disposal Areas

Husky Shaft Dump

The dump is located on the north side of the shaft pad area. It consists mainly of quartzite with some quartz and minor amounts of schist. The quartzite has disseminated pyrite, arsenopyrite and quartz veinlets. The toe of the dump shows significant iron staining and precipitates. The vegetation near the flow is heavily stressed (photo 2-2).

Analyses was conducted on waste rock at the mine shaft dump during 1995. The following chart indicates the sample analyses.

Location	Sample ID	Paste PH	S (tot.) %	S (SO4) %	AP	NP	NET NP	NP/AP
					kg CaCO3/tonne			
Husky Shaft Dump	95UKHYD01	3.69	7.76	0.09	239.69	0.00	-239.7	<0.10

5.3 Tailings Impoundments

No tailings impoundments were encountered at the Husky mine site.

5.4 Tailings Dams

No tailings dams were noted at the site.

5.5 Tailings Ponds

No tailings ponds were noted at the site.

5.6 Minesite Water Treatment

No mine site water treatment facilities or operations were noted at the site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There were two areas of infrastructure at the Husky mine site. One area included a raise structure and a boiler house that were attached by an air duct. Both structures were used as a hot air ventilation unit to the underground workings. The main site was situated approximately 106m from the raise and included a shaft headframe, hoist house, and numerous outbuildings. A utilidor appears to extend from the raise and boiler down to the main site.

Building 2A – Shaft Headframe (photo 2-3)

The structure has been constructed over the main shaft.
Location: Located on the Husky mine site map approximately 14m from the hoist house.
Dimensions (L x W x H): 17m x 18m x 25m.
Construction: The building appears to be wood frame with metal sheathing encompassing the structure, roof and headframe. There are timber supports tied into the concrete pads on the southwall and timber supports on the north wall tied into a submerged concrete wall, both were constructed to stabilize the headframe structure.

Paint: No paint was noted on the exterior.

Asbestos: No asbestos was noted on the exterior.

Foundation: It appears from the exterior that the foundation is a floating concrete slab.

Non-Hazardous Contents: No contents were noted around the exterior of the building.

Hazardous Contents: There was one fuel drum that was not labeled sitting horizontally with a small amount of product having leaked from the bung. Soil staining was very minor.

Note: The building was locked and the interior was not accessible.

Building 2B – Hoist House (photo 2-4)

The structure was the hoist house adjacent to the shaft headframe building.

Location: Located on the Husky mine site location map approximately 14m from the head frame shaft house.

Dimensions (L x W x H): 24m x 12.5m x 10m.

Construction: The structure was wood frame and encased in exterior steel sheathing including the roof. The building had fibreglass insulation. A small wooden porch was located off the west end. The doors were metal. The hoist cable openings were stained with lubricants and tar. There were some tar stains located directly under the cable openings, however, soil staining was minor in nature.

Paint: There was no paint noted on the exterior.

Asbestos: No asbestos was noted on the exterior.

Foundation: The foundation consisted of a concrete pad.

Non-Hazardous Contents: No non-hazardous contents were noted around the exterior of the building.

Hazardous Contents: No hazardous contents were noted around the exterior of the building.

Note: The building was locked and the interior was not accessible.

Building 2C-Boiler House (photo 2-5)

The building housed a boiler and a diesel generator.

Location: The boiler house is located 18m to the southwest of the hoist house.

Dimensions (L x W x H): 10m x 7m x 6m.

Construction: The structure consists of wood frame construction sheathed in metal with wood panel doors. A utilidor is attached to the east side of the building. A plywood addition was located at the rear of the building.

Paint: No paint was noted in the building.

Asbestos: {estimate volume of friable asbestos as waste (e.g. exterior siding on collapsed building) and asbestos still in service (e.g., exterior and interior siding, vinyl-and-asbestos floor tiles}

Foundation: Concrete slab foundation.

Non-Hazardous Contents: No non-hazardous contents were noted.

Hazardous Contents: There were two ASTs located in the interior of the building in the northeast corner. There did not appear to be any contents, however, it was difficult to determine as the tanks were encompassed with building debris.

Note: Staining was noted in the exterior of the building on the concrete floor as well as on the exterior of the rear addition. No staining was noted on the surrounding soils. A large vertical AST was located at the rear of the boiler house.

Building 2D – Storage Shed (photo 2-5)

The building appeared to be used as a storage shed.

Location: Structure is directly adjacent to the west wall of the boiler house.

Dimensions (L x W x H): 2.5m x 4m x 4m

Construction: Wood frame construction with metal sheathing.

Paint: No paint was noted.

Asbestos: No asbestos was noted on the structure.

Foundation: Raised wood platform.

Non-Hazardous Contents: There were no hazardous contents noted.

Hazardous Contents: The interior of the structure was heavily stained with both tar and rock drill oil. There was a drip pan under a 200L drum of rock drill oil that contained some product. There was some minor staining at the entrance to the building. 3 - 200L drums were located at the rear of the building and were empty. Minor surficial staining was noted surrounding the drums.

Building 2E - Large Storage Shed (photo 2-6)

The building was padlocked, however, it appeared to be used for storage.

Location: The structure was located 15m to the northwest of the boiler house.

Dimensions (L x W x H): 16m x 5m x 4m

Construction: The structure was of wood frame construction with metal sheathing on exterior and roof.

Paint: No paint was noted on the exterior.

Asbestos: No asbestos was noted on the exterior.

Foundation: Raised timber foundation.

Non-Hazardous Contents: No non-hazardous contents were noted around the exterior of the building.

Hazardous Contents: No hazardous contents were noted around the exterior of the building.

Note: There was some metal debris that was noted along the south side of the building that included empty and rusted out drums (photo 2-7). There was no sign of staining around the perimeter of building 2E.

6.2 Fuel Storage

Location: An aboveground storage tank was located behind the boiler house (photo 2-8).

Above Ground Storage Tanks: The AST measured 3m in height and 2 m in diameter and consisted of steel bolted construction. There appeared to be staining along the bolted joints (photo 2-9). Soil staining was evident around the perimeter of the tank. There was heavy staining at the valves. A waste rock berm extends around the perimeter of the AST. Samples were not collected as the area surrounding the AST consisted exclusively of large waste rock.

6.3 Rail and Trestle

There were rails extending approximately 25m from the shaft house and stopped abruptly, rail debris and cars were abandoned in this area (photo 2-10). Approximately 28 rail cars were located behind building 2E (photo 2-11).

6.4 Milling and Processing Infrastructure

No milling or processing infrastructure was noted at the site.

6.5 Electrical Equipment

There were three transformers at the site located to the southeast of the boiler house (photo 2-12). No samples were taken as the transformers were still in use and the perimeter was fenced and padlocked.

7. SOLID WASTE DUMPS

No solid waste dumps were identified at the site.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No out-of-service transformers were noted at the site.

8.2 Metals and Hydrocarbons in Soil

Soil staining was apparent in numerous areas of the site. Most of the areas were surficial in nature and did not appear to be an adversely affecting the surrounding environment. The major area of concern noted was the aboveground storage tank. There is staining around the perimeter of the AST and it is difficult to determine the extent of contamination as the AST was placed on top of waste rock as well as the perimeter bermed with waste rock. Samples were not taken as the sample medium was too coarse to provide a representative sample.

8.3 Liquid Hazardous Materials

There were only 2 drums that contained product. One unlabelled 200L drum was located to the east of the headframe shaft house. There was some very minor leakage and the drum was ¾ full of unknown product. A sample of the product was not taken as the drum itself was in poor condition, lying horizontal and the bung was inaccessible.
Location(s): Behind headframe shaft house.
Volume(s): 150L
Label information: Unlabelled
Contents: Unknown

The second drum was located in the small storage shed (building 2D). The drum was labeled as "rock drill oil" and had been placed horizontally with only residue remaining in the drum. A drip pan had been placed under the nozzle.
Location(s): Building 2D
Volume(s): Residue
Label information: Rock drill oil
Contents: Hydrocarbon based liquid

8.4 Solid Hazardous Materials

No solid hazardous waste materials were noted at the site.

9. WATER QUALITY

Mine water from this site flows through a drainage system that extends underground from the shafthouse and discharges under the toe of the waste rock dump.

Two water quality samples were taken at the site. Sample 02-03-water was collected 78m from the headframe building @170° (photo 2-2). The sediments at this location were orange brown with a noticeable sheen on the surface. Water flow rate at the sample location was .3L/s with a pH level of 2.6 and conductivity at 147 µS.

Sample 02-04-water was collected 200m downstream of sample 02-03-water at the toe of the dump. Water flow at this location was .3L/s with a pH of 3.6 and conductivity of 99µS. The vegetation at the sample location appeared to be stressed.

Laboratory metal analysis, pH and conductivity results on both samples can be found in Attachment B.

10. RECLAMATION

There did not appear to be any reclamation measures carried out by past or present site operators. Some scrub brush and willows have grown on the site, however, very little natural revegetation has occurred.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

DIAND 1984 YUKON GEOLOGY Volume 1, pp83-87.

Table B1. 1999 Water Quality Results, Husky Site

Sample Number		Detection Limit	Units	Site 02-03-Water Husky - 99/09/16	Site 02-04-Water Husky - 16/09/99
pH (field)					
Conductivity (field)					
pH (Lab)		0.01	pH	1.98	3.46
Conductivity (Lab)		0.01	µS/cm	13000	1450
Total Alkalinity		5	mg CaCO3/L	<5	<5
Chloride		0.01	mg/L	na	1.4
Chloride		5	mg/L	<5	na
Hardness (CaCO3 equiv)		5	mg/L	457	557
Nitrate-N		0.05	mg/L	364	na
Nitrite-N		0.003	mg/L	0.15	0.003
Sulphate		1	mg/L	1020	740
Total Dissolved Solids		5	mg/L	3420	1240
ICP-USN Total Metals Scan in Water					
	Aluminum	0.0008	mg/L	10.9	6.68
	Antimony	0.005	mg/L	<0.005	<0.005
	Arsenic	0.01	mg/L	0.1	<0.01
	Barium	0.00004	mg/L	0.00929	0.0475
	Beryllium	0.00001	mg/L	0.002	0.00114
	Bismuth	0.0004	mg/L	0.0005	<0.0004
	Boron	0.002	mg/L	0.078	0.022
	Cadmium	0.00006	mg/L	0.0849	0.0469
	Calcium	0.002	mg/L	113	169
	Chromium	0.00006	mg/L	0.0152	0.00549
	Cobalt	0.00003	mg/L	0.11	0.0609
	Copper	0.00003	mg/L	0.736	0.284
	Iron	0.00001	mg/L	99.8	13
	Lead	0.0003	mg/L	0.184	0.0257
	Lithium	0.001	mg/L	0.031	0.024
	Magnesium	0.0005	mg/L	40.6	44.8
	Manganese	0.00002	mg/L	8.48	8.26
	Mercury	0.0001	mg/L	<0.0001	<0.0001
	Molybdenum	0.00007	mg/L	<0.00007	<0.00007
	Nickel	0.00001	mg/L	0.279	0.144
	Phosphorus	0.03	mg/L	0.17	0.05
	Potassium	0.4	mg/L	<0.4	0.5
	Selenium	0.004	mg/L	0.014	0.007
	Silicon	0.004	mg/L	9.02	8.61
	Silver	0.00005	mg/L	0.0125	0.00366
	Sodium	0.4	mg/L	1.3	1.8
	Strontium	0.00002	mg/L	0.183	0.242
	Sulphur	0.008	mg/L	372	247
	Thallium	0.001	mg/L	0.079	0.044
	Titanium	0.00002	mg/L	0.00074	0.022
	Vanadium	0.00003	mg/L	<0.00003	0.00232
	Zinc	0.0002	mg/L	5.82	3.07
Total Arsenic by Hydride AA					
	Arsenic	0.0002	mg/L	0.108	0.0036
Total Selenium by Hydride AA					
	Selenium	0.0001	mg/L	<0.0001	<0.0001

HUSKY SOUTHWEST #2
(MINFILE # 105M 001bb)

1. LOCATION AND ACCESS

From Keno City drive 14 km west on Highway #11 just past the Elsa Townsite turn left (approximately 0.3 km past the Flat Cr. crossing) follow the access road for ~0.8 km NW to the site. There is a locked gate at the entrance to the Husky SW access road. The site is at latitude 63°54'26"N and longitude 135°30'53"W with an elevation of 970m. UTM co ordinates for the site are 7 086 77m N 474 740m E.

2. SITE PHYSIOGRAPHY

The site consists of mining structures constructed on a waste rock plateau. There is very little vegetation on the site. Soils that exist in the area are very coarse in texture. Vegetation that exists in the area of the mine site is stunted black spruce, a variety of willow, scrub brush and a variety of mosses and lichens.

3. GEOLOGY AND MINERALIZATION

The Husky deposit is located near the base of Galena Hill and any surface exposure is covered by a significant depth of overburden and glacial till. The deposit is hosted in Keno Hill Quartzites with interbedded graphitic and micaceous schists. The vein material is reported to consist of quartzite breccia, quartz, with pirite/graphitic veinlets. The mineralization occurs as non-visual native silver with minor argentite and stephanite. There is very little galena and almost no sphalerite associated with this deposit.

4. SITE HISTORY

From 1987 to 1988 a 600 foot shaft was developed with partial development on 3 levels and was connected to the Husky mine site on the 250 level. Total production was estimated at 9,490 tonnes @ 1358g/t Ag, 0.3% Pb, 0.1% Zn and some gold.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

The Husky southwest mine is accessed via a shaft. The workings are flooded to surface and are hydraulically connected with the Husky workings. The headframe structure and shop buildings remain onsite and in good condition.

Husky SW Shaft

Location: Main workings, located at the north of the hoist house.
Dimensions (L x W x H): Shaft house is 15m x 8m x 25m.
Supports: Head frame structure is supported.
Condition: The structure appears to be stable.
Accessibility: The building is padlocked.

5.2 Waste Rock Disposal Areas

Husky SW Shaft Dump

The dump is located on the northwest (downhill) side of the shaft pad area. It consists of a base of glacial till excavated from the shaft pad covered with development material. The development waste consists of quartzite with some quartz and minor amounts of schist. The quartzite has disseminated pyrite. The waste dump has stockpiles of ore remaining on its surface. The ore consists of Quartzite breccia flooded with quart stringers containing both disseminated and veinlets of pyrite and arscenopyrite

Analyses was conducted on waste rock at the mine shaft dump during 1995. The following chart indicates the sample analyses.

Location	Sample ID	Paste PH	S (tot.) %	S (SO4) %	AP	NP	NET NP	NP/AP
					kg CaCO3/tonne			
Husky SW Shaft Dump	95UKHWD01	3.72	0.96	0.28	21.25	0.00	-21.3	<0.10

5.3 Tailings Impoundments

No tailings impoundments were noted at the site.

Tailings Dams

There were no tailings dams noted at the site.

Tailings Ponds

There were no tailings ponds noted at the site.

5.4 Minesite Water Treatment

There were no minesite water treatment facilities at the site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

The buildings at the Husky Southwest mine site appear well maintained and consist of a shaft headframe, hoist house and various outbuildings. An active transformer compound is also present at the site (photo 2-12). A utilidor extends from the rear of the shaft headframe to the west side of the hoist house.

Building 2H – Workshop (photo 2-13)

The building was used as a workshop.
Location: Listed as building 2H on the Husky SW site map.
Dimensions (L x W x H): 6m x 4m x 5m.
Construction: The structure consisted of wood frame construction with metal sheathing on the exterior and roof.
Paint: There was no paint noted on the interior.
Asbestos: No asbestos was noted on the building.
Foundation: The foundation consisted of raised wood platform.
Non-Hazardous Contents: There were no containers noted inside the building.
Hazardous Contents: No hazardous contents were noted in the building.

Building 2I – Shaft House and Headframe (photo 2-14)

The structure consisted of a shaft house and headframe.
Location: Listed as building 2I on the Husky SW site map.
Dimensions (L x W x H): 15m x 4m x 5m (headframe structure measured 25m in height).
Construction: The structure consisted of wood frame construction with exterior galvanized steel sheathing. A timber reinforcement structure was located on the west wall of the building to stabilize the headframe.
Paint: No paint was noted on the interior.
Asbestos: No asbestos was noted.
Foundation: The foundation consisted of both plank flooring and soils.
Non-Hazardous Contents: No non-hazardous contents were noted at the site during the inspection.
Hazardous Contents: No hazardous contents were noted during the site inspection.

Building 2J – Hoist House (photo 2-15)

The building served as the hoist house, administration offices, and garage.

Location: Listed as building 2J on the Husky SW site map.

Dimensions (L x W x H): 35m x 12m x 10m

Construction: The building was wood frame with galvanized steel exterior and roof.

Paint: Interior was not accessible, no paint was noted on exterior.

Asbestos: No asbestos was noted at the site.

Foundation: Concrete pad foundation.

Non-Hazardous Contents: There were no non-hazardous contents noted at the building site.

Hazardous Contents: An aboveground storage tank was located on the northwest corner of the building and was incorporated into the structure(photo 2-15). Secondary containment consists of a concrete berm that extends half way up the AST. The tank is open to the elements, however, it is located under a building overhang (photo).

Note: The area to the west of the building has scattered debris. Approximately 300 bags of powder concrete are stacked. Approximately half of the bags have been exposed and are no longer useful. There is various metal debris scattered, one empty AST was noted, and a fuel drum that was labeled as motor oil Chevron 200L was ¾ full. There is some staining surrounding the fuel drum indicating that it is or has been leaking. Area impacted is approximately 4m x 2m. Two air compressor tanks are located on the south wall of the hoist house (photo 2-16). The tanks are situated on a concrete pad and are piped into the utilidor that enters the hoist house at this point. Both tanks measure 6m in height and 3m in diameter.

Building 2K – Atco Trailer (photo 2-17)

Structure appears to be used as a storage shed for miscellaneous debris.

Location: Listed as building 2K on the Husky SW mine site map.

Dimensions (L x W x H): 11m x 3m x 3m

Construction: The trailer is metal.

Paint: The trailer is painted yellow and brown – no samples were taken.

Asbestos: No asbestos was noted.

Foundation: No foundation.

Non-Hazardous Contents: No non-hazardous contents were noted.

Hazardous Contents: No hazardous contents were noted.

Note: It appears that the site is maintained and potentially in use. The above information regarding non-hazardous and hazardous contents pertains to the date of the site inspection and may potentially change should the site be in use.

Building 2L – Detonator House (photo 2-18)

Ammunitions magazine.

Location: The detonator house was located on the access road to the mine site.

Dimensions (L x W x H): 3.5m x 3m x 3.5m

Construction: The structure is a wood frame, metal clad building with metal roof and metal padlocked door.

Paint: Interior was not accessible; no paint was noted on exterior.

Asbestos: No asbestos was noted at the site.

Foundation: Structure was situated on steel sleds.

Non-Hazardous Contents: There were no non-hazardous contents noted at the building site.

Hazardous Contents: No hazardous materials were noted at the site.

6.2 Fuel Storage

There was one aboveground storage tank (photo 2-15) that was located on the northwest corner of the hoist house. The tank was welded steel and no leaks were noted - no staining was noted in the concrete secondary containment.

There were two 200L drums labeled as torque fluid. One of the drums was horizontal on a wood platform with a closed bottom valve (photo 2-19). The drums did not contain any product or residue however, the area around the horizontal drum was stained. Intrusive investigation indicated that the contamination was surficial. The area of contamination was estimated at 10m x 8m with an approximate depth of .25m.

6.3 Rail and Trestle (photo 2-20)

Location: There was a track that extended from the interior of the headframe building to just beyond the hoist house. There were six rail cars that had been abandoned beside the rails.

Fabrication: Steel tracks with wooden ties.

Amount of materials: Tracks extended 60m.

Condition: The tracks and ties appear to be in good condition.

6.4 Milling and Processing Infrastructure

There were no milling or processing structures at the site.

6.5 Electrical Equipment

In-Service Transformers

There was a transformer station at the site that was fenced and padlocked (photo 2-12). The transformers were situated on a concrete pad. They were still in service at the time of the site inspection, however, admittance to the transformers was restricted by padlock and no identification of the equipment was attempted. No samples were taken. These transformers were older and may contain PCB's.

A utilidor extends from the shaft headframe building on the south wall to the hoist house and is protected by a fibreglass insulated 1m x.5m boxed plywood receptacle with power cables running alongside (photo 2-21).

7. SOLID WASTE DUMPS

No solid waste dumps were noted at the site.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

There did not appear to be any out-of-service transformers at the site.

8.2 Metals and Hydrocarbons in Soil

There was surficial staining in various areas of the site that indicated some hydrocarbon contamination. The stained areas were investigated. All were determined to be surficial in nature and did not appear to pose any severe environmental conditions that would adversely affect surrounding receptors. Samples were not taken of the soils.

8.3 Liquid Hazardous Materials

<u>Location(s)</u>: One drum was noted at the site.
<u>Volume(s)</u>: 200L.
<u>Label information</u>: labeled as Chevron motor oil.
<u>Contents</u>: ¾ full of product.

8.4 Solid Hazardous Materials

No solid hazardous materials were noted at the site.

9. WATER QUALITY

Two samples were taken at the Husky SW mine site. The first sample (02-01-upswater) was taken above the site (photo 2-22). The water was clear and there was abundant mosses and lichens along the rock faces. The sample was taken on the south side of the road at the culvert. Water flow at the sampling location was .75L/s with a field testing of 7.6 pH and conductivity at 18μS. Laboratory sample results can be found in Attachment B.

The second sample (02-02-water) was collected at the toe of the waste rock dump (photo 2-23). Flow rate at the sampling location was 0.1L/s with field testing indicating a pH of 7.1 and conductivity of 132 μS. Laboratory sample results can be found in Attachment B.

Previous Environmental Studies/Sampling

Documentation from the United Keno Hills Mines Limited (Report No. UKH/96/01 Site Characterization) indicates that the drainage from the Husky SW shaft has been reasonably consistent in chemistry and flow over the past five years. The pH values are generally alkaline in nature - approximately 7. Zinc appears to be the primary contaminate of interest with occasional spikes of other metals above detection limits.

The chart below indicates results from a water sampling program conducted in 1995. The sample was collected 500m downstream from the discharge point.

Sample	PH	Alkalinity	SO4	Fet	Fed	Znt	Znd
Shaft Discharge	6.9	135	685	16.3	9.68	0.555	0.45
500m Downstream	8.2	120	762	4.3	0.01	0.071	0.024

10. RECLAMATION

There has been little natural revegetation in the area, possibly due to the fact that the mine has been recently active. It does not appear that reclamation measures have been carried out by past or present site operators.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

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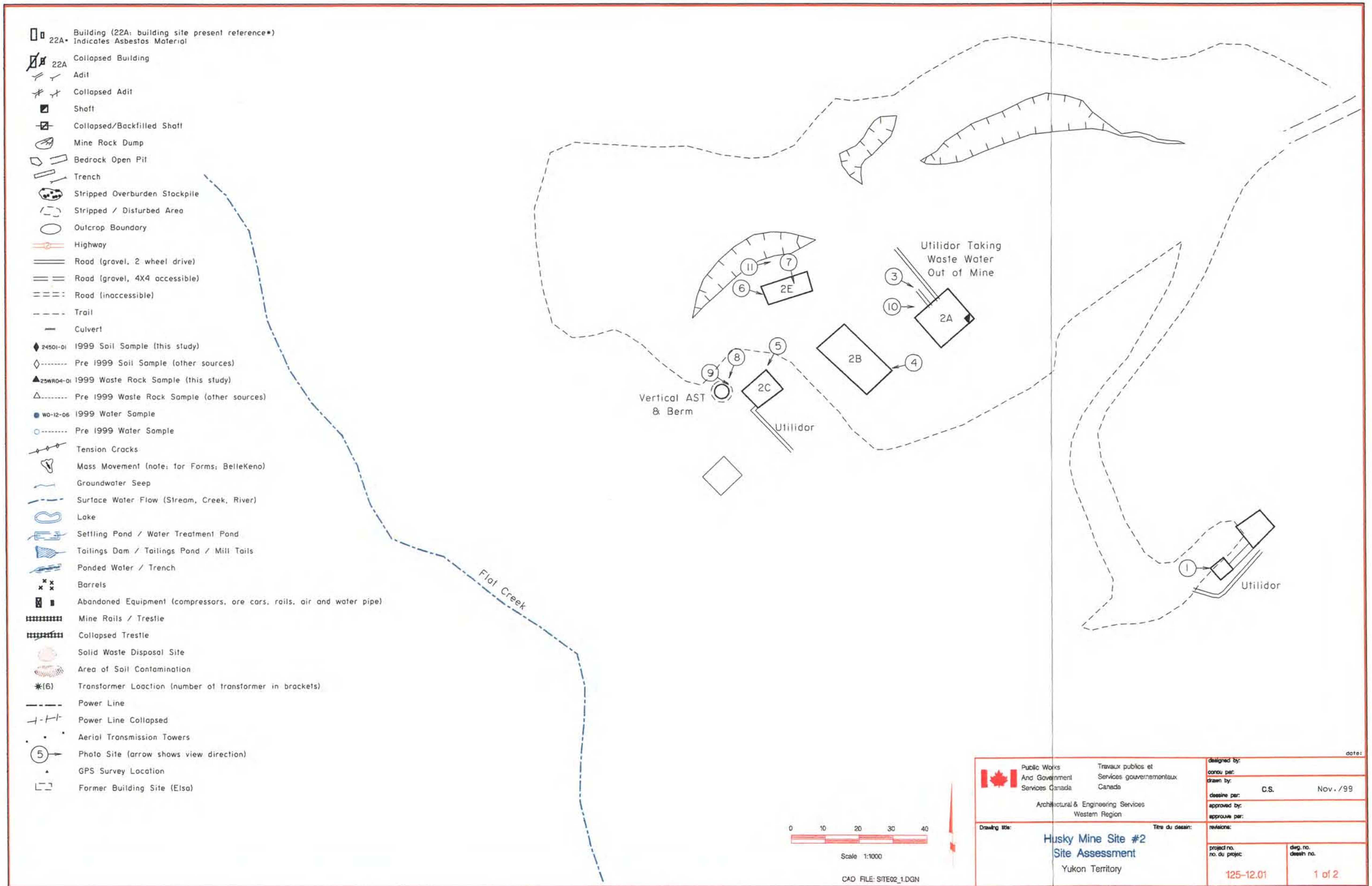
Table B1. 1999 Water Quality Results, Husky Southwest Site

		Detection Limit	Units	Husky SW 02-01-Upswater - Husky SW - 99/09/16	Site 02-02 - Husky - 99/09/16
pH (field)					
Conductivity (field)					
pH (Lab)		0.01	pH	7.62	1.84
Conductivity (Lab)		0.01	µS/cm	490	21000
Total Alkalinity		5	mg CaCO3/L	230	<5
Chloride		0.01	mg/L	na	na
Chloride		0.25	mg/L	<0.25	<5
Hardness (CaCO3 equiv)		5	mg/L	257	1160
Nitrate-N		0.05	mg/L	0.14	730
Nitrite-N		0.003	mg/L	<0.003	0.013
Sulphate		1	mg/L	21.5	952
Total Dissolved Solids		5	mg/L	308	3100
ICP-USN Total Metals Scan in Water					
	Aluminum	0.0008	mg/L	0.0203	0.008
	Antimony	0.005	mg/L	<0.005	<0.005
	Arsenic	0.01	mg/L	<0.01	<0.01
	Barium	0.00004	mg/L	0.0822	0.0111
	Beryllium	0.00001	mg/L	<0.00001	<0.00001
	Bismuth	0.0004	mg/L	<0.0004	<0.0004
	Boron	0.002	mg/L	<0.002	0.008
	Cadmium	0.00006	mg/L	0.00012	0.0388
	Calcium	0.002	mg/L	72.8	336
	Chromium	0.00006	mg/L	<0.00006	<0.00006
	Cobalt	0.00003	mg/L	<0.00003	0.00171
	Copper	0.00003	mg/L	0.0013	0.00381
	Iron	0.00001	mg/L	0.048	0.084
	Lead	0.0003	mg/L	<0.0003	0.003
	Lithium	0.001	mg/L	0.002	0.026
	Magnesium	0.0005	mg/L	17.4	90.7
	Manganese	0.00002	mg/L	0.0118	1.95
	Mercury	0.0001	mg/L	<0.0001	<0.0001
	Molybdenum	0.00007	mg/L	0.00029	0.00021
	Nickel	0.00001	mg/L	0.0002	0.0951
	Phosphorus	0.03	mg/L	<0.03	<0.03
	Potassium	0.4	mg/L	0.5	4.1
	Selenium	0.004	mg/L	0.011	0.004
	Silicon	0.004	mg/L	2.49	2.83
	Silver	0.00005	mg/L	<0.00005	0.00014
	Sodium	0.4	mg/L	0.6	5.6
	Strontium	0.00002	mg/L	0.207	0.613
	Sulphur	0.008	mg/L	7.43	350
	Thallium	0.001	mg/L	<0.001	0.002
	Titanium	0.00002	mg/L	0.0003	<0.00002
	Vanadium	0.00003	mg/L	<0.00003	<0.00003
	Zinc	0.0002	mg/L	0.0138	2.25
Total Arsenic by Hydride AA					
	Arsenic	0.0002	mg/L	0.0006	0.0007
Total Selenium by Hydride AA					
	Selenium	0.0001	mg/L	<0.0001	<0.0001



22A• Building (22A: building site present reference•) Indicates Asbestos Material
22A Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WO-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Flat Creek
Utilidor Taking Waste Water Out of Mine
2E
2A
2B
2C
11
7
6
3
10
8
5
9
4
1
Vertical AST & Berm
Utilidor
Utilidor
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Scale 1:1000
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Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title:
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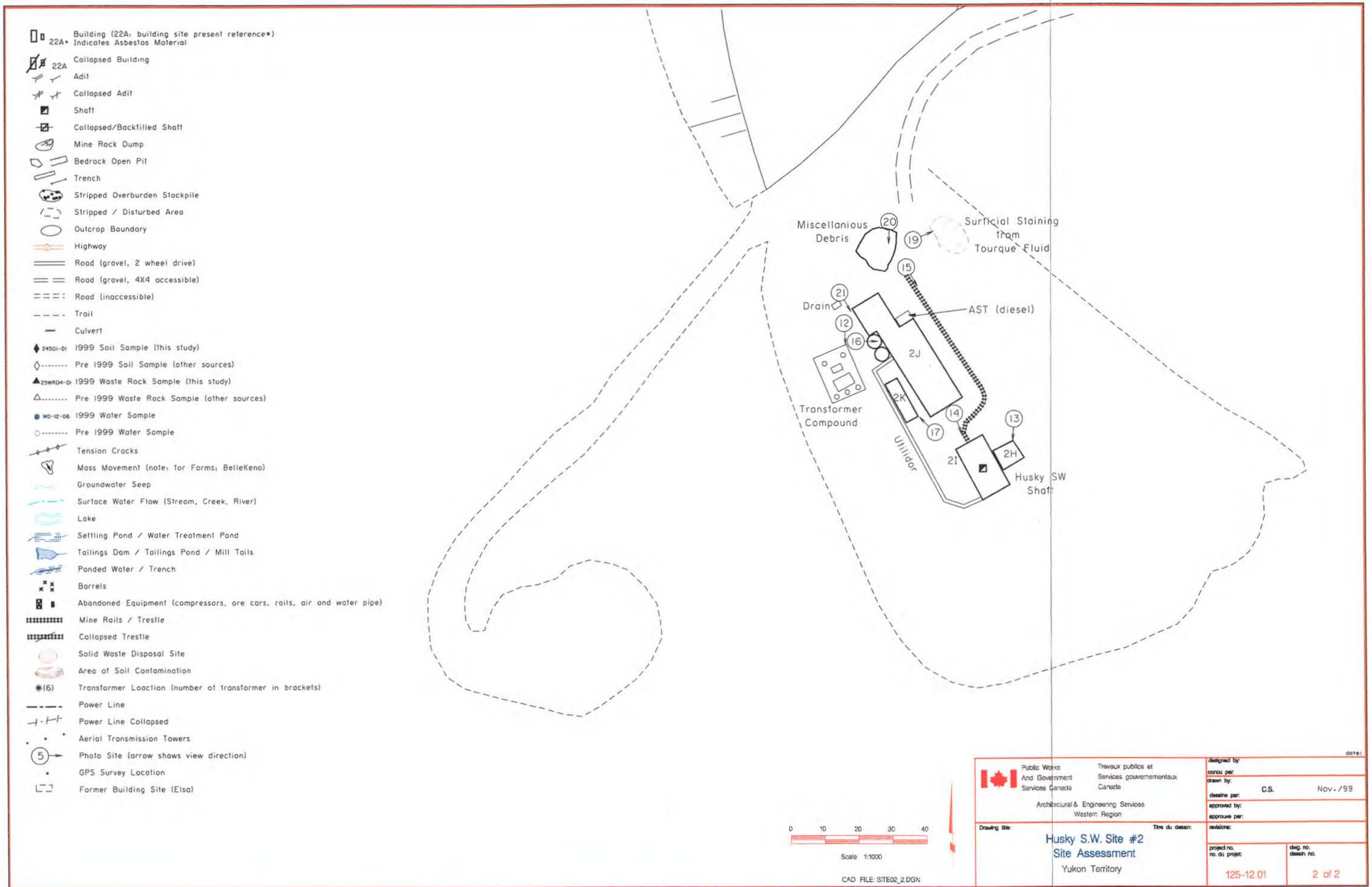
Site Assessment
Yukon Territory
designed by: conçu par:
drawn by: dessiné par: C.S.
date: Nov./99
approved by: approuvé par:
revisions:
project no. no. du projet: 125-12.01
dwg. no. dessin no.: 1 of 2


Building (22A: building site present reference*)
22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WO-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Miscellanious Debris
20
19
Surficial Staining from Tourque Fluid
15
21
Drain
AST (diesel)
12
16
2J
2K
Transformer Compound
14
13
17
Utilidor
2I
2H
Husky SW Shaft
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Scale 1:1000
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Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services
Western Region
Drawing title:
Titre du dessin:
Husky S.W. Site #2
Site Assessment
Yukon Territory
designed by:
concu par:
drawn by:
dessine par:
C.S.
date:
Nov./99
approved by:
approuve par:
revisions:
project no.
no. du projet
125-12.01
dwg. no.
dessin no.
2 of 2

Photo 2-1: Boiler house down draft raise & duct.

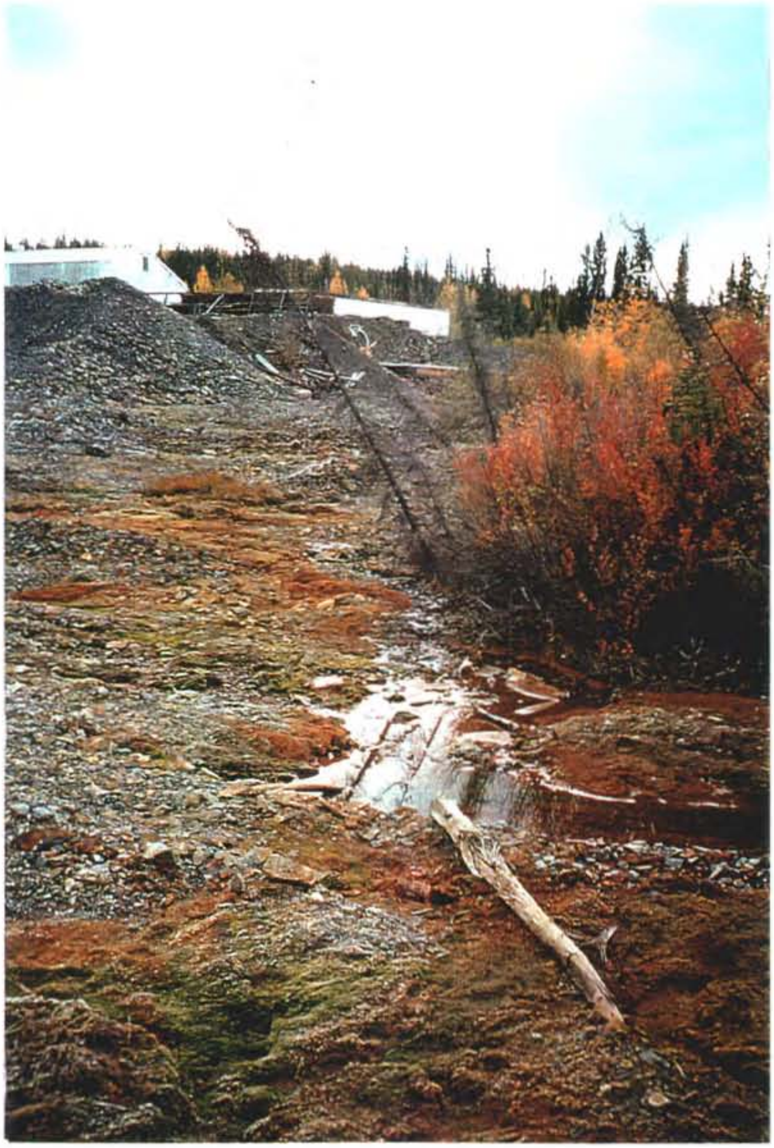


Photo 2-2: Sample location 02-03, water taken 98 m from headframe.

Photo 2-3: Shaft & headframe.

Photo 2-4: Hoist house.

Photo 2-5: Boiler house.

Photo 2-6: Large storage shed.

Photo 2-7: 200L drums at rear of storage shed.

Photo 2-8: AST behind boiler.

Photo 2-9: AST & piping.

Photo 2-10: West side of headframe.

Photo 2-11: 28 Rail cars.

Photo 2-12: Transformer compound.

Photo 2-12: Power compound generating station.

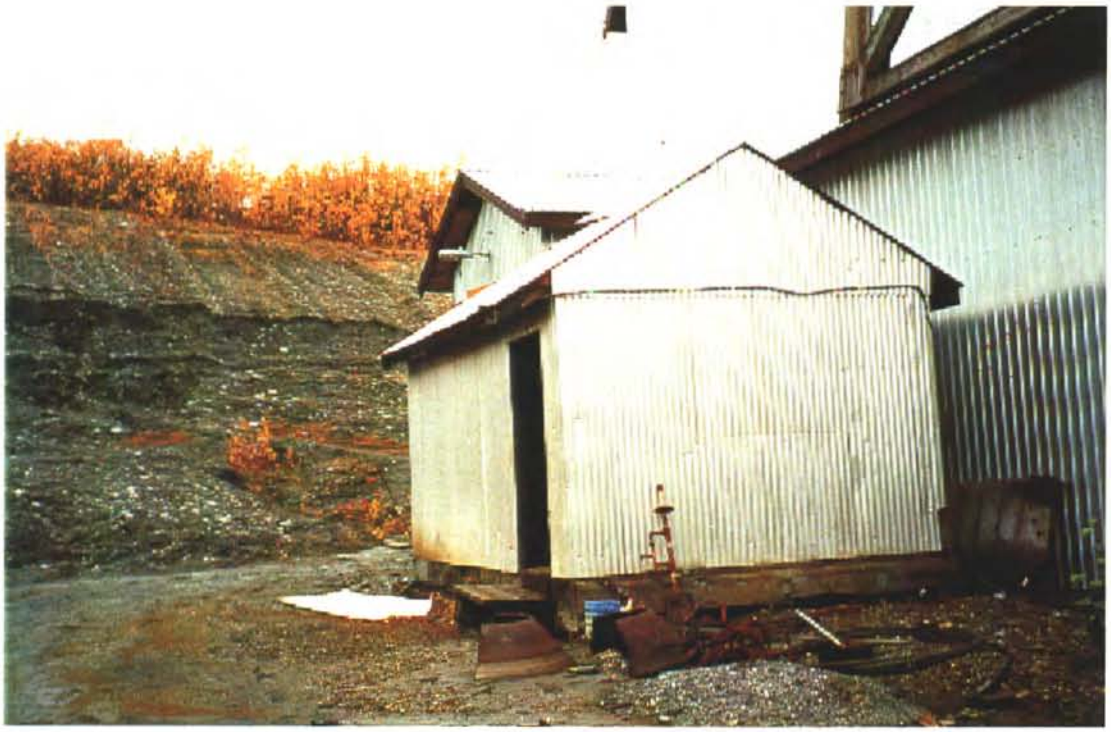


Photo 2-13: Building 1 - Workshop.

Photo 2-14: Shaft headframe house.

Photo 2-15: Structures at site.

Photo 2-16: Air compressor tanks, south wall.

Photo 2-17: Atco trailer.

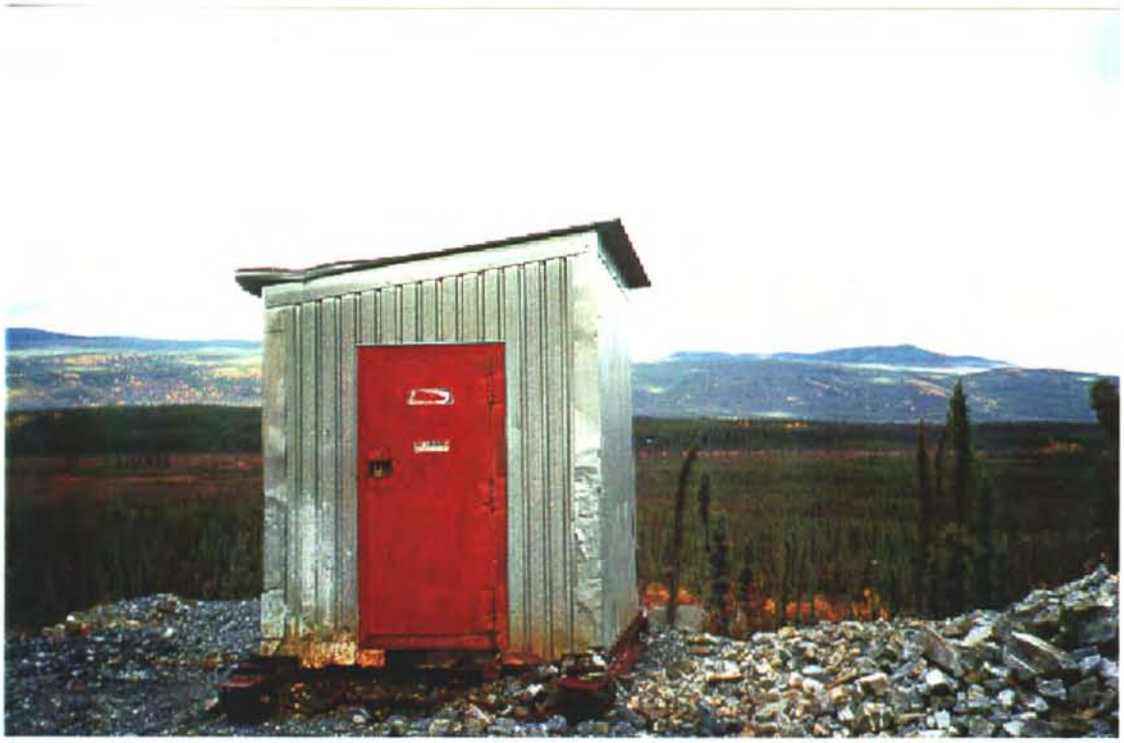


Photo 2-18: Ammunitions magazine

Photo 2-19: Torque fluid 200L staining is evident.

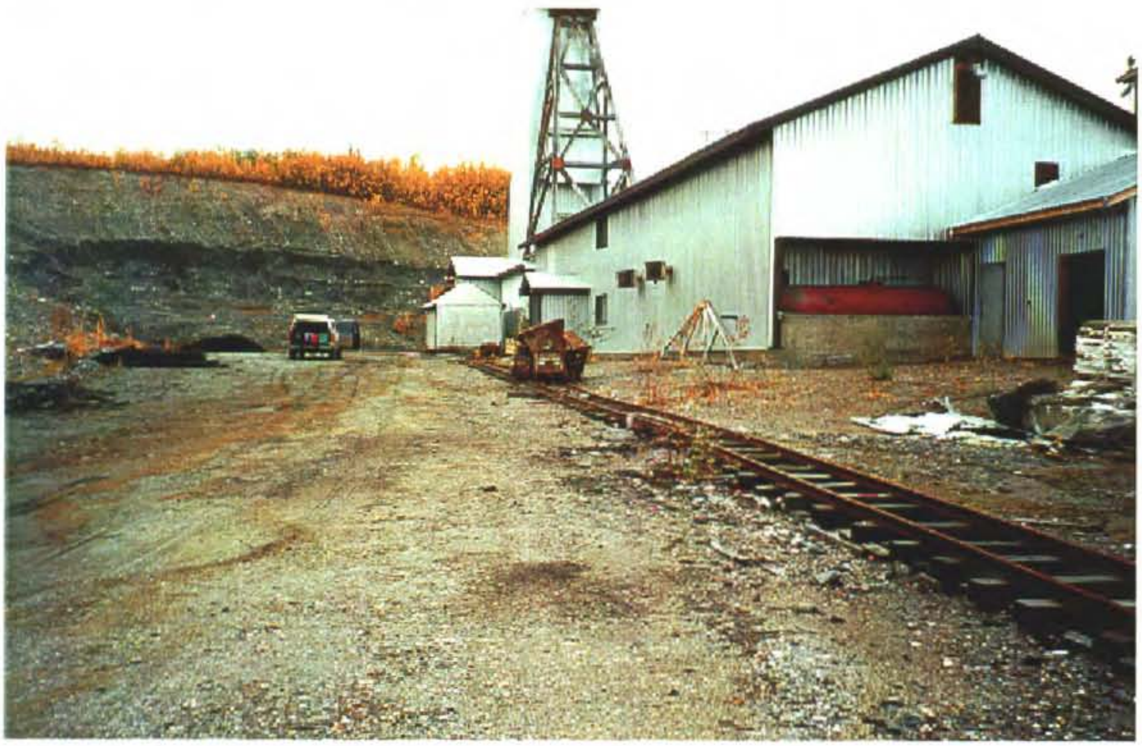


Photo 2-20: Tracks & Cars.

Photo 2-21:

Photo 2-22: Sample location 02-01 - upstream. Sample location just off Hwy 2 at culvert.

ELSA MINE

SITE #3

MINFILE #105M OO1a

1. LOCATION AND ACCESS

The main production level (400) portal is within the Elsa town site, about 100m from the mill, at an elevation of 940m. UTM co-ordinates for this location are 7 087 000m N and 476 000m E (Latitude 63 54 36°N and Longitude 135 29 06°W)

2. SITE PHYSIOGRAPHY

The site is on the north-facing slope of Galena Hill. Three creeks flow over the mine area; Porcupine Creek, Brefalt Creek and Flat Creek. The entire area drains into the Flat Creek drainage system. The sites of development are overgrown with thick second growth dominated by alder and willow. The area is likely underlain by permafrost.

3. GEOLOGY AND MINERALIZATION

Two principal veins are hosted by massive, thick-bedded quartzite with minor greenstone lenses. The veins form a Y-junction, and are cut by several post-ore faults. The veins are very highly oxidized from surface down to the 400 level. Near surface the mineralization consists of highly altered siderite, galena, pyrite, freibergite, cerrusite, anglesite, native silver, pyrargyrite, argentite, beudantite, bindhemite, silver-bearing jarosites, quartz, limonite and manganese oxides. At depth the primary sulphide ore is dominated by quartz, pyrite and galena, with relatively little sphalerite, and minor chalcopyrite.

4. SITE HISTORY

The Elsa mine has operated during three periods: 1928 to 1941, 1948 to 1951 and 1955 to 1988. Site development began in 1928 at the upper levels of the mine. The 200 and 400 levels were the main production levels. Adits were driven at +50, 50, 100, 200 and 400 levels, and the Gravel adit. The Elsa town site and mill were built to service the Elsa mine. The 1948 to 1951 era saw minor production and development, including raises driven to surface. In the 1955 to 1988 era an internal shaft was sunk 375 feet below the 400 level. There are a total of 8 levels developed and stoped. Backfill was used to stabilize the mine in the later years of production. Pebble-sized screened fill was sent underground by pipes from a site west of the 200 portal. A small open pit was excavated in the 50 portal area. Total mine production was 445,440 tonnes averaging 2105 g/t silver, 4.9% lead and 1.4% zinc, the second largest producer of silver in the Keno Hill district.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

Adits/Shafts/Portals

400 Level Portal (Photo 3-1)

Description: The portal is covered with an insulated, asbestos-clad building. Tracks from underground lead across the road to a dump chute and to the mill.

Location: The portal is in the Elsa town site, near the crusherhouse and mill (Building #20).

Dimensions (L x W x H): Adit is about 6' by 7'.

Supports: Portal building is of wood-frame construction. The mine was not inspected underground.

Condition: Appears to be very stable.

Accessibility: The portal door was left open for inspection, but can be locked. This site is inspected by mine employees several times per day, as it is in the town.

200 Level Portal (Photo 3-4)

Description: This portal was the major production level during the early years of the mine. The portal is in good condition, with a locked steel door. Tracks from underground lead to an ore dump station. Two ore cars are present on the tracks. Virtually all of the ore has been removed from the ore dumpsite.

Location: Located on the west side of Porcupine Creek, just above lower Calumet Drive and the Elsa town site.

Dimensions (L x W x H): Portal is about 6' by 7'.

Condition: The portal appears to be very stable, but the ore dump structure is perched on a steep bank that has been undermined

Accessibility: Access underground is blocked by a locked steel door.

Note: This mine level is reported by local residents to have high radon levels.

100 Level Portal

Description: Portal is collapsed, level part of waste dump is overgrown by alders. The waste rock appears to be almost entirely barren country rock. Ore from this level was delivered to the mill from the 200 or 400 levels.

Location: Located on west side of Porcupine Creek, below the 50 Level.

Dimensions (L x W x H): Unknown.

Supports: Unknown.

Condition: Portal is completely collapsed.

Accessibility: No access to underground.

50 Level Portal/ Open Pit Site (Photo 3-7)

Description: A small open pit was mined in the 50 portal area to remove a crown pillar of ore in the late 1980's. A small shed is present. The portal was not located, and has likely been destroyed by the open pit.

Location: Below Calumet Drive, west of Porcupine Creek.

Dimensions (L x W x H): Main disturbed area is about 50 by 50m.

Supports: None observed.

Condition: Site appears to be fairly stable.

Accessibility: Easy access from Calumet Drive. No access to underground observed.

Gravel Portal

Description: A collapsed adit, site totally overgrown. Waste dump appears to consist of overburden only.

Location: Just above Porcupine Creek on the east side, opposite the 100 level portal.

Dimensions (L x W x H): Unknown.

Supports: Unknown.

Condition: Totally collapsed.

Accessibility: No access to underground. Site accessed by walking along creek.

+50 Portal (Photos 3-8, 3-9)

Description: Portal is collapsed. Level part of site is totally overgrown. Steep bank of waste dump is not vegetated, shows some slumping. Two small, collapsed raises were found uphill from the adit.

Location: Above Porcupine Creek on east side, below Calumet Drive.

Dimensions (L x W x H): Unknown.

Supports: Some rotten timbers present.

Condition: Portal is collapsed.

Accessibility: No access to underground.

Powderhouse Corner Vent Raise (Photo 3-6)

Description: A vent raise that has been backfilled is subsiding. A hole is present, with minor pipe and timber indicating mine association.

Location: The raise is about 5m from Calumet Drive, at a switchback corner known as powderhouse corner.

Dimensions (L x W x H): A pit about 10m by 10m wide and 5m deep is present.

Supports: Unknown.

Condition: Appears to be unstable.

Accessibility: Easy access from Calumet Drive.

Note: There is a northeast-trending linear depression evident about 100m uphill from this site. The depression crosses Calumet Drive, and is thought to be due to stope subsidence.

Shaft Northwest of Ball Field

Description: A shallow, overgrown depression was found that may have been a test pit. Note that this "shaft" is not connected to the main Elsa mine, and appears to be only a shallow pit.

Location: Downhill from the Ball Field, near the ski hill.

Dimensions (L x W x H): 1.5m by 1.5m by 0.5m deep.

Supports: Unknown.

Condition: Stable.

Accessibility: Not a significant site, easy access.

Shaft South of Aurora Heights

Description: A depression is present at the side of a minor road. Some pipe and timber suggest that this is a backfilled vent raise. Water was observed draining into the depression from a ditch.

Location: A minor road leads from powderhouse corner to the southwest.

Dimensions (L x W x H): The depression is about 2m by 2m by 0.5m deep.

Supports: Unknown.

Condition: May be unstable.

Accessibility: No access to underground. There is easy access to the site from minor road.

Tick Shaft (photo 3-10)

Description: A small, collapsed inclined shaft with small timber hoist frame mounted above. Note that this shaft is not connected to the main Elsa mine.

Location: In dense alder woods west of Elsa town, above Silver Trail highway.

Dimensions (L x W x H): Unknown, appears to have been about 1.5m by 1.5m.

Supports: Some rotten timbers present.

Condition: Collapsed.

Accessibility: No access to underground.

Backfill Site (photo 3-5)

Description: A large-diameter pipe leads underground from surface. Gravel sized rock was delivered underground for use as backfill. Piles of gravel are present, and minor timbers, pipe, and other materials.

Location: Located west of the 200 portal, just above lower Calumet Drive.

Dimensions (L x W x H): Unknown.

Supports: Unknown.

Condition: Site appears to be stable.

Accessibility No access to underground except through pipe, diameter approximately 20 cm.

Open Pits

A small pit was excavated around the 50 adit – see description above.

Trenches

No significant trenches were identified at the site, except near the 50 portal pit. The thick growth present on older disturbed areas may obscure trenching. It is likely that the surface trace of the main veins was trenched at some time past.

5.2 Waste Rock Disposal Areas

Each of the adits above the 400 level has a small (1 to 5 thousand tonnes) waste dump at the portal. These waste dumps were commonly totally revegetated except on oversteepened slopes. The waste rock was either barren waste rock or very low-sulphide mineralized rock. There is very little low-grade ore in the dumps due to the close proximity to the mill.

The waste from the 400 level adit has been used for construction in the Elsa village, and is not deposited in a typical waste dump.

There are a few piles of low-grade open pit material (distinguished by larger rock size than from underground) near the 400 portal. This material is highly oxidized, and siderite-rich. The dark boulder pile in photo 3-1 is typical of this material.

400 Portal Area Waste Rock Pile (Photo 3-2)

General Description: The waste rock sampled is from underground development. It is quartzite and phyllite with quartz-siderite-pyrite vein material. Limonite and manganese oxide staining is very common. The area is quite well drained by ditches and culverts, and the material is quite coarse, with little water-retention capacity. There is minor, local vegetation in the area.

Location: Across the road from the 400 portal, adjacent to the rails, near the grizzly.

Dimensions: Dimensions of the waste rock in this area are unknown, as they have been incorporated into the site landscaping and roadbeds. The site sampled was adjacent to the rails from underground, and was obviously mineralized underground material.

Sampling: One sample of underground waste rock was collected from an excavation beside the rails near the grizzly at the 400 level.

Waste Rock Samples:

Sample #	Location	Paste pH	Conductivity	Lab Results
3-WR-TPBM-01	400 portal	2.62	2.75 µS/cm	See Table – Attach. 2

5.3 Tailings Impoundments

Tailings are located north of Elsa Village, 500m north of Hwy #2. For further details, see separate report on Elsa tailings (site #79).

5.4 Mine Site Water Treatment

None of the adits examined were noted to produce water, and no water treatment facilities were observed. Water is reported to be collected at the 400 level and pumped down the internal shaft. This water is thought to flow through permeable fault zones to the Husky mine.

6. MINE SITE INFRASTRUCTURE

Most of the buildings and infrastructure for this mine is included in a separate report on the Elsa Village (site #78).

6.1 Buildings

Building 3A: 50 Level Shack

Dimensions (L x W x H): approximately 4m by 4m by 2.5m high.

Location: Above 50 level open pit.

Construction: Wood frame and siding. No windows, door locked.

Paint: Blue paint.

Asbestos: None observed.

Foundation: Wood – portable?

Non-Hazardous Contents: Unknown.

Hazardous Contents: Unknown.

Several small wooden shacks, some partially collapsed were observed at various sites in this area. None were considered to be of environmental significance (no asbestos, hazardous contents).

There is a covered barbecue area at the Ball Field, of wood frame construction with a metal roof. This structure is in good condition, and appears to be stable.

The 400 level portal building is an insulated wood frame structure with asbestos siding (photo 3-1).

6.2 Fuel Storage

Location: Backfill site.

Description: Two drums, one empty, one approximately 1/3 full, labeled Automatic Transmission Fluid.

6.3 Rail and Trestle

200 Level Portal

Fabrication: Steel rails on wooden ties, wooden ore dump trestle.

Amount of materials: Approximately 50m of installed rails, more rails and pipes in bushes southwest of portal.

Condition: Good condition, except ore dump trestle has been undermined and may be unstable.

400 Level Portal (Photos 3-1, 3-2, 3-3)

Fabrication: Steel rails on wooden ties, wooden ore dump trestle, steel grizzly, wooden dump chute.

Amount of materials: Approximately 150m of installed rails.

Condition: :Mostly in good condition. The ore dump/ grizzly section is perched at the top of a steep bank, and supporting timbers may be rotting. The ore chute timbers are badly rotted.

6.4 Milling and Processing Infrastructure

Elsa mill is reported separately as part of the Elsa Village report (site #78).

6.5 Electrical Equipment

The electrical equipment associated with mine workings is discussed in the Elsa Village report (site #78).

7. SOLID WASTE DUMPS

See Elsa town site report (site #78).

8. POTENTIAL CONTAMINANTS OF CONCERN

No Potential Contaminants of Concern (PCCs) were observed in association with the Elsa mine itself. There are a number of PCCs associated with the Elsa Village and are reported separately (site #78).

9. WATER QUALITY

At the time of the site visit, there was no water observed at any of the mine workings or waste disposal sites. No water samples were collected.

10. RECLAMATION

There is extensive natural revegetation at all of the older disturbed sites. The vegetation is dominated by deciduous shrubs and trees such as alder and willow. There were no known reclamation measures carried out at this site by past or present operators.

11. OTHER INFORMATION AND DATA

There are high radon gas levels reported from the Elsa mine (alone out of all the mines in the area) by local residents who worked at the mine. The 200 level is specifically noted to have high radon levels.

12. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Boyle, R.W., 1965. Geology, Geochemistry and Origin of the Lead-Zinc-Silver Deposits of the Keno Hill – Galena Hill Area, Yukon Territory. Geological Survey of Canada Bulletin 111.

ATTACHMENT 2: 1999 ELSA MINE WASTE ROCK LABORATORY RESULTS			
Site Number	**Detection Limit**	**Units**	**3_WR_TPBM_01**
Sample Desciption			400 portal area waste rock pile
Paste pH (field)	N/A	pH	
Conductivity (field)	N/A	µS/cm	
pH in Saturated Paste			
pH	0.1	pH	2.2
pH in Soil (1:2 water)			
pH	0.01	pH	2.3
ICP Semi-Trace Scan			
Aluminum	5	µg/g	38600
Antimony	2	µg/g	21
Arsenic	2	µg/g	478
Barium	0.05	µg/g	268
Beryllium	0.1	µg/g	0.3
Bismuth	5	µg/g	<5
Cadmium	0.1	µg/g	3.3
Calcium	5	µg/g	3020
Chromium	0.5	µg/g	47
Cobalt	0.1	µg/g	3
Copper	0.5	µg/g	156
Iron	1	µg/g	79000
Lead	1	µg/g	2880
Lithium	0.5	µg/g	13.8
Magnesium	1	µg/g	1330
Manganese	0.5	µg/g	646
Mercury	0.01	µg/g	0.24
Molybdenum	1	µg/g	4
Nickel	1	µg/g	12.2
Phosphorus	5	µg/g	644
Potassium	20	µg/g	12400
Selenium	2	µg/g	<2
Silicon	5	µg/g	43
Silver	0.5	µg/g	219
Sodium	5	µg/g	1470
Strontium	1	µg/g	47
Sulphur	10	µg/g	22700
Thorium	1	µg/g	<1
Tin	1	µg/g	24
Titanium	0.2	µg/g	135
Uranium	5	µg/g	<5
Vanadium	1	µg/g	66
Zinc	0.5	µg/g	477
Zirconium	0.1	µg/g	20.4

ATTACHMENT 2: 1999 ELSA MINE WASTE ROCK LABORATORY RESULTS MODIFIED SOBEK METHOD ACID-BASE ACCOUNTING TEST								
SAMPLE	SITE DESCRIPTION	PASTE pH	S(T) %	S(SO4) %	AP	NP	NET NP	NP/AP
3_WR_TPBM_01	400 portal area waste rock pile	3.5	2.05	0.43	50.6	-1.3	-51.9	<0.1

AP = ACID POTENTIAL IN TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.
NP = NEUTRALIZATION POTENTIAL IN TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.
NET NP = NET NEUTRALIZATION POTENTIAL = TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.
NOTE: WHEN S(T) AND/OR S(SO4) IS REPORTED AS <0.01, IT IS ASSUMED TO BE ZERO FOR THE AP CALCULATION.
N/D = NO DUPLICATE ASSAY. CALCULATIONS ARE BASED ON ASSAY RESULTS OF THE INITIAL SAMPLE.
RE = REPLICATE.

NOTE - A HIGH LEVEL OF SOLUBLE METALS (ESPECIALLY IRON) WERE OBSERVED IN MANY SAMPLES DURING THE ABA TITRATIONS.
SAMPLES WITH A NEGATIVE NET NP SHOULD BE TESTED FOR MOBILE METALS USING STANDARD SHAKE FLASK EXTRACTION TESTS.

Photo 3-1 : Elsa Mine. Elsa 400 Level Portal. Looking southeast. Low grade open pit ore pile to the right of the tracks.

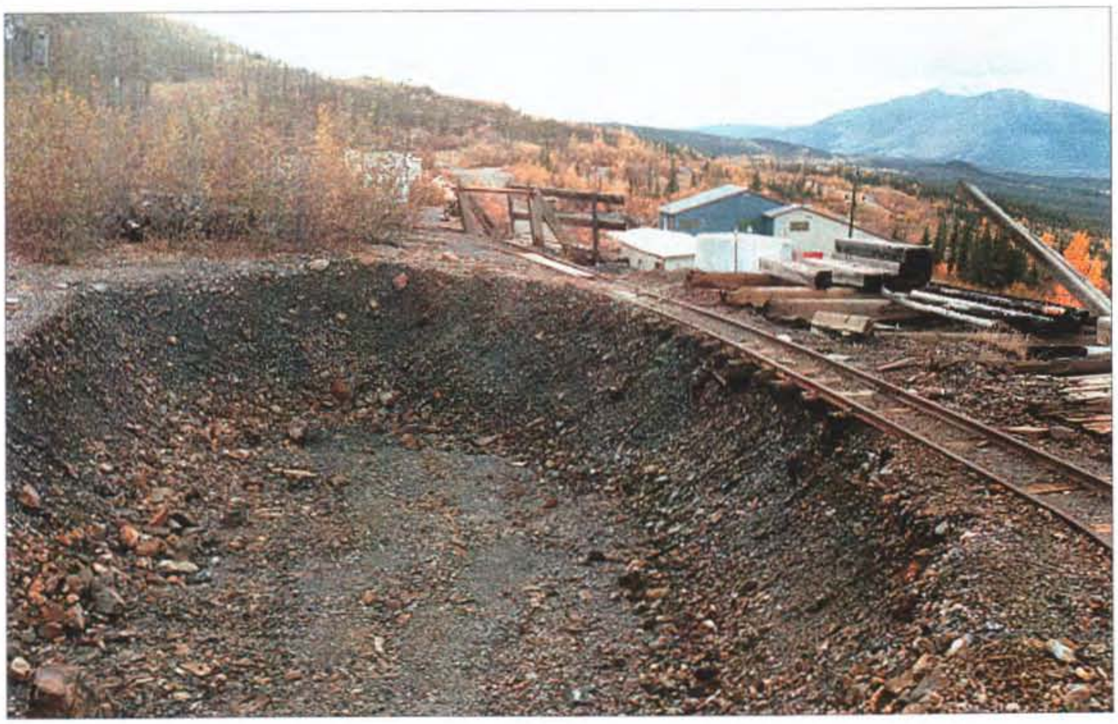


Photo 3-2 : Elsa Mine. Elsa 400 level tracks and grizzly. Looking southwest. Waste rock sample site 3_WR_TPBM_01.

Photo 3-3 : Elsa Mine. Elsa 400 ore chute and grizzly from below. Looking southeast.
Note steep banks of waste rock.

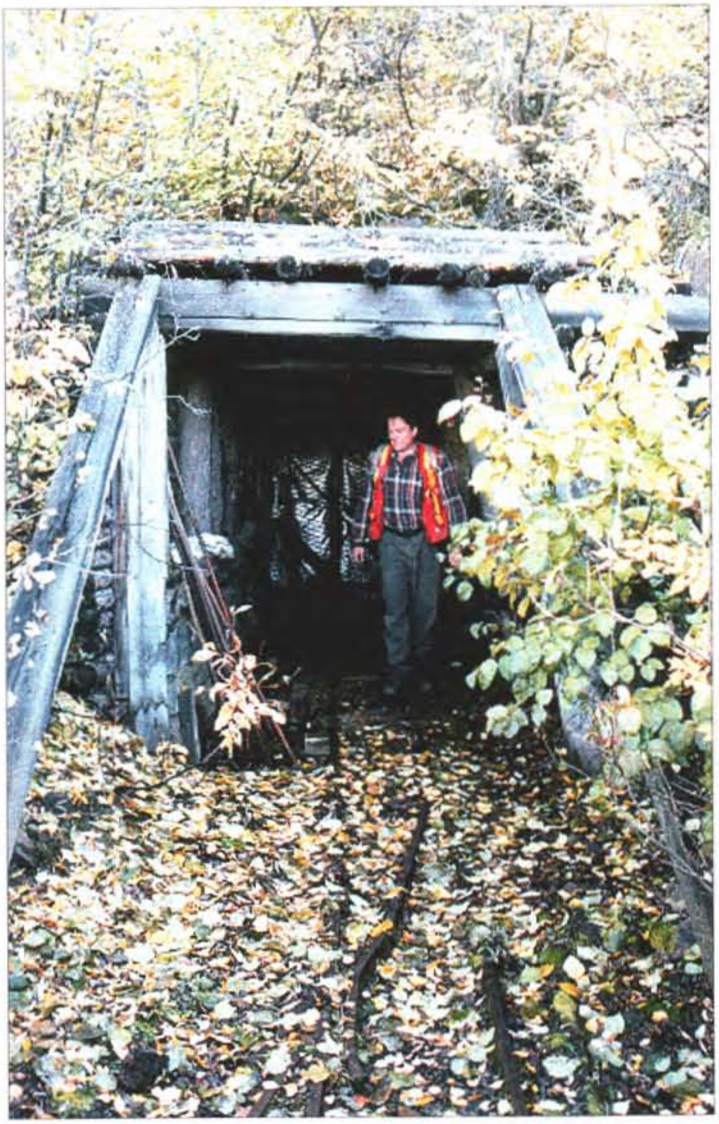


Photo 3-4 : Elsa Mine. Elsa 200 Level Portal. Looking south.

Photo 3-5 : Elsa Mine. Elsa mine backfill pipe. Looking west.

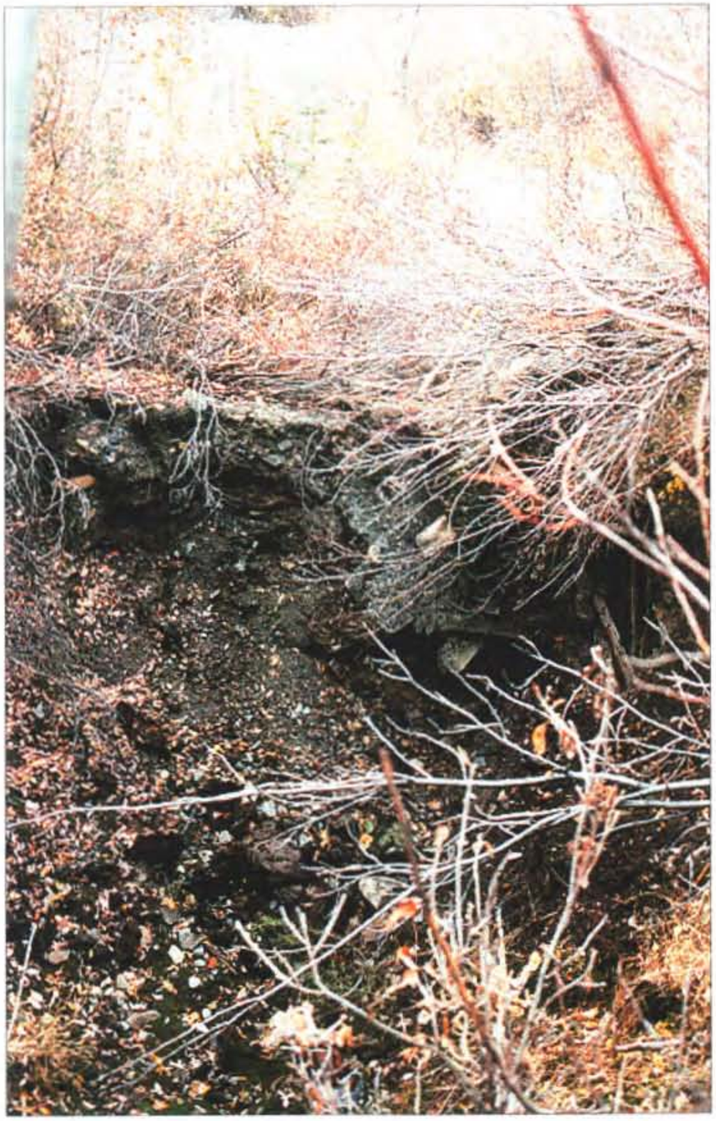


Photo 3-6 : Elsa Mine. Collapsed ventilation raise, Powderhouse Corner on Calumet Drive. Sink hole is about 10m by 10m by 5m deep. Looking north.

Photo 3-7 : Elsa Mine. Elsa 50 Level open pit and mine shack.
Looking southeast.

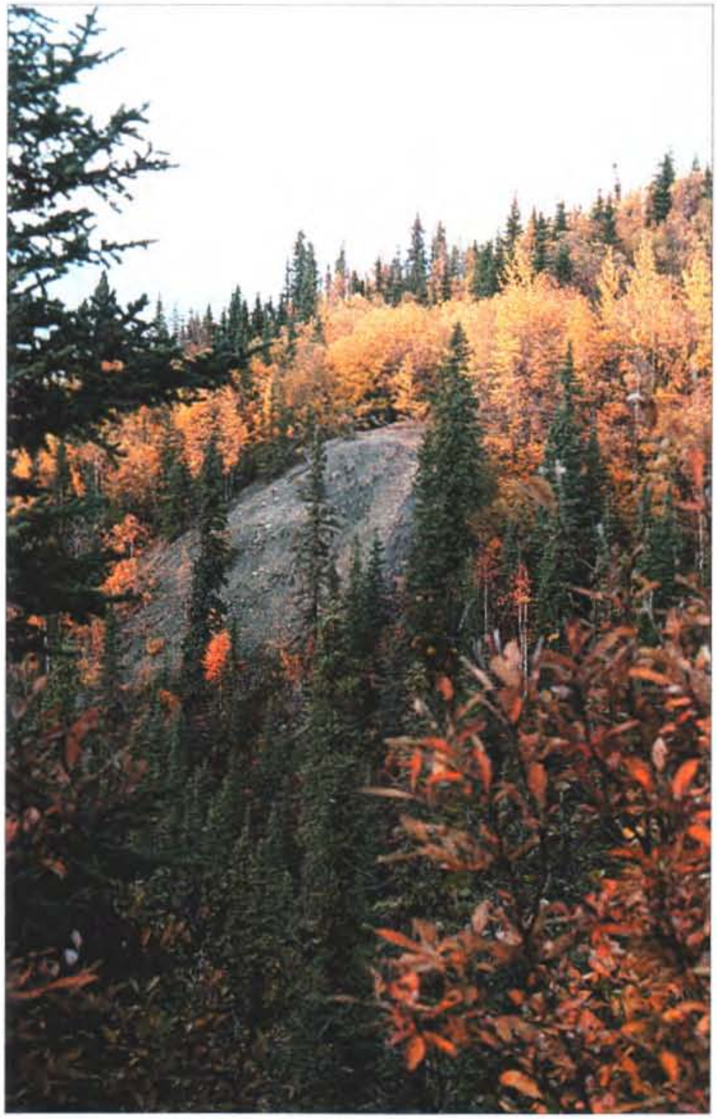


Photo 3-8 : Elsa Mine. Elsa +50 adit waste dump. Photo taken from Calumet Drive, across Porcupine Creek, looking northeast.

Photo 3-9 : Elsa Mine. Elsa +50 adit dump, showing dense natural revegetation and some slump features. Looking northwest.

Photo 3-10 : Elsa Mine. Tick shaft. Rotting timberframe, collapsed adit. Looking south.

DIXIE #4
(MINFILE# 105M 001b)

1. LOCATION AND ACCESS

Access to the site is from Keno City drive 12km west on Highway #11 to the Elsa Townsite, turn left at the junction and stay left. From the Elsa Townsite @ the junction of Calumet Drive and Wernecke Road travel 3.6 km. along Calumet Drive to the Dixie Portal. This road is two-wheel drive accessible at 4.3 km along Calumet Drive a 4-wheel drive track switchbacks to the S. W. to the Dixie Shaft and Raises # 1 & #2. 300 m along the track, it intersects the powerline right-of-way, the Dixie shaft is 30 meters upslope from this junction; 100 m further on is the site of a backfilled raise, the last backfilled raise is another 100 m at the end of the track. The Dixie mine site is at an approximate elevation of 1200m. UTM co ordinates for the site are 7,087,200m N 477,000m E.

2. SITE PHYSIOGRAPHY

The site is on a Northwest facing slope, dipping at ~20% overlooking the McQuesten Valley at an elevation of 1037m. The surrounding vegetation consists of black spruce, willows, and alder with a floor covering of mosses. Drainage from the site flows towards the bogs in the McQuesten Valley, to the east of the Elsa tailings area.

3. GEOLOGY AND MINERALIZATION

The Dixie adit and dump are located in the Keno Hill quartzites with no known surface mineralization. The surface exposures of the mineralized vein are 200 to 400 meters up slope to the East. The vein is hosted in barren quartzite and the vein material is heavily weathered with strong manganese staining. The vein material is composed of brecciated quartzite with disseminated pyrite, siderite, quartz stringers, galena and pyrite.

4. SITE HISTORY

Early workings from 1925 through 1930 consisted of several surface pits and a 23 m deep shaft with short drifts off of it. 26 tonnes of ore were produced. During the 1970's the 200 Level adit and development produced 21,630 tonnes of ore and 18,000 tonnes of waste.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

200 Level Adit (Photo 4-1)

The adit has dimensions of 2.5 m x 2.5 m; mine drawings show the adit to be 300 meters long with 960 m of drifting off it. The portal is wood frame construction with timber cribbing blocking any access into the mine. The talus around the portal is retained by 5 m high wood frame walls. The construction appears stable. The rails and any mine services have been removed.

Dixie Shaft (Photo 4-2)

The shafthouse (4 m x 5 m) is wood frame construction and has collapsed. The shaft dimensions are 1.2 m x 2 m, the lagging has partially collapsed and the shaft appears to be filled with water and soil ~3 m below ground level. This site should be considered a hazardous area.

Vent Raises

Eastern Raise (Photo 4-3)

The raise has been backfilled and any surface installations removed. The level pad area is 50 m x 30 m.

There is minor subsidence 2.5 m in diameter by 1 m deep. The raise poses a minimal hazard.

Western Raise (Photo 4-4)

The raise has been backfilled and any surface installations removed. The level pad area is 50 m x 50 m.

There is an area of subsidence 5 m in diameter by 3 m in depth. The raise poses a minor hazard.

Open Pits

There are no open pits associated with this site.

Trenches

No significant trenches were observed.

5.2 Waste Rock Disposal Areas

Waste rock pile at the 200 Level Portal

Comprised of vein material overlying development waste rock and the quartzite excavated to collar the portal. (~18,000 tonnes). The vein material consists of brecciated quartzite, quartz stringers with disseminated pyrite and minor amounts of galena. There is no sign of any significant water flow through the dump. There is a significant kill zone below the toe of the dump. It comprises an area of 50 m wide x 80 m downslope, it has been bulldozed in the past (Sept. 14 F04-P22A). Minimal revegetation has occurred.

Sampling:

Three samples were taken at the adit dump site during a 1995 investigation. The following table illustrates the findings.

Table 1 – 1995 Waste Rock Samples

Location	Sample ID	Paste PH	S (tot.)	S (SO4)	AP	NP	NET NP	NP/AP
			%	%	kg CaCO3/tonne			
Dixie	95UKHDD01	4.14	0.35	0.28	2.19	0.00	-2.2	<0.1
Dixie	95UKHDD01	4.44	0.51	0.34	5.31	2.25	-3.1	0.4
Dixie	95UKHDD03	5.55	0.47	0.42	1.56	13.56	12.0	8.7

Waste rock pile at the Dixie Shaft

Comprised of vein material and barren quartzite, dimensions 10 m x 8 m x 1.5 m thick (~300 tonnes). Vein material is heavily weathered, with strong manganese staining and cubic crystal vugs, brecciated quartzite is cemented with siderite, quartz stringers, galena and pyrite. No signs of any stressed vegetation were observed. No samples were taken at this site.

5.3 Tailings Impoundments

There were no tailings impoundments at the site.

5.4 Tailings Ponds

There were no tailings ponds at the site.

5.5 Minesite Water Treatment

There were no water treatment facilities located at the site. The adit is dry, however, de-watering during production has affected the vegetation downslope.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There were two buildings located on the Dixie mine site. One of the structures was used as a garage and office and the other structure was the portal to the mine. A loading area is located on the Dixie mine site and is constructed of timber cribbing and a timber reinforcement wall (photo 4-5).

Building 4A – Garage/Office

Office and garage.
Location: The structure is located on the Dixie mine site and labeled as Building 4A.
Dimensions (L x W x H): 3m x 6m x 3m
Construction: The building is of wood frame construction with metal sheathing on the exterior and roof. Tile flooring is located throughout the office. The garage area has a soil and gravel base with some areas stained with hydrocarbons.
Paint: The interior was painted white, however, the paint has faded and flaked off over the years and there are only small areas that remain adhered.
Asbestos: There is asbestos board in the office area of the structure. A sample of the floor tile was taken to determine potential asbestos content. The analysis is shown in the table below.
Foundation: No foundation other than raised timber sheathing.
Non-Hazardous Contents: No non-hazardous contents were noted in the building
Hazardous Contents: No hazardous materials were noted in the building.
Samples:

Table 2 - Asbestos

Asbestos	**Units**	**06-01-tile (Dixie)**
Approximate % fibrous asbestos and most similar type	%	1-10% chrysotile

Building 4B – Portal

Portal opening
Location: The portal is listed on the Dixie site map as Building 4B.
Dimensions (L x W x H): The portal structure is encased in the rock and there is little protrusion.
Construction: The portal is constructed of wood and timber. The portal entrance has been blocked permanently by a timber crib structure located just within the double steel doors. A timber retaining wall has been constructed to reinforce the portal entrance and extends approximately 20m in length.
Paint: There is no paint visible on the structure.
Asbestos: There is no asbestos visible on the structure.
Foundation: No foundation.

Non-Hazardous Contents: No non-hazardous contents were noted at the site.

Hazardous Contents: No hazardous contents were noted at the site.

Samples: No samples were taken at the portal structure.

6.2 Fuel Storage

No fuel storage sites were found at the site.

6.3 Rail and Trestle

No rail structure was found intact at the site.

6.4 Milling and Processing Infrastructure

There were three grizzlies noted at the loading area signifying that the site conducted minor amounts of processing by hand shoveling the ore for separation purposes.

6.5 Electrical Equipment

No electrical equipment was found at the site.

7. SOLID WASTE DUMPS

There is a small dump area that consists mostly of waste rock, however, there is also miscellaneous debris that has been deposited at the site. Most of the materials appear to be from the dismantling of equipment at the site such as rails and ties from the tracks and old fuel drums. The drums were inspected and all were empty, rusted and void of any interior residues (photo 4-7).

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No out-of-service transformers were found at the site.

8.2 Metals and Hydrocarbons in Soil

Soil staining was visible at the site both in the garage and around the exterior of the garage. The largest area of staining was located along the north wall of the garage and measured 5m in wide and 2m in length. Another smaller area of staining was noted on the west side of the building. Both areas appeared to be limited to surficial soils and were caused by heavy machinery maintenance procedures (photo 4-8).

Samples: No samples were taken.

8.3 Liquid Hazardous Materials

No liquid hazardous materials were noted at the site.

8.4 Solid Hazardous Materials

No solid hazardous materials were noted at the site.

9. WATER QUALITY

A downstream water sample (04-01-water) was taken below the Dixie Mine site along the No Cash 500 access. Water flow at the site was approximately 0.2 L/s. There were two piezometers located in the same vicinity (95-UK-2, 95-UK-3) and sampling was attempted at both, however, both piezometers were dry. Attachment B contains the sample analyses results completed on sample 04-01-water.

There was no seepage from the portal itself, however, there was evidence that seepage does occur. An area of 15m x 1m of bright orange brown staining was noted at the entrance to the portal.

10. RECLAMATION

There was sparse revegetation at the site, however, the waste rock dump site has had no revegetation. A large kill zone exists below the waste rock dump site and only sparse vegetation re-growth has occurred (photo 4-9).

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

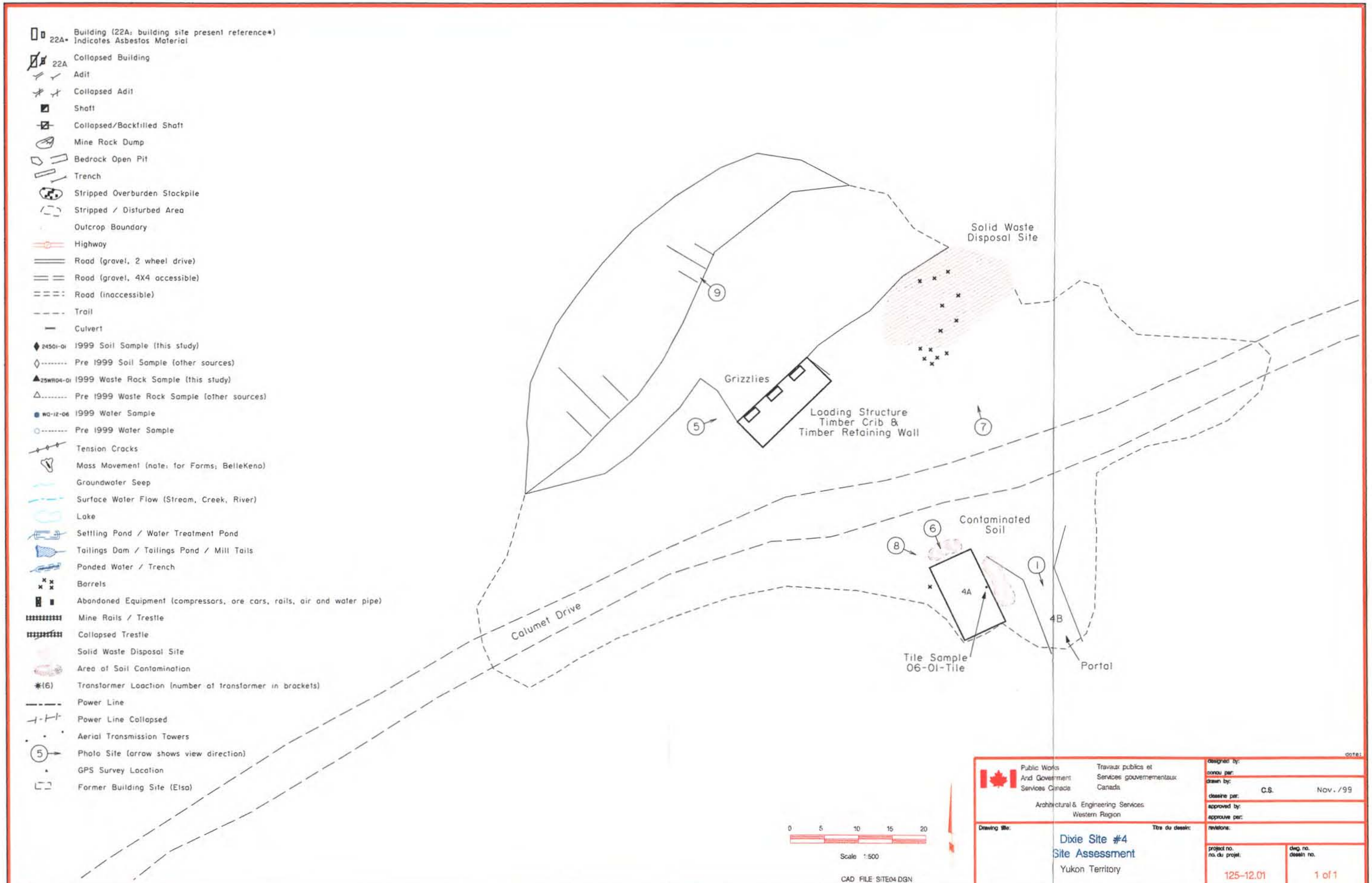
Table 3 – Metal Analysis – mg/L

Total Metals	Detection	04-01-water
Aluminum	0.0008	0.0086
Antimony	0.005	<0.005
Arsenic	0.01	<0.01
Barium	0.00004	0.0184
Beryllium	0.00001	<0.00001
Bismuth	0.0004	<0.0004
Boron	0.002	<0.002
Cadmium	0.00006	0.00021
Calcium	0.002	128
Chromium	0.00006	0.00038
Cobalt	0.00003	<0.00003
Copper	0.00003	0.00252
Iron	0.00001	0.02
Lead	0.0003	<0.0003
Lithium	0.001	0.011
Magnesium	32.9	24.9
Maganese	0.00002	0.0114
Mercury	0.0001	<0.0001
Molybdenum	0.00007	0.00027
Nickel	0.0001	<0.00001
Phosphorus	0.03	<0.03
Potassium	0.4	0.8
Selenium	0.004	<0.004
Silicon	0.004	4.12
Silver	0.00005	<0.0000

Table 4 – Water Analysis

Water Analysis	Units	04-01-water	
		Field	Lab
Total Alkalinity	g CaCO3		199
Chloride in Water	mg/L		<0.25
EC	ℓS/cm	640	810
Hardness	mg/L		455
Nitrate-N in H2O	mg/L		0.3
Nitrate Nitrogen	mg/L		<0.003
pH in Water	pH	8.1	8
Sulphate	mg/L		240
TDS	mg/L		552

		5
Sodium	0.004	1.6
Strontium	0.00002	0.179
Sulphur	0.008	76.2
Thallium	0.001	<0.001
Titanium	0.00002	<0.00002
Vanadium	0.00003	<0.00003
Zinc	0.0002	0.0698
Total Arsenic Hydride AA	0.0002	0.0006
Total Selenium Hydride AA	0.0001	<0.0001



Building (22A: building site present reference*)
22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24S01-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WQ-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms; BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
*(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Solid Waste Disposal Site
Grizzlies
Loading Structure Timber Crib & Timber Retaining Wall
Contaminated Soil
4A
4B
Tile Sample 06-01-Tile
Portal
Calumet Drive
0 5 10 15 20
Scale 1:500
CAD FILE SITE04.DGN
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title:
Titre du dessin:
Dixie Site #4
Site Assessment
Yukon Territory
designed by: conçu par:
drawn by: dessiné par: C.S.
date: Nov./99
approved by: approuvé par:
revisions:
project no. no. du projet: 125-12.01
dwg. no. dessin no. 1 of 1

Photo 4-1: Photograph of the adit at Dixie Mine, note the portal entrance has been blocked off with timber cribbing. (Azimuth 145^{o})

Photo 4-2: Collapsed structure above raise. The raise is located at the intersection of the powerline and roadway approximately 500m above the main Dixie site. (Azimuth 95^{o})

Photo 4-3: Eastern raise of the Dixie mine site. Magnesium staining is evident on the vein rocks. (Azimuth 25°)

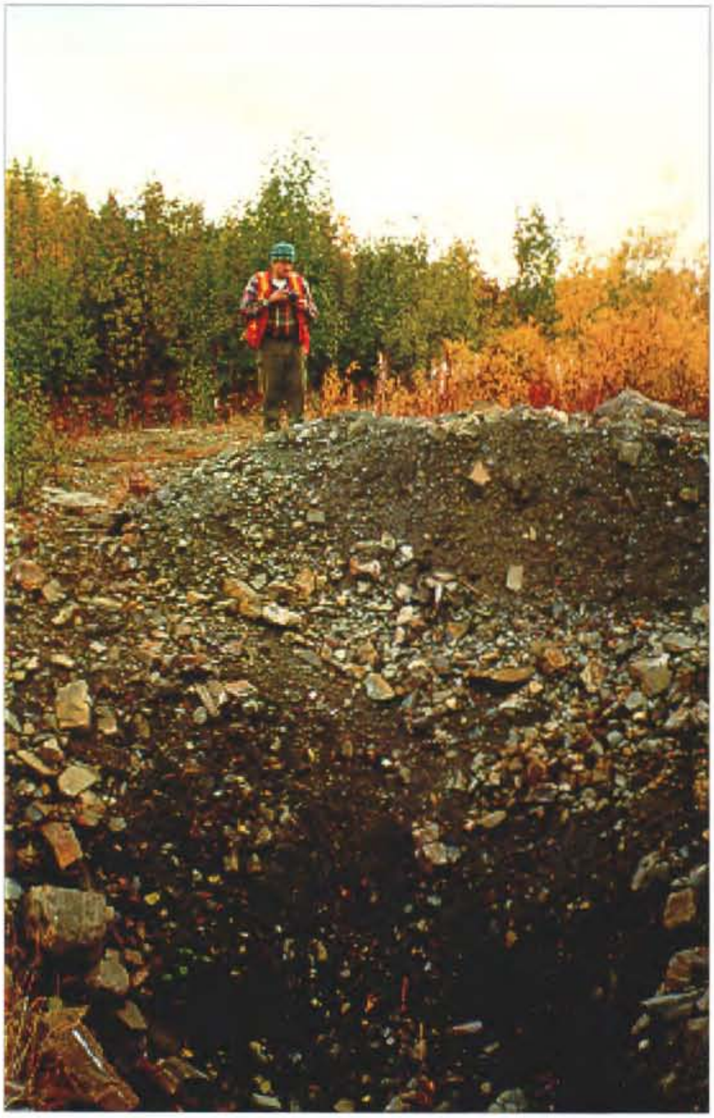


Photo 4-4: Photo of the collapsed western raise located directly above the main Dixie site. (Azimuth 210°)

Photo 4-5: The loading area at the main Dixie mine site. (Azimuth 80°)

Photo 4-6: Building 4A (garage/office) facing NE. (Azimuth 75°)

Photo 4-7: Empty barrels at the solid waste dump site. (Azimuth 25^{o})

Photo 4-8: Stained soil on the west side of building 4A. (Azimuth 135^{o})

Photo 4-9: The kill zone associated with the waste rock dump site. (Azimuth 320°)

CORAL WIGWAM #5
(MINFILE# 105M 001C)

1. LOCATION AND ACCESS

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 (S. W.) and follow the Bermingham Rd. for 2.8 Km. At this point, a rough cat trail leads N.W. for 100 meters to the Coral-Wigwam Site. The Coral Wigwam mine site is at an approximate elevation of 1200m. UTM co ordinates are 7,086,250m N 477,900m E.

2. SITE PHYSIOGRAPHY

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 120 m 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 colluvium 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.

3. GEOLOGY AND MINERALIZATION

The site is hosted in interbedded schists and massive quartzite. Vein material consists of brecciated quartzite and schist with quartz stringers and disseminated pyrite, there is considerable limonite and manganese staining. Mineralization is reported to consist primarily of galena, with lessor amounts of freibergite in a gangue of siderite, with minor quantities of quartz and pyrite.

4. SITE HISTORY

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.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

Adits/Shafts/Portals

No adits were observed or reported in the literature. Two shafts were found and are detailed below.

Shaft 1

Location: Western shaft
Dimensions: The inside dimensions are 1.6m x 1m about 8m deep with what appears to be a drift taking off in a SE direction.
Supports: The shaft is cribbed with round timber that appears sound.
Condition: The shaft is open and unguarded and should be considered a safety hazard. The dump from shaft has been bulldozed away during the stripping operation.
Accessibility: The shaft is open and accessible.

Shaft 2

Location: Eastern Shaft
Dimensions: Subsidence zone is about 5 m in diameter and 3 m deep.
Supports: The shaft is unguarded and poses a safety hazard.
Condition: This shaft is collapsed with timber with an old ladder in the hole. The waste rock dump dimensions are 15 m x 3 m x 6 m (~ 600 tonnes) consisting of Quartzite with quartz veining and minor pyrite.
Accessibility: The shaft is collapsed and is a safety hazard.

Open Pits

There are no open pits at this site.

Trenches

There are seven backhoe trenches in the stripped area. They are 1.5 to 2 m deep by 2 to 3 m wide and from 10 to 15 m long. The material taken from the cuts is piled alongside the trenches. The trenches present a minor hazard.

5.2 Waste Rock Disposal Areas

Waste piles

The waste piles are made up of the overburden stripping, mainly glacial till with some quartzite and schist colluvium mixed in. The waste piles comprise approximately 75,000 tonnes of material. Vegetation is reestablishing itself on the waste piles and no evidences of vegetation stress were observed below the toe of the piles. There is significant drainage through the site and no sign of water being impounded.

5.3 Tailings Impoundments

There are no tailings at this site.

5.4 Mine Site Water Treatment

There are no water treatment facilities at this site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There were structural remains of four buildings at the site. Two of the structures appeared to have been residential and the third was potentially a workshop, however, this is difficult to determine from the deteriorated debris remaining at the site. The fourth structure was a collapsed shaft house.

Building 5A – Residential (collapsed)

Building has collapsed and deteriorated.
Location: The building can be found in a forested area along the access road to the site and adjacent to buildings 5B and 5C.
Dimensions (L x W x H): N/A
Construction: The structure appeared to be of one room log construction.
Paint: No paint.
Asbestos: No asbestos visible.
Foundation: No foundation present.
Non-Hazardous Contents: Wood debris.
Hazardous Contents: No hazardous materials visible at the building location.
Samples: No samples were taken at the building site 5A.
Building 5B

Building has burnt and collapsed.
Location: The foundation can be located at the junction of the small path and the access road.
Dimensions (L x W x H): N/A
Construction: There is some metal debris at the site, however, there is very little wood debris left at the site as any flammable or combustible materials have been incinerated.
Paint: No paint.
Asbestos: No asbestos visible.

Foundation: No foundation.
Non-Hazardous Contents: Metal and partial wood debris.
Hazardous Contents: No hazardous materials visible at the building location.
Samples: No samples were taken at the building site 5B.

Building 5C

There is only wood plank floor remnants left at the site. A drum utilized as a stove was situated in the corner of the building site.
Location: The foundation can be found just beyond building 5B along the pathway.
Dimensions (L x W x H): N/A
Construction: There is no structure at the site, however, it appears to have been constructed of wood.
Asbestos: No asbestos visible.
Foundation: No foundation other than the wood plank flooring.
Non-Hazardous Contents: Metal and partial wood debris.
Hazardous Contents: No hazardous materials visible at the building location.
Samples: No samples were taken at building site 5C.

Building 5D

The structure was utilized as a shaft house, however, it has collapsed and deteriorated and is a safety hazard.
Location: [map/describe]
Dimensions (L x W x H): N/A
Construction: The collapsed structure consists of wood plank sheathing and roofing.
Asbestos: No asbestos visible.
Foundation: No foundation.
Non-Hazardous Contents: Wood debris.
Hazardous Contents: No hazardous materials visible at the building location.
Samples: No samples were taken at building site 5D.

6.2 Fuel Storage

Drum Storage Area(s)

There were no fuel storage areas visible at the site.

Above Ground Storage Tanks

No above ground storage tanks were noted at the site.

Samples:

No samples were taken at the site.

6.3 Rail and Trestle

There was no evidence that a rail and trestle structure existed at the site.

6.4 Milling and Processing Infrastructure

There was no indication that milling and processing structures were constructed at the site.

6.5 Electrical Equipment

In-Service Transformers

There were no transformers visible at the site nor any electrical equipment.

Capacitors

N/A

7. SOLID WASTE DUMPS

There was no evidence of any solid waste dumping at the site. The area appears to have been abandoned for a number of years. Any biodegradable wastes are gone, there does not appear to be any metals other than two empty fuel drums at the site. Surrounding areas are void of wastes. No sampling was conducted.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

There were no transformers noted at the site.

8.2 Metals and Hydrocarbons in Soil

There was no visible contamination noted at the site, nor were any materials or sources noted that would have contributed to potential site contamination.

8.3 Liquid Hazardous Materials

No liquid hazardous materials were visible at the site. There were two fuel drums noted on the site, however, they were empty. There were no labels to indicate historical contents, no residue nor any staining noted in the vicinity of the drums.

8.4 Solid Hazardous Materials

No solid hazardous materials were present on the site at the time of the inspection.

9. WATER QUALITY

A water sample (03-01-upstream) was collected at Porcupine Creek, just above the townsite of Elsa. The water appeared clear with very little sediment loading. Moss and lichens were abundant on the surrounding exposed rock faces. Sample analyses results can be found in Attachment B for sample location 03-01-upstream.

10. RECLAMATION

The site does not appear to be greatly disturbed by the historical mining activities other than by mine waste rock disposal areas. These areas have started to revegetate with native vegetation and consist mostly of low shrub and lichens, although there are still many areas of exposed waste rock. This appears to be natural attenuation and no visible reclamation measures that have been carried out by past site operators.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

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ATTACHMENT B: 1999 CORAL WIGWAM WATER SAMPLES LABORATORY RESULTS			
Sample Number	**Detection Limit**	**Units**	**03-01 - Upswater - 99/09/17**
Site Desciption			Porcupine Creek, upstream from Elsa Village
pH (field)	N/A	pH	
Conductivity (field)	N/A	µS/cm	
pH (Lab)	0.01	pH	7.99
Conductivity (Lab)	0.01	µS/cm	510
Total Alkalinity	5	mg CaCO3/L	103
Chloride	2.5	mg/L	<0.25
Hardness (CaCO3 equiv)	5	mg/L	316
Nitrate-N	0.05	mg/L	<0.05
Nitrite-N	0.003	mg/L	<0.003
Sulphate	1	mg/L	152
Total Dissolved Solids	5	mg/L	353
Analysis by ICP-USN			
Aluminum	0.0008	mg/L	0.0162
Antimony	0.005	mg/L	<0.005
Arsenic	0.01	mg/L	<0.01
Barium	0.00004	mg/L	0.0501
Beryllium	0.00001	mg/L	<0.00001
Bismuth	0.0004	mg/L	<0.0004
Boron	0.002	mg/L	0.016
Cadmium	0.00006	mg/L	0.00002
Calcium	0.002	mg/L	84.3
Chromium	0.00006	mg/L	0.00021
Cobalt	0.00003	mg/L	<0.00003
Copper	0.00003	mg/L	0.00118
Iron	0.00001	mg/L	0.027
Lead	0.0003	mg/L	<0.0003
Lithium	0.001	mg/L	0.004
Magnesium	0.0005	mg/L	11.9
Manganese	0.00002	mg/L	0.00303
Mercury	0.0001	mg/L	<0.0001
Molybdenum	0.00007	mg/L	0.00017
Nickel	0.00001	mg/L	0.0011
Phosphorus	0.03	mg/L	<0.03
Potassium	0.4	mg/L	<0.4
Selenium	0.004	mg/L	<0.004
Silicon	0.004	mg/L	3.38
Silver	0.00005	mg/L	<0.00005
Sodium	0.004	mg/L	1
Strontium	0.00002	mg/L	0.137
Sulphur	0.008	mg/L	49.6
Thallium	0.001	mg/L	<0.001
Titanium	0.00002	mg/L	0.00118
Vanadium	0.00003	mg/L	<0.00003
Zinc	0.0002	mg/L	<0.0002
Analysis by Hydride AA			
Arsenic	0.0002	mg/L	0.0007
Selenium	0.0001	mg/L	<0.0001

Building (22A: building site present reference*)
22A* Indicates Asbestos Material

Collapsed Building

Adit

Collapsed Adit

Shaft

Collapsed/Backfilled Shaft

Mine Rock Dump

Bedrock Open Pit

Trench

Stripped Overburden Stockpile

Stripped / Disturbed Area

Outcrop Boundary

Highway

Road (gravel, 2 wheel drive)

Road (gravel, 4X4 accessible)

Road (inaccessible)

Trail

Culvert

24501-01 1999 Soil Sample (this study)

Pre 1999 Soil Sample (other sources)

25WR04-01 1999 Waste Rock Sample (this study)

Pre 1999 Waste Rock Sample (other sources)

WO-12-06 1999 Water Sample

Pre 1999 Water Sample

Tension Cracks

Mass Movement (note: for Forms: BelleKeno)

Groundwater Seep

Surface Water Flow (Stream, Creek, River)

Lake

Settling Pond / Water Treatment Pond

Tailings Dam / Tailings Pond / Mill Tails

Ponded Water / Trench

Barrels

Abandoned Equipment (compressors, ore cars, rails, air and water pipe)

Mine Rails / Trestle

Collapsed Trestle

Solid Waste Disposal Site

Area of Soil Contamination

(6) Transformer Loaction (number of transformer in brackets)

Power Line

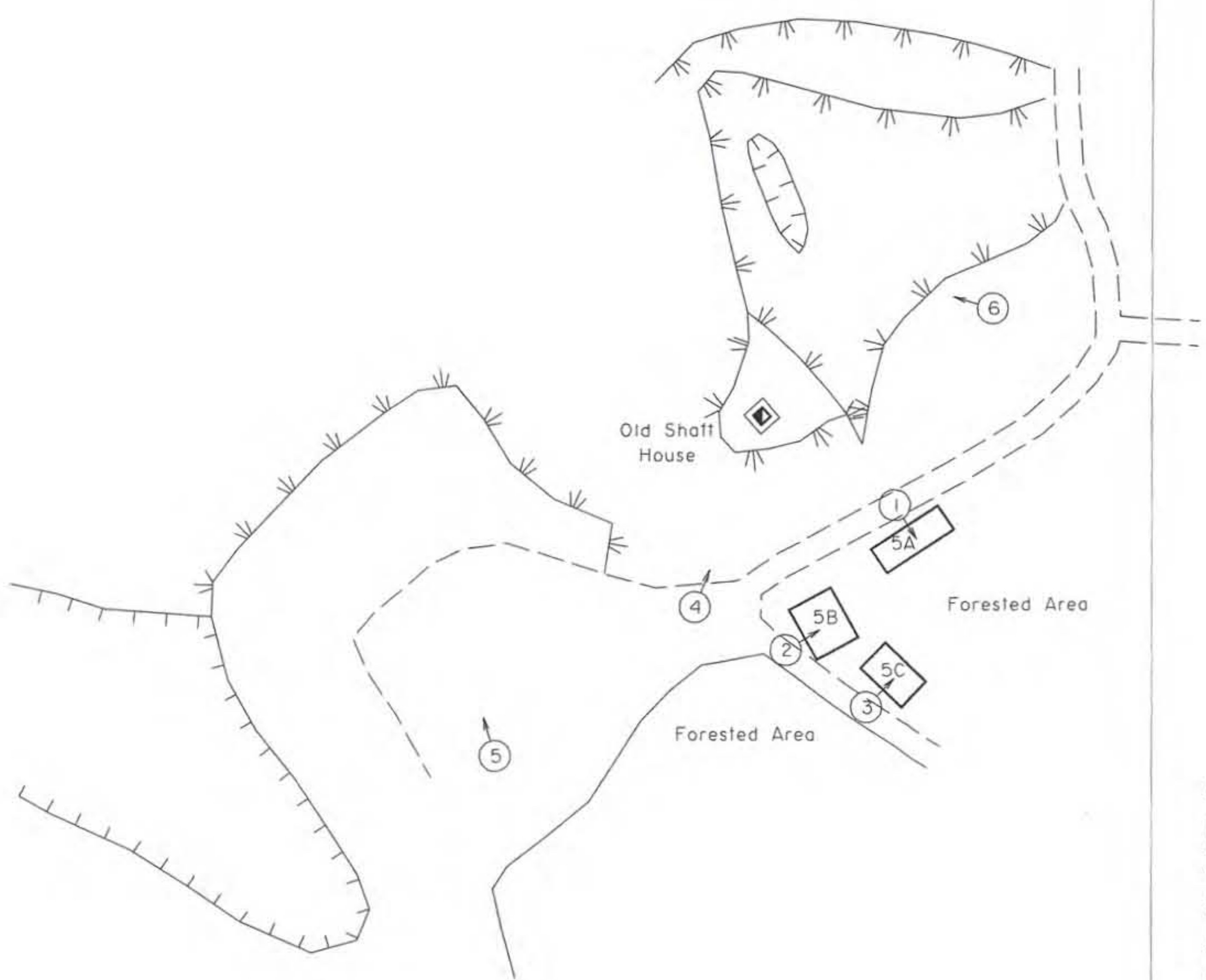
Power Line Collapsed

Aerial Transmission Towers

5 Photo Site (arrow shows view direction)

GPS Survey Location

Former Building Site (Elsa)



0 10 20 30 40

Scale 1:1000

CAD FILE: SITE05.DGN

Waste Rock Geological Legend

This legend intended for use as a key to the observed lithological content of the mine dumps and stockpiles of surficial materials investigated. It does not represent regional stratigraphy and no stratigraphic sequence is implied.

Pyrite content as percent: eg. Py 2%. Occurs as an alteration halo adjacent to vein fault structure.

Oxidation: Weak (wOx), moderate (mOx) and intense (iOx).

Quarternary: (5) Undifferentiated, unconsolidated colluvium, glacial till.

Veins: (4a) Quartz veins;
(4b) Quartz-pyrite veins;
(4c) Quartz-siderite •trace galena-sphalerite veins;
(4d) Siderite-quartz •trace galena-sphalerite veins;
(4e) Suphide (galena-sphalerite) •quartz•siderite veins.

Greenstone: (3) Amphibole-chlorite-plagioclase metadiorite or metagabbro.

Quartzite: (2a) Thick beded, blocky gray quartzite;
(2b) Thin banded, broken, quartzite with carbonaceous phyllite interbeds;
(2c) Calcareous quartzite.

Phyllite: (1a) Broken sericite-chlorite phyllite;
(1b) Carbonaceous phyllite.

Public Works And Government Services Canada / Travaux publics et Services gouvernementaux Canada Architectural & Engineering Services Western Region	designed by: / concu par:		date:
	drawn by: / dessine par:	C.S.	Nov./99
	approved by: / approuve par:		
Drawing title: / Titre du dessin: Coral & Wigwam Site #5 Site Assessment Yukon Territory	revisions:		
	project no. / no. du projet: 125-12.01	dwg. no. / dessin no. 1 of 1	

Photo 5-1: Building 5A - Building was of log construction has deteriorated and collapsed.

Photo 5-2: Building 5B - Building had collapsed and burnt - metal debris appeared to be burnt.

Photo 5-3: Building 5C - Building has collapsed and only plank flooring is evident.

Photo 5-4: Trenched area below the collapsed shafthouse (shafthouse debris can be seen on the far right of photo).

Photo 5-5: Small trenched areas can be noted in the foreground of the photo within the leveled area of the waste rock dump.

Photo 5-6: Trenched area is on the southwest portion of the Coral and Wigwam site.

BERMINGHAM (# 6)
(MINFILE# 105M 001,d,e)

1. LOCATION AND ACCESS

The Bermingham mine site is located near the summit of Galena Hill, approximately 1.5 km southwest of the Calumet town site at an elevation of approximately 1100m. Access to the mine is by gravel road from Calumet. The site is at latitude 63° 54' 35"N and longitude 135° 25' 53". UTM co ordinates are 7 086 77m N 474 740m E.

2. SITE PHYSIOGRAPHY

The Bermingham mine site is located facing east over the McQuesten Valley. The site consists of two areas of mining, Bermingham pit and the Bermingham adit. There are two large pits located at the Bermingham pit as well as 6 smaller trenches that have been excavated. The Ruby shaft is located just below the Bermingham pit and is part of this report. The Ruby adit site is documented in another report.

Vegetation in the area consists of black spruce, a variety of willow, scrub brush and a variety of mosses and lichens. The pit is uphill from the adit site. Some revegetation has occurred and the site slopes steeply from the waste rock dump towards the adit site.

3. GEOLOGY AND MINERALIZATION

The site is located in a sequence of thick and thin bedded quartzites and graphitic schist. The vein mineralization is reported to be a heavily weathered mix of brecciated quartzite and schists, serisite, galena, quartz and a variety of oxides and carbonates of iron, lead, manganese and copper.

4. SITE HISTORY

From 1925 to 1941 there were approximately 2720 tonnes of ore mined from several shafts, drifts and crosscuts. Between 1948 and 1951 The Bermingham 200 level crosscut adit was constructed measuring approximately 300m in length and has a portal dump of 6350 tonnes. From 1977 to 1979 the Bermingham and the Bermingham Southwest pits were mined and produced a 1,360,000 tonne waste dump. The Bermingham mine site has the largest open pit in the study area.

5. MINE DEVELOPMENT

Mine development at the Bermingham site includes several trenches, two large pits, shafts (both collapsed and open) and an adit. The Ruby shaft house has collapsed at the shaft opening and is unsafe in its present condition. A raise is located approximately 5m from the shaft building. The raise is open and is considered a safety hazard.

5.1 Mine Openings and Excavations

Bleiler Shaft (backfilled)

The Bleiler Shaft has been backfilled.

Birmingham 200 Level Adit

Portal is collapsed and partially filled with water.
Location: 300m NW of the Bermingham Pit entrance.
Dimensions (L x W x H): 700m long by 2m wide x 2m deep
Supports: Rough timber supports, caved at portal.
Condition: Unstable
Accessibility: Open

Open Pits

Birmingham Open Pit

Location: 300m SE of the 200 level adit.
Dimensions (L x W x H): 200m long x 100m wide by 50m deep
Condition: Walls are quite steep (pre-sheared) but appear stable.
Accessibility: Open; easily accessible.

Trenches (photo 6-1)

Stripped area (100 m x 250 m) located ~150 m southwest of the Birmingham SW pit, contains 6 backhoe trenches with exposed veins.

5.2 Waste Rock Disposal Areas

Birmingham and Birmingham SW Open Pit Dumps

Composed of thick and thin bedded barren quartzites and graphitic schists with a remnant skim of ore remaining in stockpile areas. (~ 1,500,000 tonnes). The Birmingham Pit drains to the underground workings and reports at the Birmingham 200 level adit. The Birmingham SW Pit retains water and the overflow likely drains through the dumps, although no seepage areas were observed at the toe of the dumps. The vegetation below the toe of the dumps did not appear to be stressed.

Birmingham 200 Level Adit Dump

Composed of stained quartzite, schist and fault gouge. (70 m long x 25 m wide x 3 m deep approximately 12,000 tonnes).

Rock sample

Previous environmental sampling was conducted on the waste rock disposal areas in 1995. Results are presented in the following table.

Sample	Paste pH	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Bermingham Pit Wall							
95UKHBP01	7.05	0.09	0.09	0.00	1.50	1.5	-
95UKHBP02	7.09	0.07	0.07	0.00	1.75	1.8	-
95UKHBP03	6.94	0.21	0.20	0.31	0.00	-0.3	<0.1
95UKHBP04	6.89	0.04	0.03	0.31	0.25	-0.1	0.8
95UKHBP05	6.87	0.07	0.06	0.31	1.56	1.3	5.0
95UKHBP06	8.03	0.95	0.27	21.3	70.1	48.9	3.3
95UKHBP07	8.68	0.19	0.16	0.94	9.63	8.7	10.3
Bermingham Pit Dump							
95UKHBD01	7.34	0.03	0.03	0.00	6.00	6.0	-
95UKHBD02	7.20	0.32	0.31	0.31	7.19	6.9	23.0
95UKHBD03	6.62	1.94	0.69	39.1	155.6	116.6	4.0
95UKHBD04	7.24	0.49	0.21	8.75	14.13	5.4	1.6
95UKHBD05	7.56	2.50	0.54	61.3	144.4	83.1	2.4
95UKHBD06	7.32	0.07	0.07	0.00	0.00	0.0	-

5.3 Tailings Impoundments

There are no tailings impoundments at the site.

5.4 Tailings Dams

There are no tailings dams at the site.

5.5 Tailings Ponds

There are no tailings ponds at the site.

5.6 Minesite Water Treatment

There are no water treatment facilities or operations conducted at the site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There are two separate sites that are included under the Bermingham report. The first site is the Bermingham pit and includes two large pits, 6 trenchs and the Ruby shafthouse with one raise. The second site is the Bermingham adit that accommodates 6 buildings, including an adit and an explosives magazine. The explosives magazine consisted of two adjoining separate entrance buildings, the other being the detonator house. A wooden utilidor runs between buildings 6B,C and D.

Building 6A – Ruby Shafthouse (photo 6-2)

The building is a shafthouse that has partially collapsed over the shaft.
Location:
Dimensions (L x W x H): 15m x 6m x12m
Construction: The structure is of wood frame construction with metal sheathing on exterior walls and roof. The floor and walls are constructed of wood planks and the shaft area is reinforced with timber.
Paint: No paint was noted on exterior or interior of shafthouse.
Asbestos: No asbestos was noted at the structure
Foundation: Timber above grade.
Non-Hazardous Contents: No non-hazardous contents were found.
Hazardous Contents: There were two barrels with lubricant labels, however, it is not known if the barrels contained any product as the building has become a safety hazard and was not entered during the site investigation. Some rags stored in pails appeared to be stained with hydrocarbon product.

Building 6B – Explosives Magazine and Detonator House (photo 6-3)

This structure served as the explosives magazine and the detonator house. The detonator house appeared to be of newer construction than the adjoining explosives magazine. The timber plank walls had been partially removed in both buildings.
Location: Listed as building 6B on the Bermingham site map.
Dimensions (L x W x H): 6m x 4m x 4m

Construction: The building is wood frame construction and the interior walls are fortified with sand (photo 6- 4).
Paint: There was no paint evident on either the exterior or interior of the building.
Asbestos: No asbestos was noted.
Foundation: The foundation consisted of concrete pad in some areas and soil floor in others. There were also two built up concrete pads that supported diesel generators.
Non-Hazardous Contents: The building had no contents stored inside.
Hazardous Contents: There were no hazardous contents stored inside the building or around the exterior.

Building 6C – Residential (photo 6-5)

The structure appears to have been residential.
Location: Listed as 6C on the Bermingham Adit site plan.
Dimensions (L x W x H): The building has collapsed.
Construction: The structure appears to have been wood frame, board and batten construction from the debris that was scattered.
Paint: No paint was noted.
Asbestos: No asbestos was noted.
Foundation: Foundation was wood.
Non-Hazardous Contents: There were no contents stored in or around the building.
Hazardous Contents: No hazardous contents were noted in or around the collapsed building.

Building 6D – Water Shack (photo 6-6)

The function of the building was to heat water and pipe it down gradient to avoid ice build up.
Location: The building is listed as 6D on the Bermingham Adit site map.
Dimensions (L x W x H): 4m x 2m x 3m
Construction: The structure is of wood frame construction with tar paper exterior and tar shingles on roof and rear.
Paint: No paint was noted at the building.
Asbestos: No asbestos was noted at the building.
Foundation: The foundation consists of raised timber slats with metal sheathing along some of the length.
Non-Hazardous Contents: There were two barrels inside the shack. One of the barrels was utilized for heating the water and the other barrel was empty (photo 6-7).
Hazardous Contents: There were no hazardous contents inside the building or around the exterior.

Building 6E – Residential (photo 6-8)

The building appears to be residential.

Location: The structure is listed as 6E on the Bermingham Adit site map.

Dimensions (L x W x H): 6m x 4m x 4m

Construction: The building consists of wood frame with asphalt shingles.

Paint: The building was unpainted.

Asbestos: No asbestos was noted.

Foundation: The foundation consisted of a raised wood platform.

Non-Hazardous Contents: No contents were noted in the building.

Hazardous Contents: No hazardous contents were noted either in the building or the surrounding area.

Building 6F – Residential

The building appears to be residential

Location: The structure is listed as building 6F on the Berminingham Adit site map.

Dimensions (L x W x H): 6m x 4m x 4m

Construction: The structure is of timber frame construction with asphalt shingles.

Paint: No paint was noted on either the exterior or interior of the building.

Asbestos: No asbestos was noted.

Foundation: The foundation consisted of a raised wooden platform.

Non-Hazardous Contents: No contents were noted inside the structure.

Hazardous Contents: There were no hazardous contents noted in the building nor were there any in the surrounding area of the structure.

Note: Both building 6E and 6F have deteriorated and were unsafe to enter during the site investigation.

Building 6G – Adit (photo 6-9)

Portal structure.

Location: Listed as building 6G on the Bermingham Adit site map.

Dimensions (L x W x H):

Construction: Timber and wood structure.

Paint: There was no paint noted on the exterior.

Asbestos: There was no asbestos noted on the exterior.

Foundation: No foundation.

Non-Hazardous Contents: There were no non-hazardous contents noted.

Hazardous Contents: There were no hazardous contents noted in or around the structure.

Note: The structure has deteriorated to the point that it has become a safety hazard. It appears that the shaft has collapsed into itself and there are danger signs posted on the wooden doors.

6.2 Fuel Storage

There was no fuel storage noted at the site, and no above ground storage tanks were evident.

6.3 Rail and Trestle

There were no rail or trestle structures at the site. There were metal tracks and associated debris piled at the site near building 6C (photo 6-10). The tramway structure is directly below the site, however, there is no indication that it was used by the Bermingham mine site.

6.4 Milling and Processing Infrastructure

No milling or processing infrastructure was noted at the site.

6.5 Electrical Equipment

A power line extends from Ruby 400 to Bermingham and Ruby Shaft areas and is still in existence (photo 6-11).

7. SOLID WASTE DUMPS

No solid waste dumps were noted at the mine site.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No transformers were noted at the site.

8.2 Metals and Hydrocarbons in Soil

No staining was evident on the soils at the site.

8.3 Liquid Hazardous Materials

No liquid hazardous waste materials were noted at the site.

8.4 Solid Hazardous Materials

No solid hazardous materials were noted at the site.

9. WATER QUALITY

One water sample (06-01-water) was collected at the Bermingham pit from the eastern pit surface water. The second sample (06-02-water) was taken at the Bermingham adit site of discharge water from the adit (photo 6-12). The sample results can be found in Attachment B.

10. RECLAMATION

There has been some natural revegetation of the site in the form of small shrubs and grasses. There does not appear to be any reclamation measures being carried out either historically or presently at the site.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were available.

12. REFERENCES

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

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Table B1. 1999 Water Quality Results, Bermingham Site

		Detection Limit	Units	Site 6-01-Water - Ruby - 14/09/99	Site 6-02-Water - Ruby - 14/09/99
pH (field)					
Conductivity (field)					
pH (Lab)		0.01	pH	6.76	7.11
Conductivity (Lab)		0.01	µS/cm	85	300
Total Alkalinity		5	mg CaCO3/L	18	113
Chloride		0.1	mg/L	0.17	<0.25
Hardness (CaCO3 equiv)		5	mg/L	42.3	170
Nitrate-N		0.01	mg/L	0.03	<0.05
Nitrite-N		0.003	mg/L	<0.003	<0.003
Sulphate		1	mg/L	19.7	63
Total Dissolved Solids		5	mg/L	58	216
ICP-USN Total Metals Scan in Water					
	Aluminum	0.0008	mg/L	0.113	0.0128
	Antimony	0.005	mg/L	<0.005	<0.005
	Arsenic	0.01	mg/L	<0.01	0.06
	Barium	0.00004	mg/L	0.0167	0.0035
	Beryllium	0.00001	mg/L	<0.00001	<0.00001
	Bismuth	0.0004	mg/L	<0.0004	<0.0004
	Boron	0.002	mg/L	<0.002	<0.002
	Cadmium	0.00001	mg/L	0.00586	0.148
	Calcium	0.002	mg/L	8.66	50
	Chromium	0.00006	mg/L	0.00012	<0.00006
	Cobalt	0.00003	mg/L	0.00011	0.00026
	Copper	0.00003	mg/L	0.00177	0.00168
	Iron	0.00001	mg/L	0.16	0.107
	Lead	0.0003	mg/L	0.0168	0.0034
	Lithium	0.001	mg/L	<0.001	0.013
	Magnesium	0.0005	mg/L	3.07	9.69
	Manganese	0.00002	mg/L	0.133	1.19
	Mercury	0.0001	mg/L	<0.0001	<0.0001
	Molybdenum	0.00007	mg/L	<0.00007	0.00089
	Nickel	0.00001	mg/L	0.0004	0.0017
	Phosphorus	0.03	mg/L	<0.03	0.1
	Potassium	0.4	mg/L	<0.4	<0.4
	Selenium	0.004	mg/L	<0.004	<0.004
	Silicon	0.004	mg/L	1.03	4.06
	Silver	0.00005	mg/L	0.00043	0.00029
	Sodium	0.4	mg/L	<0.4	0.9
	Strontium	0.00002	mg/L	0.0439	0.0988
	Sulphur	0.008	mg/L	6.98	21.9
	Thallium	0.001	mg/L	<0.001	0.002
	Titanium	0.00002	mg/L	0.00207	<0.00002
	Vanadium	0.00003	mg/L	0.00011	<0.00003
	Zinc	0.0002	mg/L	0.0806	4.44
Total Arsenic by Hydride AA					
	Arsenic	0.0002	mg/L	0.0037	0.0588
Total Selenium by Hydride AA					
	Selenium	0.0001	mg/L	<0.0001	<0.0001

RUBY 400 #6
(MINFILE # 105M 001 d,e)

1. LOCATION AND ACCESS

Access to the site is by way of the townsite of Elsa up the Galena summit on Calumet Road and taking the switchback at Hector Calumet mine site along the Bermingham Road. The Ruby 400 mine site is situated on a road to the right just before the Bermingham mine site at approximately 1125m at Latitude 63° 54' 35"N, Longitude 135°25' 53"W. UTM co ordinates are 7 080 025m N 478 831m E.

2. SITE PHYSIOGRAPHY

The site is located on the northwest slope overlooking the McQuesten Valley. It is downgradient of the Bermingham mine site. The site consists of cleared areas where all soils have been stripped off and pushed downslope. The surrounding vegetation consists of stunted black spruce, willows, and alder with a floor covering of mosses, indicative of a permafrost environment.

3. GEOLOGY AND MINERALIZATION

The site is located in a sequence of thick and thin bedded quartzites and graphitic schist. The vein material is reported to be a heavily weathered mix of brecciated quartzite and schists, quartz, serisite, galena and pyrite.

4. SITE HISTORY

Historical Ruby 400 production is estimated at 36,879 tonnes @ 864 g/t Ag, 3% Pb, and 1.3% Zn. Information gathered from previous reports indicates that there is planned future underground mining for the Ruby 400.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

Portals

Level 400 adit entrance
Location: Portal is located at the Ruby 400 site adjacent to the garage.
Dimensions: 20m x 4m x 4m
Supports: The entrance is timber frame construction.
Condition: Structure appeared stable at the time of inspection.

Accessibility: Portal is open and accessible up to ice plug.

5.2 Waste Rock Disposal Areas

Ruby Shaft

There appears to be no underground waste dumps associated with the Ruby shaft area.

Ruby 400 Level Portal Dump

The dump and load out cover an area of 100 m x 50 m (~ 28,000 tonnes).

The dump is composed of quartzite, quartz and schist; minor staining is present.

There is a kill zone between the toe of the dump and Calumet Drive (~100 m x 10 m). Few sulphides were observed in the dump and the rock samples data shown in the UKHM reports indicate low acid potential, so the kill zone is likely caused by the portal drainage seeping through the dump area.

Waste rock pile #

(Identify which waste rock pile(s) is (are) related to which development; geology, vegetation, presence/absence of surface or subsurface drainage over/through waste rock; oxidation/staining; water content/retention capacity. State whether waste rock piles are derived from mine development, open pits etc. and those which are overburden)

Location: (map/describe)

Dimensions: (L x W x H)

Sampling: Waste rock samples were collected during a 1995 assessment of the site. The results are presented in the following table.

Sample ID	Paste pH	S(tot) %	S(SO4) %	AP	NP	NET NP	NP/AP
				Kg CaCO3/t			
95UKHRD01	7.82	1.06	0.43	19.69	36.25	16.6	1.8
95UKHRD02	7.83	0.72	0.28	13.75	51.13	37.4	3.7
95UKHRD03	7.02	0.66	0.32	10.63	15.00	4.4	1.4

5.3 Tailings Impoundments

Tailings Dams

There were no tailing dams at the site.

Tailings Ponds

There were no tailing ponds at the site.

5.4 Minesite Water Treatment

There are no water treatment facilities or operations at this site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There are two structures at the Ruby 400 mine site, the adit to the underground mine works, and a structure that served as workshop, garage and boiler house. A utilidor extends from the portal to the workshop (photo 6-14).

Building 6G – Adit (photo 6-15)

The structure is a portal with the above dimensions exposed.
Location: The building is located on the Ruby 400 location map and is labeled as 6G.
Dimensions (L x W x H): 20m x 4m x 4m.
Construction: The structure is constructed of wood frame with tar paper lining the exterior. The interior consists of wood plank sheathing (photo 6-16).
Paint: No paint was visible on either exterior or interior of the structure.
Asbestos: No asbestos was visible at the building site.
Foundation: No foundation.
Non-Hazardous Contents: There were wooden boxes situated just inside the entrance to the adit, however, there were no contents visible. Steel piping was located inside the entrance wrapped with fibreglass insulation.
Hazardous Contents: No hazardous contents were noted either inside the building or around the outside perimeter.
Samples: Water sample 06-03-water was taken 12m inside the adit from a pipe (photo 6-17). The sample analyses can be found in this report under Section 9. Water Quality.

Building 6H - Garage (photo 6-18)

This structure functions as a garage, workshop and boiler house.
Location: The building can be found on the Ruby 400 site map labeled as building 6H.
Dimensions (L x W x H): 12m x 10m x 8m
Construction: The building is wood frame construction with metal clad sheathing and a metal roof.

Paint: No painted surfaces are present in this builidng.
Asbestos: There was no asbestos noted in the building.
Foundation: The foundation was above grade with dirt/gravel floors in the two bays and a wood plank floor in the workshop.
Non-Hazardous Contents: A furnace was located in the workshop with some staining evident around the base. Wood shelving with metal debris was located on two walls (photo 6-19).
Hazardous Contents: No hazardous contents were noted in the building.
Samples: Sample 06-01-soils was taken at the north west corner of the receiving tank (photo 6-20). Sample analyses results can be found in the table listed in *6.2 Fuel Storage.*

6.2 Fuel Storage

Location: Northwest corner of the receiving tank behind the garage.
Above Ground Storage Tanks: The tank appears to be empty, however, there may be some residue inside the tank. The tank appears to be in good condition, however, there is no secondary containment associated with the AST. There is some leakage that has occurred and the soils surrounding the tank have been stained. Sample 06-01-soils was taken to the northwest of the AST and consisted of a soil sample taken at a depth of 5 cm. Soils in the area consisted of dense, compacted fines and gravel materials. Table 1 in Attachment B indicates the sample analyses results.

6.3 Rail and Trestle

Location: The track extends from the adit to the loading area.
Fabrication: The track consists of both metal rails and wood ties.
Amount of materials: There are approximately 40 metres of steel rail and associated wood ties.
Condition: The tracks do not pose a safety hazard and the loading area cribwork appears to be sound.

6.4 Milling and Processing Infrastructure

Grizzly: There were 3 grizzlies located at the loading area that each measured approximately 1.5m x 3m.

6.5 Electrical Equipment

There are intact power lines at the site and it was not know if they were still in service (photo 6- 14). An old electricity-driven compressor was located at the site near the northwest corner of the dump (photo 6- 21). There is some surficial staining under the machine, possibly from remaining product residues left in the engine at the time of abandonment. Information listed on the equipment is as follows.

Electrical Compressor
Vertical Air Compressor
Model # BJ4001
Serial # 140040
RPM 870 Pressure: 100 PSI
GARDNER DENVER CO
A pressure vessel was also found at the site and was labeled with the following information.

Pressure Vessel
Approx. 3 m. long x 1.5 m. diam.
Steel Weld . 1965 . Ltd.
Algoma A285C
MAX. W. I. 124
Serial 7675
T. S. 55,000
Y 1324

7. SOLID WASTE DUMPS

There were no solid waste dumps noted at the site.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

The following transformers and associated electrical panels were located in a collapsed wood fence enclosure (photo 6-22). There were no signs of any leakage from the transformers.

Westinghouse Single Phase Transformers
50 KVA
135 L Oil
SERIAL # 246241

Westinghouse Single Phase Transformers
50 KVA
135 L Oil
SERIAL # 246234

Westinghouse Single Phase Transformers

50 KVA
135 L Oil
SERIAL # 246236

8.2 Metals and Hydrocarbons in Soil

The interior of the adit was stained with hydrocarbons, however, it was difficult to determine where the staining was situated as an ice plug, located to the back of the adit, was draining melt water and the entire soil floor was encased in 5cm of mud (photo 6-17). Some precipitation was noted and listed as bright orange. No samples were taken in the adit structure.

8.3 Liquid Hazardous Materials

No liquid hazardous materials were noted at the site.

8.4 Solid Hazardous Materials

No solid hazardous materials were noted at the site.

9. WATER QUALITY

Water sample 06-03-water was taken approximately 12m horizontally inside the portal. There was a discharge pipe at the sample location. Water flow at the sample location was 1.5L/s. The pH levels were 7.6 and conductivity was 43µS. The soils in the portal were generally silts and were stained with bright orange by precipitate. Approximately 5 cm of mud was located on the floor of the portal partially due to the melt water from an ice plug.

Water sample 06-04-water was taken at piezometer 95 UKHRD-2, located on the north side of the center of the dump. pH levels were tested at 4.9 and the conductivity was 490µS.

Water sample 06-05-water was collected from a ditch located at the toe of the Ruby 400 on the corner of the south bank (photo 6-23). Drainage is from both groundwater and seepage from the dump. The ditch was dry at the north corner and down gradient for 50m. Field test results for pH levels were 3.3 and conductivity at 228µS.

Water sample 06-06-water was taken below the Ruby 400 at piezometer 95UKN1/1. Field testing indicated a pH of 6.1 with conductivity at 11µS. Sample collection was also attempted at piezometers 95UKN1/2 and 95UKN1/3, however, both locations were dry and no sample was obtained.

Sample analyses for all water samples taken at the site can be found in Attachment B.

Previous Environmental Studies/Sampling
The Ruby 400 adit has been documented as having an ice plug present throughout the year inside the portal. The water quality monitoring data shows more variability than the other adits on Galena Hill due to this ice formation. The freezing and thawing of the ice affects the water chemistry throughout most of the year.

There has been a consistent decrease in the peak and average zinc concentrations over the course of the past five years of the site water quality monitoring program. Copper, lead, cadmium and arsenic are occasionally present in the drainage water, however, these metals and conductivity do not indicate a decreasing trend in concentrations and have been consistent for the past five years.

10. RECLAMATION

Describe the nature and approx. extent of any natural revegetation that has occurred on disturbed ground. Describe any reclamation measures carried out by past or present site operators.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were available.

12. REFERENCES

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

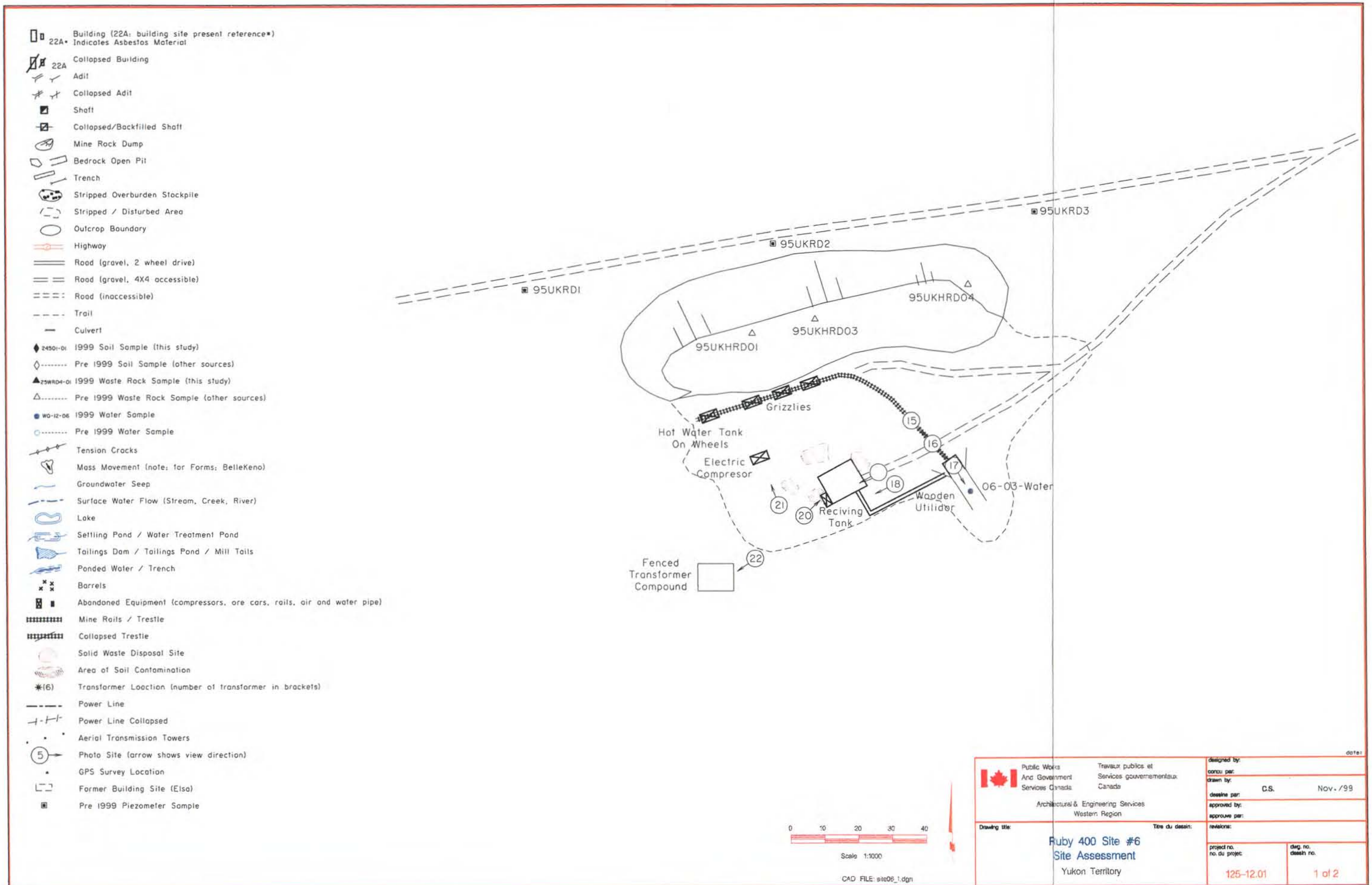
United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Table B1. 1999 Water Quality Results, Ruby 400 Site

	Detection Limit	Units	06-03 - Water - 99/09/14	06-04-Water - Bermington - 14/09/99	Ruby 400 06-05-Water - Ruby 400 - 99/09/15	06-06 - Water - 99/09/17
pH (field)						
Conductivity (field)						
pH (Lab)	0.01	pH	7.56	5.06	3.43	5.89
Conductivity (Lab)	0.01	μS/cm	520	3000	2700	820
Total Alkalinity	5	mg CaCO3/L	119	<5	<5	25
Chloride	0.25	mg/L	<0.25	na	na	0.37
Chloride	0.5	mg/L	na	4.3	1.4	
Hardness (CaCO3 equ	5	mg/L	253	1280	774	468
Nitrate-N	0.05	mg/L	<0.05	3.9	0.9	0.06
Nitrite-N	0.003	mg/L	<0.003	0.004	0.012	0.004
Sulphate	1	mg/L	138	2300	1860	410
Total Dissolved Solids	5	mg/L	341	3730	2950	650
ICP-USN Total Metals Scan in Water						
Aluminum	0.0008	mg/L	0.118	55.9	12.5	12.8
Antimony	0.005	mg/L	<0.005	0.025	<0.005	0.013
Arsenic	0.01	mg/L	0.03	0.14	<0.01	0.1
Barium	0.00004	mg/L	0.00866	1.49	0.0079	0.466
Beryllium	0.00001	mg/L	<0.00001	0.00339	0.00289	0.00044
Bismuth	0.0004	mg/L	<0.0004	0.0028	<0.0004	0.0022
Boron	0.002	mg/L	<0.002	0.166	0.067	0.057
Cadmium	0.00001	mg/L	0.00833	1.81	1.63	0.193
Calcium	0.002	mg/L	80.2	272	171	117
Chromium	0.00006	mg/L	<0.00006	0.098	0.0259	0.0231
Cobalt	0.00003	mg/L	0.00518	0.173	0.185	0.0146
Copper	0.00003	mg/L	0.00196	0.455	0.336	0.0423
Iron	0.00001	mg/L	1.95	124	7.83	84.6
Lead	0.0003	mg/L	0.001	0.917	0.329	0.14
Lithium	0.001	mg/L	0.014	0.106	0.019	0.025
Magnesium	0.0005	mg/L	11.9	169	94.1	32.9
Manganese	0.00002	mg/L	2.69	5.2	6.57	4.87
Mercury	0.0001	mg/L	<0.0001	0.0003	<0.0001	<0.0001
Molybdenum	0.00007	mg/L	0.00049	0.00421	<0.00007	0.00268
Nickel	0.00001	mg/L	0.0299	1.39	0.802	0.0868
Phosphorus	0.03	mg/L	0.05	5.53	<0.03	1.64
Potassium	0.4	mg/L	<0.4	6.1	0.9	1.8
Selenium	0.004	mg/L	<0.004	0.144	0.11	<0.004
Silicon	0.004	mg/L	3.66	82.9	9.27	24.8
Silver	0.00005	mg/L	0.0003	0.0583	0.0366	0.00337
Sodium	0.4	mg/L	0.9	4.5	2.2	2.2
Strontium	0.00002	mg/L	0.0915	0.305	0.197	0.15
Sulphur	0.008	mg/L	47.5	750	594	136
Thallium	0.001	mg/L	0.004	0.405	0.344	<0.001
Titanium	0.00002	mg/L	0.00013	1.74	0.00033	0.563
Vanadium	0.00003	mg/L	<0.00003	0.141	<0.00003	0.0406
Zinc	0.0002	mg/L	1.2	21.1	27.7	7.91
Total Arsenic by Hydride AA						
Arsenic	0.0002	mg/L	0.0269	0.23	0.0005	0.0435
Total Selenium by Hydride AA						
Selenium	0.0001	mg/L	0.0002	0.0008	<0.0001	0.0016

Table B1. 1999 Soil Quality Results, Ruby 400 Site

		Detection Limit	Units	06-01-Soils - Ruby 400
PCBs in Soil				
Total PCBs		0.1	mg/kg	<0.1
pH in Saturated Paste				
pH		0.1	pH	6.8
pH in Soil (1:2 water)				
pH		0.01	pH	6.9
ICP Semi-Trace Scan - Metals in Soil				
	Aluminum	5	µg/g	22500
	Antimony	2	µg/g	210
	Arsenic	2	µg/g	269
	Barium	0.05	µg/g	399
	Beryllium	0.1	µg/g	0.4
	Bismuth	5	µg/g	<5
	Cadmium	0.1	µg/g	158
	Calcium	5	µg/g	1760
	Chromium	0.5	µg/g	28.1
	Cobalt	0.1	µg/g	7.2
	Copper	0.5	µg/g	184
	Iron	1	µg/g	51000
	Lead	1	µg/g	4500
	Lithium	0.5	µg/g	9.6
	Magnesium	1	µg/g	2400
	Manganese	0.5	µg/g	8230
	Mercury	0.01	µg/g	0.808
	Molybdenum	1	µg/g	3
	Nickel	1	µg/g	19.2
	Phosphorus	5	µg/g	447
	Potassium	20	µg/g	7400
	Selenium	2	µg/g	<2
	Silicon	5	µg/g	3870
	Silver	0.5	µg/g	357
	Sodium	5	µg/g	741
	Strontium	1	µg/g	20
	Sulphur	10	µg/g	17900
	Thorium	1	µg/g	<1
	Tin	1	µg/g	9
	Titanium	0.2	µg/g	87.6
	Uranium	5	µg/g	<5
	Vanadium	1	µg/g	45
	Zinc	0.5	µg/g	9890
	Zirconium	0.1	µg/g	10.6


22A* Building (22A: building site present reference*) Indicates Asbestos Material
22A Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24S01-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WRD4-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WO-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Pre 1999 Piezometer Sample
95UKRD3
95UKRD2
95UKRD1
95UKHRD04
95UKHRD03
95UKHRD01
Grizzlies
Hot Water Tank On Wheels
Electric Compresor
15
16
17
18
20
21
22
06-03-Water
Wooden Utilidor
Reciving Tank
Fenced Transformer Compound
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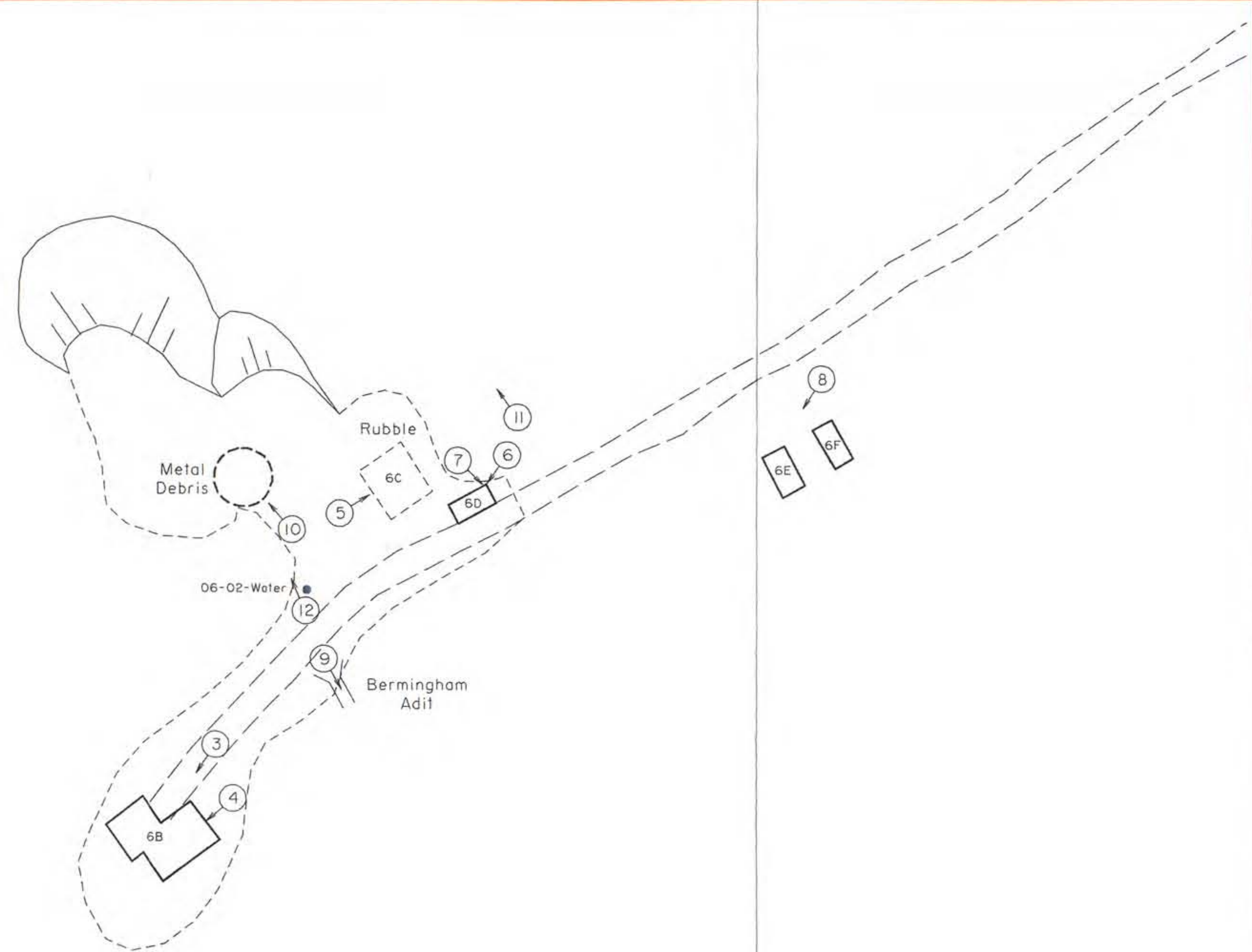
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title:
Titre du dessin:
Ruby 400 Site #6
Site Assessment
Yukon Territory
designed by:
concu par:
drawn by:
C.S.
dessine par:
approved by:
approuve par:
revisions:
date:
Nov./99
project no.
no. du projec
125-12.01
dwg. no.
dessin no.
1 of 2

Building (22A: building site present reference*) 22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WO-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
*(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)



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Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region

Drawing title: / Titre du dessin:
Bermingham & Ruby (Arctic & Mastiff)
Site #6
Site Assessment
Yukon Territory

designed by: / concu par:	
drawn by: / dessine par:	C.S. Nov./99
approved by: / approuve par:	
revisions:	
project no. / no. du projet: 125-12.01	dwg. no. / dessin no. 2 of 2

Photo 6-1 : Panoramic view of trenching at Bermingham Pit. (Azimuth 210^{o})

Photo 6-2 : Ruby Shaft. South portion of shaft house over opening has collapsed.

Photo 6-3 : Bermingham Pit. Building 1. Explosives magazine. (Azimuth 235°)

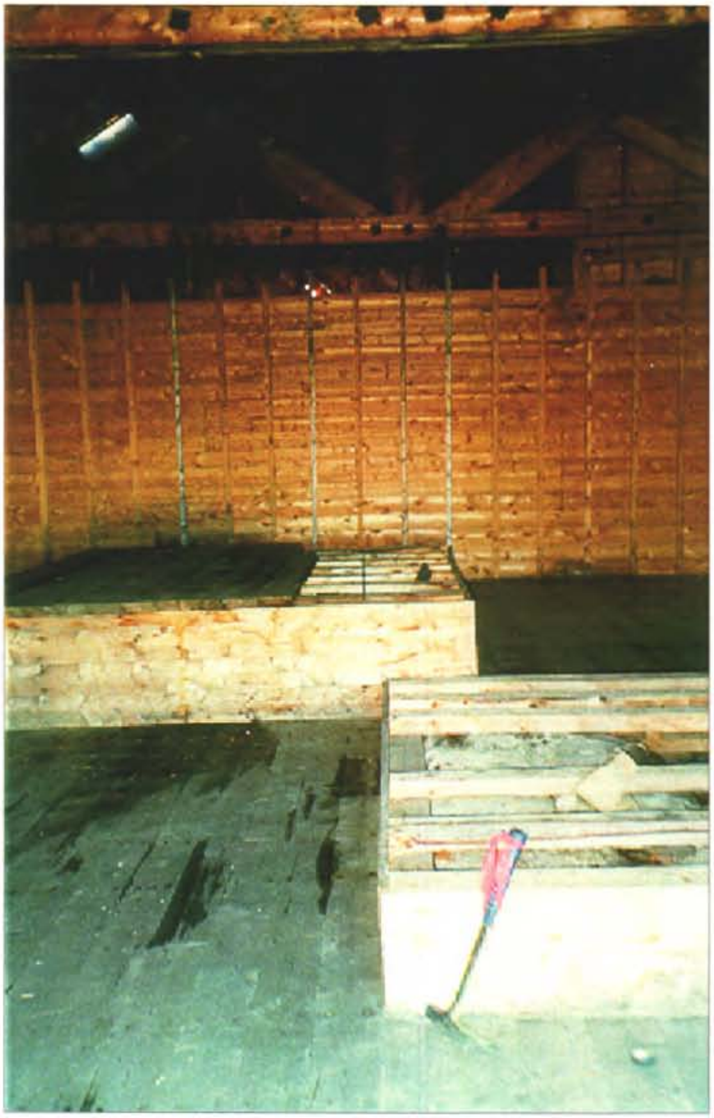


Photo 6-4 : Bermingham Pit. Building 1. Interior of explosives magazine. (Azimuth 225°)

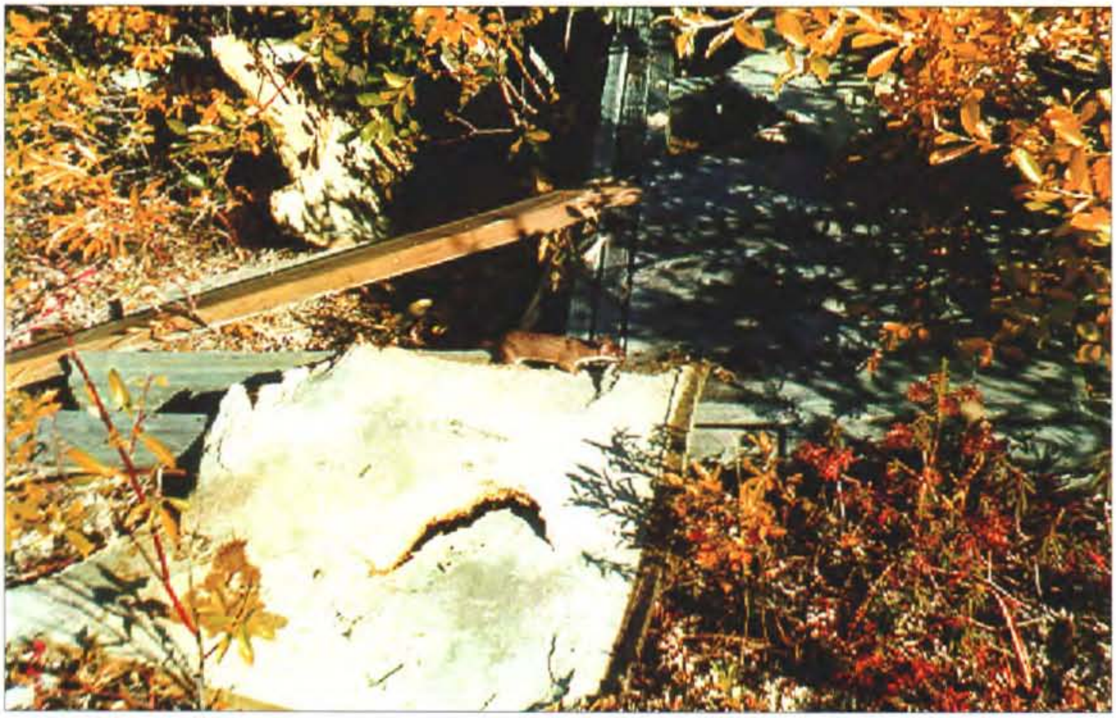


Photo 6-5 : Bermingham Adit.

Photo 6-6 : Bermingham Adit. Wooden pipe extending from Building #3. (Azimuth 160°)

Photo 6-7 : Bermingham Adit. Interior of Building #3.

Photo 6-8 : Bermingham Adit. Buildings 4 & 5. Wood frame asphalt shingles - tar paper exterior. (Azimuth 195°)

Photo 6-9 : Bermingham Adit. Portal at Bermingham Adit. (Azimuth 170°)

Photo 6-10 : Bermingham Adit. Metal debris on dump. (Azimuth 325°)

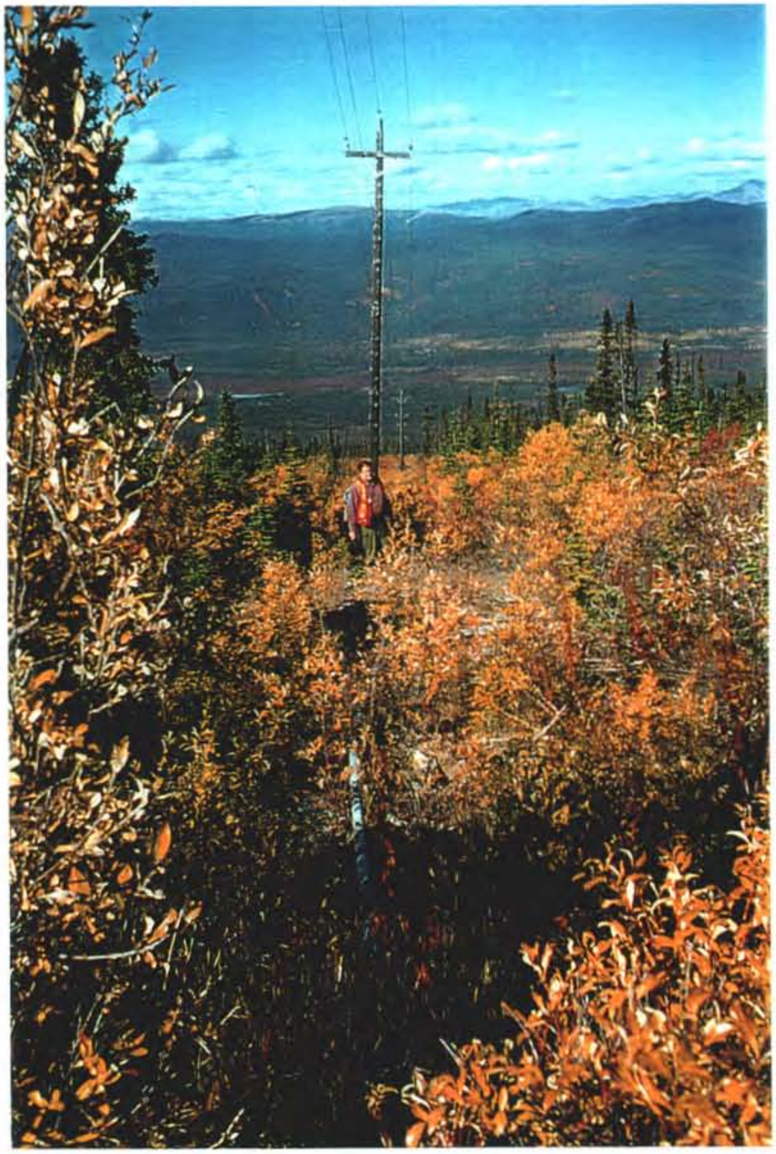


Photo 6-11 : Bermingham Adit. Powerlines from Adit.
Also note wooden pipe extends down
along powerline.

Photo 6-12 : Bermingham Adit. Water sample location. (Azimuth 348^{o})

Photo 6-14 : Ruby 400. Utildor from adit structure to garage. Transformer compound is in the background.

Photo 6-15 : Ruby 400. Adit structure with rail tracks extending from the structure and utildor on right..

Photo 6-16 : Ruby 400. Interior photo of the adit structure.

Photo 6-17 : Ruby 400. 12 metres into the interior of adit at sampling location.

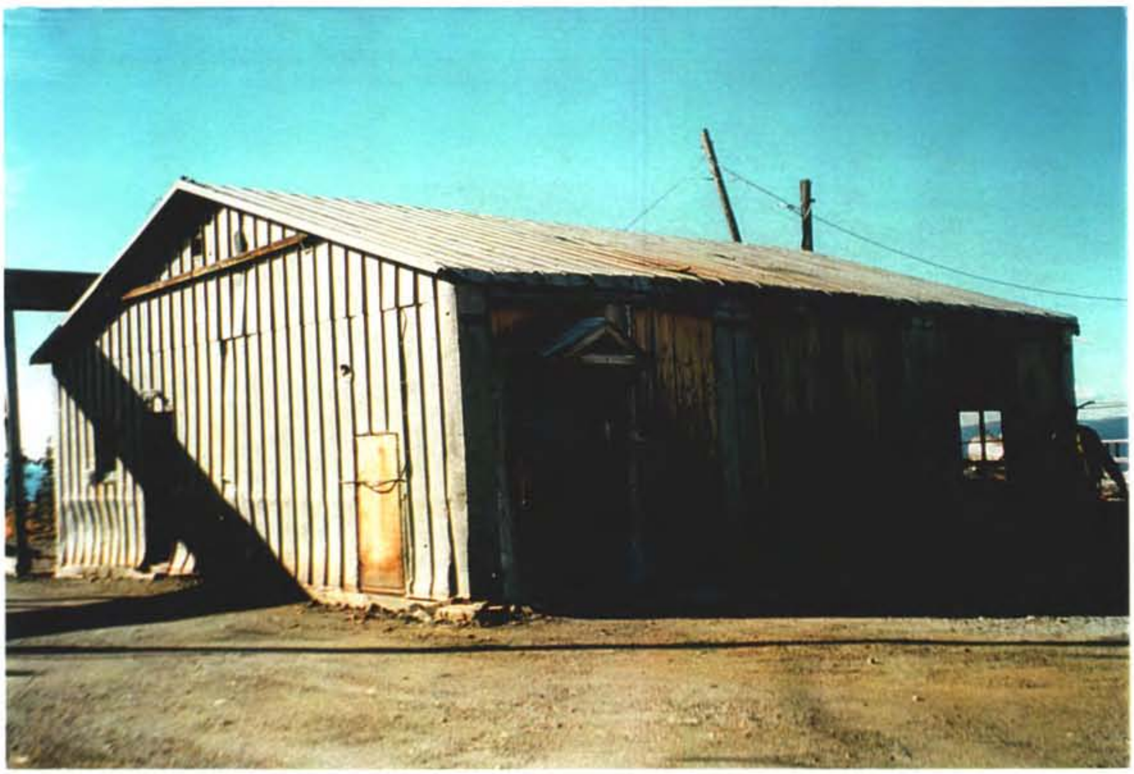


Photo 6-18 : Boiler house and garage structure.

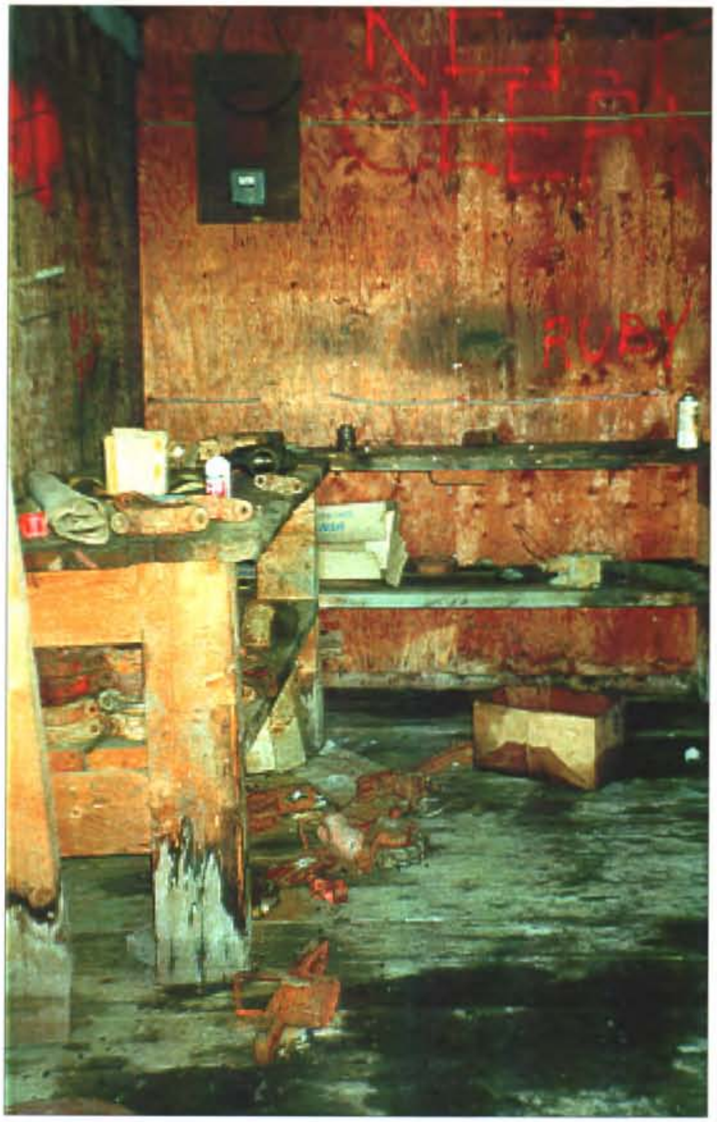


Photo 6-19 : Ruby 400. Interior of the shop area of the garage.

Photo 6-20 : Ruby 400. Receiving tank located on the exterior wall of the boiler house.

Photo 6-21 : Ruby 400. Abandoned compressor and some miscellaneous debris.

Photo 6-22 : Ruby 400. Transformer compound located at the mine site.

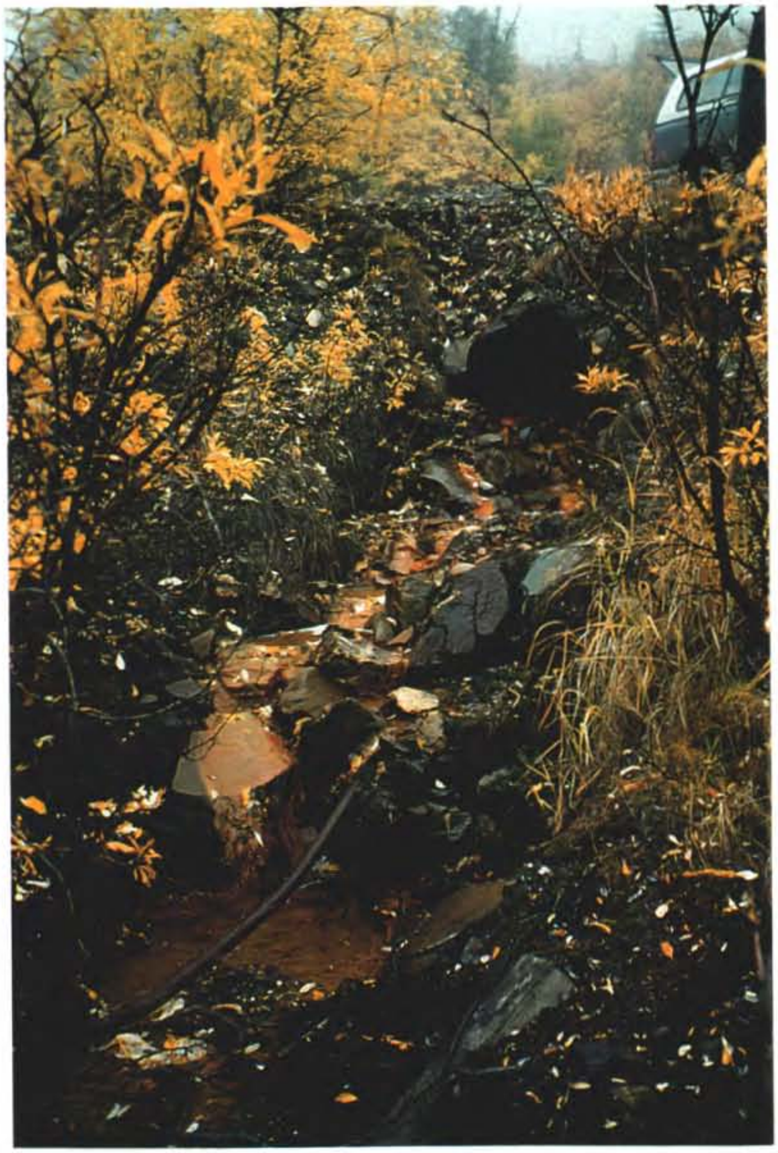


Photo 6-23 : Ruby 400. Sample location 06-05
-water collected below the Ruby 400 dump..

NO CASH 100 #7
(MINFILE # 105M 001f)

1. LOCATION AND ACCESS

Access to the site is from the Elsa townsite along Calumet Road crossing over porcupine gulch and taking a left turn onto the No Cash 100 Road. The site has a latitude of 63° 55'08"N and longitude of 135° 27' 51"W. The NTS is 105M 14. The site is at an approximate altitude of 1100m. UTM co ordinates for the site are 7 088 058m N 477 230m E.

2. SITE PHYSIOGRAPHY

The No Cash 100 mine site is located on the northwest slope of Galena Hill at an elevation of 1100 metres above sea level. The mine site is similar in drainage to the No Cash 500 site. Drainage eventually empties into the No Cash Creek, down gradient of the site, 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.

3. GEOLOGY AND MINERALIZATION

The vein is hosted in barren, massive thick-bedded quartzites interbedded with graphitic schist, phyllite and thin-bedded quartzites. The vein material is reported to be heavily weathered with strong limonite and manganese staining. The vein material is reportedly composed of brecciated quartzite with limonite, manganese oxides, siderite, quartz stringers, galena, sphalerite, freibergite, their oxides, pyrite and arscenopyrite.

4. SITE HISTORY

The No Cash site has been in operation since the 1920's and from 1928 to 1931, 19 tonnes of ore were produced at 25m drifting on the 50-level. From 1948 to 1975, mining was conducted from the 500-level adit measuring 1115m in length producing a 5900 tonne dump at the portal. There are four raises and the Brefalt Shaft, plus a very small pit at the northeast end of the veins. Deep trenches can be found on the surface near the shaft.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

No Cash 100 Level Portal

Wood frame construction, with wooden doors and a metal screen door (unlocked). Portal walls are collapsing. No water discharge was observed. The steel rails were still in place.

Brefalt Shafthouse

This structure is wood frame construction; tarpaper covered wood walls with the roof partially collapsed. Skip is on doors covering shaft (blocking any access), manway has partially collapsed.

Raises

A raise exists 160 meters West of Brefalt Shaft. The raise cover has collapsed downslope however, no obvious subsidence was noted in the area.

Open Pits

There are no open pits associated with this site.

Trenches

Trench #1

Location: West of compressor house (~ 50 meters)
Dimensions (L x W x H): 40 m x 25 m x 4m.
Vein material: quartzite with 1-2% disseminated pyrite, quartz veinlets with disseminated pyrite.
Wall rock: graphitic schist and quartzite

Trench #2

Location: Southwest of compressor house (20 meters)
Dimensions (L x W x H): 60 m x 15 m x 6 m
Wall rock: graphitic schist with quartz stringers

Trench #3

Location: South of Brefalt Shafthouse (20 meters)
Dimensions (L x W x H): 60 m x 15 m x 4 m.
Wall rock: graphitic schist and quartzite with quartz stringers and disseminated pyrite.

Trench #4

Eastern trench
Location: About 180 meters northeast of tramway mid-station (Photo 6-1)

Dimensions (L x W x H): 40 m x 20 m x 6 m.
Wall rock: interbedded schists and quartzites
Near vein: quartzite flooded with quartz veinlets

5.2 Waste Rock Disposal Areas

From trench # 1

~ 5,000 tonnes - a mixture of barren schists and quartzite

From trench # 2

~ 7,500 tonnes - barren graphitic schist with quartz veinlets

From trench # 3 (Photo 6-2)

~ 40,000 tonnes - barren graphitic schist with quartz veinlets and quartzite blocks

From trench # 4

~ 15,000 tonnes - barren quartzite with some schist

From Brefalt Shaft

~ 40,000 tonnes - difficult to estimate accurately because it has been reworked by equipment.
- quartzite, schist and vein material
- there are two kill zones below this dump (50 m. x 100 m.) with only minor revegetation occurring

5.3 Tailings Impoundments

No tailings were observed at the site.

5.4 Tailings Ponds

No tailings ponds were observed at the site.

5.5 Minesite Water Treatment

Water at this site is not being treated.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There are a total of five buildings located at the No Cash 100 mine site. These five structures consist of a tramway mid-station, garage, shaft house, lunchroom and adit.

Building 7A – Tramway Mid-station (photo 6-3)

Location: Located on the No Cash 100 site map 130m to the northeast of the shafthouse.
Dimensions (L x W x H): 26m x 6m x 5m
Construction: The structure consists of wood frame construction.
Paint: Structure is unpainted.
Asbestos: No asbestos was noted at the building site.
Foundation: There was no foundation as the tramway was constructed on timber piles with wood bracing.
Non-Hazardous Contents: Some steel cables were located under the tramway.
Hazardous Contents: No hazardous materials were observed at the tramway site.
Samples: None collected.

Building 7B – Garage(Photo 6-4)

Location: Located on the No Cash 100 site map approximately 10m west of the shafthouse.
Dimensions (L x W x H): 14m x 14m x 10m
Construction: The structure consists of wood frame construction with metal sheathing on exterior walls and roof. The garage has 3 bays with painted double wooden doors on each bay.
Paint: Structure is unpainted except for the garage doors.
Asbestos: No asbestos was noted at the building site.
Foundation: The foundation consists of an above grade concrete slab.
Non-Hazardous Contents: A large air compressor (photo 6-5) is located on the exterior wall on the northeast corner of the garage. An old abandoned air compressor (photo 6-6) is located near the southwest corner of the garage. Inside the structure is a boiler room that houses a boiler, compressor, electrical panel, and fan unit.
Hazardous Contents: A sample was taken of product labeled as 350 Chevron, from a 23L drum located immediately inside the garage (07-03-drum). There are no hazardous wastes associated with building 7B other than hydrocarbon products potentially contained within the on-site equipment. There was evidence that the equipment in the boiler room had been leaking product onto the surrounding concrete floor. A few fuel drums around the exterior of the garage were found to be empty. Soils surrounding the fuel drums were not stained. Soil staining was evident along the north side fronting the 3 bays, however, the staining was weathered and did not appear to have penetrated deeply into the surrounding soils.
Note: a small wood frame structure (photo 6-7) was located adjacent to the southeast corner of the garage. The structure measured 2.5m x 2.5m x 2.5m. There was one drum within the structure that

was ¾ full of an unknown viscous product. A sample was conducted on the drum to determine content (07-04-drum).

Samples:

Sample #	Sample Medium	Location	Lab Results
07-03-drum	liquid	garage	PCB Content - **<0.1 ppm**
07-04-drum	liquid	shed behind garage	PCB Content – **2.69 ppm**

Building 7C - Shaft House (Photo 6-8)

Location: Located on the No Cash 100 site map approximately 10m east of the garage.
Dimensions (L x W x H): 12m x 7m x 4m.
Construction: The shaft house is of wood frame construction with timber clad sheathing. Tarpaper has been utilized on the shaft housing and on the roof. Tarpaper was also used on the wood exterior.
Paint: Structure is unpainted.
Asbestos: No asbestos was noted at the building site.
Foundation: The foundation consists of wood plank flooring on grade.
Non-Hazardous Contents: The shaft house has been insulated with fibreglass insulation and there is some wood debris scattered due to deterioration of the structure. The structure should be considered a safety hazard.
Hazardous Contents: There were no hazardous materials noted at building site 7C.
Samples: No samples were taken at building site 7C.

Building 7D – Lunch Room

Location: Located on the No Cash 100 site map 30m north of the adit.
Dimensions (L x W x H): 4m x 8m x 4m
Construction: The structure was of wood frame construction and plywood.
Paint: Structure is unpainted.
Asbestos: The floor and partial wall (1m in height) is sheathed with 2 cm-thick asbestos board (photo 6-9).
Foundation: The foundation consists of wood plank flooring on grade covered with asbestos board.
Non-Hazardous Contents: The lunchroom had no other materials within the structure.
Hazardous Contents: There were no hazardous materials noted in building 7D.
Samples: No samples were taken in building 7D.

Building 7E – Adit (photo 6-10)

Location: Located on the No Cash 100 site map 30m south of the lunchroom.

Dimensions (L x W x H):

Construction: The structure was of wood frame construction and wood sheathing.

Paint: Structure is unpainted.

Asbestos: No asbestos was noted at building site 7E.

Foundation: No foundation.

Non-Hazardous Contents: The adit contained no material other than a retaining wall of chain link fencing as an entry restriction.

Hazardous Contents: There were no hazardous materials noted at building site 7E.

Sample: No samples were taken at building site 7E.

6.2 Fuel Storage

There were no fuel storage areas located at the No Cash 100 mine site. No above ground fuel storage tanks were noted at the site.

6.3 Rail and Trestle

Tramway Debris

There is an old tramway mid-station located at the site. There are a number of old steel cables that have been placed under the tramway.

4	1 cm. diameter cables
2	2 cm. diameter cables
2	4 cm. diameter cables
1	5 cm. bundle of telephone cables

6.4 Milling and Processing Infrastructure

There was no milling or processing structures observed at the site.

6.5 Electrical Equipment

There are no longer services to the site, however, there are still intermittent lines running to some of the structures.

7. SOLID WASTE DUMPS

There are two solid waste dumps adjacent to each other located at the site (photo 6-11). One of the dumps is very minor and consists of some metals but mostly household garbage. The other site consists of metal debris that has rusted and corroded. No product was noted in any of the fuel drums or containers observed in the dump. Both dumps were located on waste rock sites and it is difficult to determine if the kill zones (photo 6-12) adjacent to the dumps were from historical products dumped at the site, or if the impacted vegetation is a result of the existing/past impact from waste rock drainage.

No samples were taken at the site.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No transformers were observed at the site.

8.2 Metals and Hydrocarbons in Soil

There was some indication that spills had occurred on both the exterior and interior of the garage. These spills were associated with the equipment inside the boiler room that has leaked product onto both the concrete floor and immediately outside of the bay doors of the garage. The soils on the exterior of the building were investigated. Staining appears to be surficial and does not pose a significant impact on the surrounding environment.

8.3 Liquid Hazardous Materials

Liquid hazardous materials samples were collected from two drums at the No Cash 100 mine site. One of the drums was located in the garage and the other was found in a small shed behind the garage.

Location(s): Garage
Volume(s): 10L
Label information: Solvent 350 Chevron
Contents: The drum was approximately ½ full of a viscous, amber coloured fluid.

Location(s): Shed adjacent to garage
Volume(s): 20L
Label information: Not labeled
Contents: The drum was approximately ¾ full and the liquid inside the drum was a viscous dark fluid.

Samples:

Sample #	Drum/pail ID & location	PCB screen results
07-03-drum	Garage	<0.1 ppm
07-04-drum	Shed	2.69 ppm

8.4 Solid Hazardous Materials

No solid hazardous wastes were observed at the site.

9. WATER QUALITY

There were no water quality samples taken at the site as no water was present at the time of the site investigation. The upper reaches of Star Creek passes through the site, however, at the time of the site investigation the streambed was dry.

10. RECLAMATION

There are four kill zones at the No Cash 100 site. These areas are down gradient of the mine waste dump sites. The area has moderate revegetation (between 10 to 50%) which has occurred naturally with mosses and lichens. Further down the kill zone, low shrubs have re-colonized the area.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

ANALYTICAL REPORT

47697-7 **07-03 - Drum - 99/09/17**

ICP Semi-Trace Scan Analyte	**Detection Result**	**Limit**	**Units**
Aluminum	<5	5	µg/g wet
Antimony	<2	2	µg/g wet
Arsenic	<2	2	µg/g wet
Barium	2.93	0.05	µg/g wet
Beryllium	<0.1	0.1	µg/g wet
Bismuth	<5	5	µg/g wet
Cadmium	0.3	0.1	µg/g wet
Calcium	1390	5	µg/g wet
Chromium	<0.5	0.5	µg/g wet
Cobalt	<0.1	0.1	µg/g wet
Copper	<0.5	0.5	µg/g wet
Iron	1	1	µg/g wet
Lead	<1	1	µg/g wet
Lithium	<0.5	0.5	µg/g wet
Magnesium	4	1	µg/g wet
Manganese	<0.5	0.5	µg/g wet
Mercury	<0.01	0.01	µg/g wet
Molybdenum	<1	1	µg/g wet
Nickel	<0.2	0.2	µg/g wet
Phosphorus	476	5	µg/g wet
Potassium	40	20	µg/g wet
Selenium	<2	2	µg/g wet
Silicon	<5	5	µg/g wet
Silver	<0.5	0.5	µg/g wet
Sodium	21	5	µg/g wet
Strontium	3	1	µg/g wet
Sulphur	2530	10	µg/g wet
Thorium	<1	1	µg/g wet
Tin	4	1	µg/g wet
Titanium	<0.2	0.2	µg/g wet
Uranium	<5	5	µg/g wet
Vanadium	<1	1	µg/g wet
Zinc	515	0.5	µg/g wet
Zirconium	<0.1	0.1	µg/g wet

47697-7 **07-03 - Drum - 99/09/17**

PCBs **Analyte**	**Detection Result**	**Limit**	**Units**
Total PCBs	<0.1	0.1	ppm

ANALYTICAL REPORT

47697-6 **07-04 - Drum - 99/09/17**

ICP Semi-Trace Sc Detection

Analyte	**Result**	**Limit**	**Units**
Aluminum	12	5	µg/g wet
Antimony	<2	2	µg/g wet
Arsenic	<2	2	µg/g wet
Barium	0.21	0.05	µg/g wet
Beryllium	<0.1	0.1	µg/g wet
Bismuth	<5	5	µg/g wet
Cadmium	<0.1	0.1	µg/g wet
Calcium	8	5	µg/g wet
Chromium	<0.5	0.5	µg/g wet
Cobalt	0.1	0.1	µg/g wet
Copper	<0.5	0.5	µg/g wet
Iron	32	1	µg/g wet
Lead	2230	1	µg/g wet
Lithium	<0.5	0.5	µg/g wet
Magnesium	<1	1	µg/g wet
Manganese	<0.5	0.5	µg/g wet
Mercury	0.22	0.01	µg/g wet
Molybdenum	<1	1	µg/g wet
Nickel	0.6	0.2	µg/g wet
Phosphorus	<5	5	µg/g wet
Potassium	<20	20	µg/g wet
Selenium	<2	2	µg/g wet
Silicon	<5	5	µg/g wet
Silver	<0.5	0.5	µg/g wet
Sodium	1280	5	µg/g wet
Strontium	<1	1	µg/g wet
Sulphur	4600	10	µg/g wet
Thorium	<1	1	µg/g wet
Tin	4	1	µg/g wet
Titanium	1.3	0.2	µg/g wet
Uranium	<5	5	µg/g wet
Vanadium	<1	1	µg/g wet
Zinc	0.8	0.5	µg/g wet
Zirconium	<0.1	0.1	µg/g wet

47697-6 **07-04 - Drum - 99/09/17**

PCBs	**Detection**		**Units**
Analyte	**Result**	**Limit**	ppm
Total PCBs	2.7	0.1	

NO CASH 500 #7
(MINFILE# 105M 001f)

1. LOCATION AND ACCESS

The No Cash 500 is located on the mid northwest slope of Galena Hill and is accessed by a .75 km road leading from the Elsa-Calumet road. The site has NTS coordinates of 105M 14, latitude of 63°55'08"N and longitude of 135°27'51"W with an approximate altitude of 1100m. UTM co ordinates for the site are 7 088 058m N 477 230m E.

2. SITE PHYSIOGRAPHY

The site is on the northwest slope of Galena Hill at an approximate elevation of 1100 metres above sea level. The discharge from the adit flows down gradient from the site to No Cash Creek and then down gradient towards the wetlands northeast of the Elsa tailings.

The entire site is located within an alpine ecosystem consisting of stunted black spruce and willow. The site is in an area of discontinuous permafrost however, no surface indications of permafrost were noted during the site investigation.

3. GEOLOGY AND MINERALIZATION

The No Cash 500 adit and dump are located in the Lower Schists with no known surface mineralization. The surface exposures of the mineralized vein are 900 meters upslope to the Southeast. The vein is hosted in barren, massive thick-bedded quartzites interbedded with graphitic schist, phyllite and thin-bedded quartzites. The vein material is reported to be heavily weathered with strong limonite and manganese staining. The vein material is reportedly composed of brecciated quartzite with limonite, manganese oxides, siderite, quartz stringers, galena, sphalerite, freibergite, their oxides, pyrite and arscenopyrite.

4. SITE HISTORY

The No Cash site has been in operation since the 1920's and from 1928 to 1931 19 tonnes of ore were produced at 25m drifting on 50 level. From 1948 to 1975, mining was conducted from the 500 level adit measuring 1115m in length producing a 5900 tonne dump at the portal. There are four raises and the Brefalt Shaft, plus a very small pit at the northeast end of the veins. Deep trenches are located at the surface near the shaft.

5. MINE DEVELOPMENT

5.1 Mine Openings And Excavations

No Cash 500 Portal

~2 m. x 3 m. wood frame construction, insulated with fiberglass with aluminum foil backing. Structure appears sound, blocked with a locked metal screen gate and wooden insulated doors. The interior appears sound. A wooden culvert carries drainage to the edge of the dump, serviceable tracks are in place and no other mine services observed.

5.2 Waste Rock Disposal Areas

No Cash 500 Portal Dump

The portal dump is composed of a base mixture of glacial till and surface colluvium, excavated to expose the portal site, followed by a layer of development waste (quartzite and schists) with an upper layer of vein material, graphitic shists with disseminated pyrite, quartzite with disseminated pyrite and minor quartz veining with disseminated pyrite and arscenopyrite. No waste rock samples were collected.

5.3 Tailings Impoundments

No tailings impoundments were observed at the No Cash 500 mine site.

5.4 Tailings Ponds

No tailings ponds were observed at the site.

5.5 Minesite Water Treatment

No mine site water treatment is being conducted at the site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There are two buildings located at the No Cash 500 mine site. These consist of a garage with a boiler room and the adit/portal structure. Both buildings appear to be in fair structural condition. A timber crib structure is located to the northeast corner of the garage and appears to be an old adit that has been infilled (photo 6-13). A timber retaining wall approximately 1.5m in height has been constructed behind the garage and extends for 83m to the adit structure. A timber retaining wall constructed for the loading area is 30m in length and 15m in depth, consisting of both timber crib works and timber sheathing (photo 6-14). The access road, building site, and parking area are constructed of waste rock materials.

Building 7F – Garage (photo 6-15)

Location: Located on the No Cash 500 site map and listed as Building 7F.
Dimensions (L x W x H): 6m x 6.5m x 5m
Construction: The garage consists of a wood frame structure overlayed with tarpaper and metal sheathing on the east wall approximately .75 m in height from the foundation and metal sheathing on the roof. The interior of the structure is insulated with fibreglass.
Paint: Structure is unpainted.
Asbestos: There was no asbestos observed on the building.
Foundation: The structure has wood plank flooring on grade.
Non-Hazardous Contents: There were minor amounts of rubber hose and piping stored within the building.
Hazardous Contents: There was no evidence during the investigation that any hazardous materials were being stored at the building site.
Samples: No samples were taken at building 7F.

Building 7G – Adit (photo 6-16)

Location: Located on the No Cash 500 site map and listed as 7G.
Dimensions (L x W x H): 4m x 3m x 2.5m
Construction: The structure is wood frame with wood sheathing on the exterior. The exterior frame is insulated with fibreglass insulation.
Paint: The structure is unpainted.
Asbestos: There was no asbestos observed on the building.
Foundation: There is no foundation for this structure.
Non-Hazardous Contents: No materials were noted at the site other than trestle tracks leading from the interior of the structure.
Hazardous Contents: There were no hazardous materials noted inside or surrounding the structure.
Samples: No samples were taken at building 7G.

6.2 Fuel Storage

There was no fuel storage observed at the site.

6.3 Rail and Trestle (photo 6-17)

Location: Rail extends from the interior of the adit around to the loading area.

Fabrication: Steel tracks with wood components.

Amount of materials: Approximately 125 metres of track have been laid with additional rails stacked alongside.

Condition: Track is in good condition, however, the loading area is a safety hazard due to loss of fill in some areas. The timber retaining wall and crib have also deteriorated.

6.4 Milling and Processing Infrastructure

There is no mill facility on site.

6.5 Electrical Equipment

No transformers were noted on site, however, electrical poles and lines were still intact. Four electrical power poles with lines running to both structures totaled approximately 100m of power cable.

7. SOLID WASTE DUMPS

No solid waste dumps were noted at the No Cash 500 mine site. There was some metal debris that had been deposited over the edge of the mine waste dump and stored near the adit (photo 6-18), however, only minor quantities of non-hazardous material are present. No sampling was performed at this site.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No transformers were observed at the site.

8.2 Metals and Hydrocarbons in Soil

The site investigation did not indicate any surficial staining of the surrounding soils. No above ground storage tanks or abandoned fuel drums were noted in the area.

8.3 Liquid Hazardous Materials

No liquid hazardous materials were observed at the site.

8.4 Solid Hazardous Materials

No solid hazardous materials were observed at the No Cash 500 mine site.

9. WATER QUALITY

There is water flowing quite rapidly from the adit, while not visible at the structure, it is audible. An outfall is located to the west of the adit protruding through the outcrop of mine waste rock at the loading/dump site. The water from this outfall is flowing at 3 L/s. Sample analysis results can be found in Attachment B.

Samples:

Two water samples were taken at the No Cash 500 mine site. Sample 07-01-water was taken at the outfall below the adit, and sample 07-02-water was taken approximately 100m downstream of the outfall.

07-01-water (photo 6-19)

There was no surrounding vegetation at sample location 07-01-water. This would partially be due to the perpendicular angle of the slope, but more obviously to the mine waste rock. The volume of discharge was approximately 3 L/s.

07-02-water (photo 6-20)

Sample location 07-02-water exhibited vegetation growth in the form of spruce and scrub brush. Moss and lichens were visible on the surrounding rocks of the streambed at this location. The volume of water flow at this location was approximately 5 L/s.

Previous Environmental Studies/Sampling

Previous sampling at the site indicates that the level 500 adit discharge is high in metals, however, there is little evidence of metal loading in downstream water samples. The discharge water from the adit flows into No Cash Creek. Water quality sampling of the Creek indicates there is a consistent decrease in metal loading over the length of the Creek. Water quality sampling has been conducted at the site for the past five years and appears to be consistent with no significant increase or decrease in production. There are variations during the peak flows occurring the spring months and it is thought that the pH decreases are consistent with the flushing of acid salts and appears to be reflected in the water chemistry with peak flows coinciding with peak concentrations.

10. RECLAMATION

The No Cash 500 mine site has naturally revegetated with dwarf brushes and grasses in the vicinity of the structures. The waste rock dump has been "push dumped" and has little vegetation, although there has been some growth in localized areas. An outfall structure is located to the west of the adit and appears to have impacted down gradient vegetation. Bright orange staining is apparent along the water drainage route from the site.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Metal Analysis

	Detection Limit	Units	47694-2 07-01 - Water - 99/09/17
ICP-USN Total Metals Scan in Water			
Aluminum	0.0008	mg/L	0.101
Antimony	0.005	mg/L	<0.005
Arsenic	0.01	mg/L	0.02
Barium	0.00004	mg/L	0.00363
Beryllium	0.00001	mg/L	<0.00001
Bismuth	0.0004	mg/L	<0.0004
Boron	0.002	mg/L	<0.002
Cadmium	0.00001	mg/L	0.141
Calcium	0.002	mg/L	228
Chromium	0.00006	mg/L	0.00027
Cobalt	0.00003	mg/L	0.0107
Copper	0.00003	mg/L	0.0194
Iron	0.00001	mg/L	2.77
Lead	0.0003	mg/L	0.0159
Lithium	0.001	mg/L	0.032
Magnesium	0.0005	mg/L	26
Manganese	0.00002	mg/L	6.96
Mercury	0.0001	mg/L	<0.0001
Molybdenun	0.00007	mg/L	0.00036
Nickel	0.0001	mg/L	0.0859
Phosphorus	0.03	mg/L	<0.03
Potassium	0.4	mg/L	0.4
Selenium	0.004	mg/L	<0.004
Silicon	0.004	mg/L	2.32
Silver	0.00005	mg/L	0.00141
Sodium	0.004	mg/L	0.9
Strontium	0.00002	mg/L	0.214
Sulphur	0.008	mg/L	199
Thallium	0.001	mg/L	0.018
Titanium	0.00002	mg/L	<0.00002
Vanadium	0.00003	mg/L	<0.00003
Zinc	0.0002	mg/L	10.1
Total Arsenic by Hydride AA			
Arsenic	0.0002	mg/L	0.0163
Total Selenium by Hydride AA			
Selenium	0.0001	mg/L	<0.0001

Water Analysis

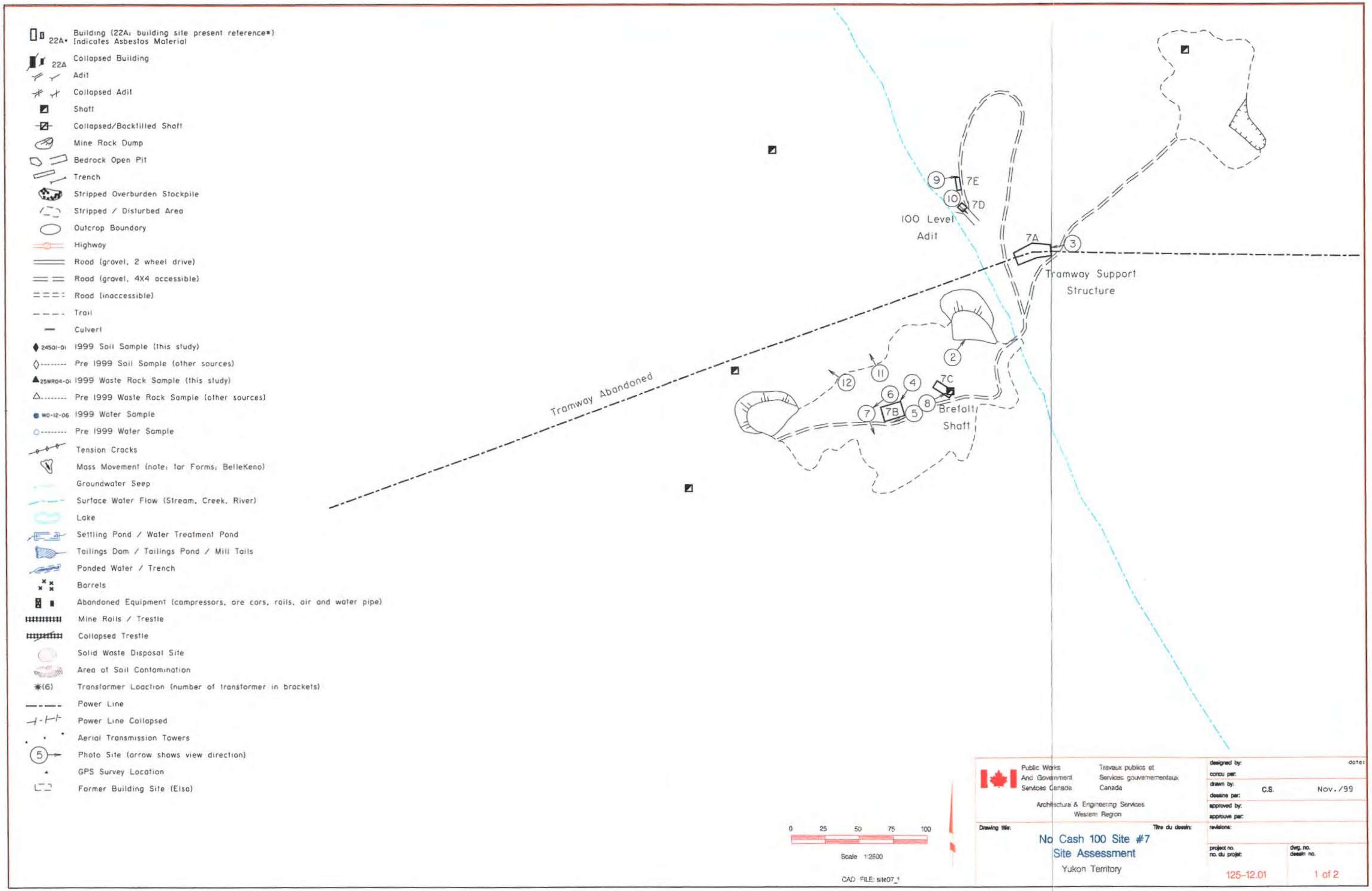
	Detection Limit	Units	47694-2 Water - 99/09/17
Alkalinity,total			
Total Alkalinity	5	mg CaCO3/L	106
Chloride in Water			
Chloride	0.25	mg/L	<0.25
Electrical Conductivity			
Electrical Conduc	0.01	µS/cm	1300
Hardness			
Hardness (CaCO	5	mg/L	785
Nitrate - Nitrogen in Water			
Nitrate-N	0.05	mg/L	<0.05
Nitrite Nitrogen			
Nitrite-N	0.003	mg/L	<0.003
pH in Water			
pH	0.01	pH	7.46
Sulphate in Water			
Sulphate	1	mg/L	580
Total Dissolved Solids			
Total Dissolved S	5	mg/L	1030

Metal Analysis

	Detection Limit	Units	47694-4 07-02 - Water - 99/09/17
ICP-USN Total Metals Scan in Water			
Aluminum	0.0008	mg/L	0.0159
Antimony	0.005	mg/L	<0.005
Arsenic	0.01	mg/L	<0.01
Barium	0.00004	mg/L	0.0309
Beryllium	0.00001	mg/L	<0.00001
Bismuth	0.0004	mg/L	<0.0004
Boron	0.002	mg/L	<0.002
Cadmium	0.00001	mg/L	0.00013
Calcium	0.002	mg/L	33.9
Chromium	0.00006	mg/L	0.00021
Cobalt	0.00003	mg/L	<0.00003
Copper	0.00003	mg/L	0.0019
Iron	0.00001	mg/L	0.016
Lead	0.0003	mg/L	<0.0003
Lithium	0.001	mg/L	<0.001
Magnesium	0.0005	mg/L	9.57
Manganese	0.00002	mg/L	0.00189
Mercury	0.0001	mg/L	<0.0001
Molybdenun	0.00007	mg/L	<0.00007
Nickel	0.0001	mg/L	0.0009
Phosphorus	0.03	mg/L	<0.03
Potassium	0.4	mg/L	<0.4
Selenium	0.004	mg/L	<0.004
Silicon	0.004	mg/L	3.5
Silver	0.00005	mg/L	<0.00005
Sodium	0.004	mg/L	1.1
Strontium	0.00002	mg/L	0.0639
Sulphur	0.008	mg/L	29.9
Thallium	0.001	mg/L	<0.001
Titanium	0.00002	mg/L	0.00024
Vanadium	0.00003	mg/L	<0.00003
Zinc	0.0002	mg/L	0.0236
Total Arsenic by Hydride AA			
Arsenic	0.0002	mg/L	0.0007
Total Selenium by Hydride AA			
Selenium	0.0001	mg/L	0.0003

Water Analysis

	Detection Limit	Units	47694-4 07-02 - Water - 99/09/17
Alkalinity,total			
Total Alkalinity	5	mg CaCO3/L	37
Chloride in Water			
Chloride	0.25	mg/L	<0.25
Electrical Conductivity			
Electrical Conductivity	0.01	μS/cm	280
Hardness			
Hardness (CaCO3 eq	5	mg/L	148
Nitrate - Nitrogen in Water			
Nitrate-N	0.05	mg/L	0.2
Nitrite Nitrogen			
Nitrite-N	0.003	mg/L	<0.003
pH in Water			
pH	0.01	pH	7.39
Sulphate in Water			
Sulphate	1	mg/L	88.3
Total Dissolved Solids			
Total Dissolved Solids	5	mg/L	196



Building (22A: building site present reference*) Indicates Asbestos Material
22A*
Collapsed Building
22A
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WO-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms; BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Tramway Abandoned
100 Level Adit
7E
7D
7A
7B
7C
Tramway Support Structure
Brefalt Shaft
9
10
3
2
4
6
7
5
8
11
12
0 25 50 75 100
Scale 1:2500
CAD FILE: site07_1
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architecture & Engineering Services Western Region
Drawing title:
Titre du dessin:
No Cash 100 Site #7
Site Assessment
Yukon Territory
designed by:
concu par:
date:
drawn by:
dessine par:
C.S.
Nov./99
approved by:
approuve par:
revisions:
project no.
no. du projet
125-12.01
dwg. no.
dessin no.
1 of 2

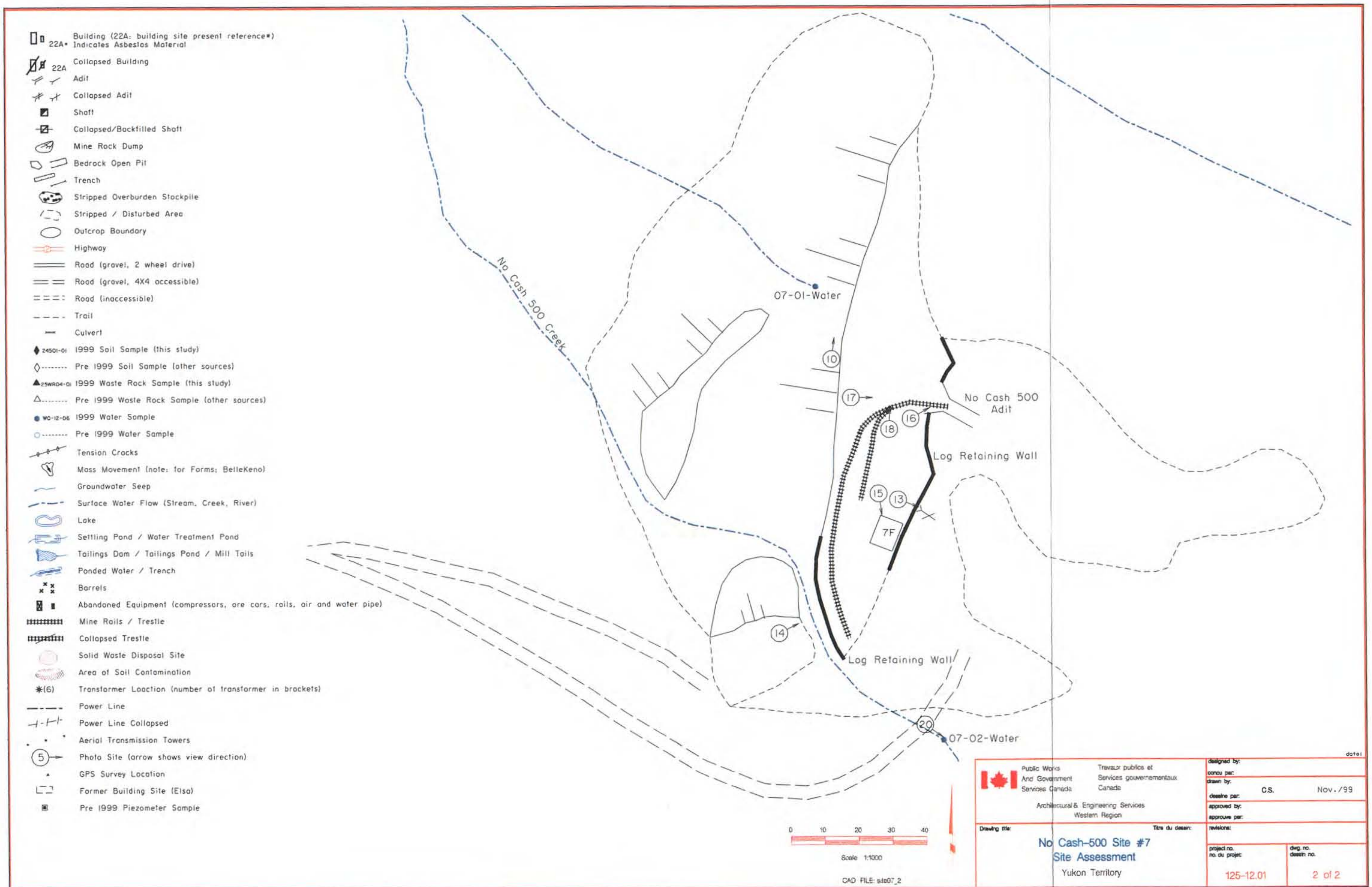

Building (22A: building site present reference*) 22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Pre 1999 Piezometer Sample
No Cash 500 Creek
07-01-Water
No Cash 500 Adit
Log Retaining Wall
Log Retaining Wall
7F
07-02-Water
0 10 20 30 40
Scale 1:1000
CAD FILE: site07_2
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title: Titre du dessin:
No Cash-500 Site #7
Site Assessment
Yukon Territory
designed by: concu par:
drawn by: dessine par: C.S.
date: Nov./99
approved by: approuve par:
revisions:
project no. no. du projet 125-12.01
dwg. no. dessin no. 2 of 2

Photo 7-1: Eastern trench of the No Cash 100 mine site

Photo 7-2: Tramway midstation located in background with an outhouse in foreground.

Photo 7-3: Tramway midstation structure.

Photo 7-4: Garage structure located adjacent to the shafthouse. Note the batteries in the foreground.

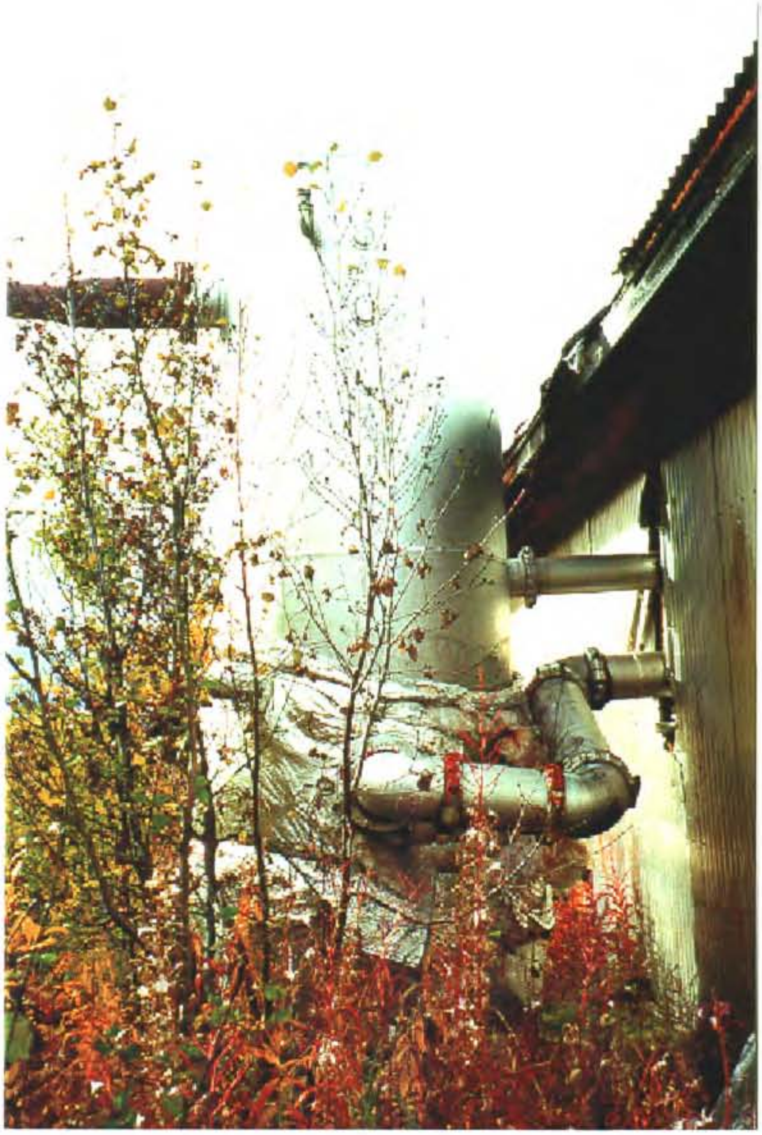


Photo 7-5: Receiving tank located on the outside of the garage structure. Tank was insulated with fibreglass.

Photo 7-6: Abandoned compressor located on the northwest corner of the garage.

Photo 7-7: Shed on the southwest corner of garage that housed unknown product (samples taken).

Photo 7-8: Shafthouse located to the east of the garage.

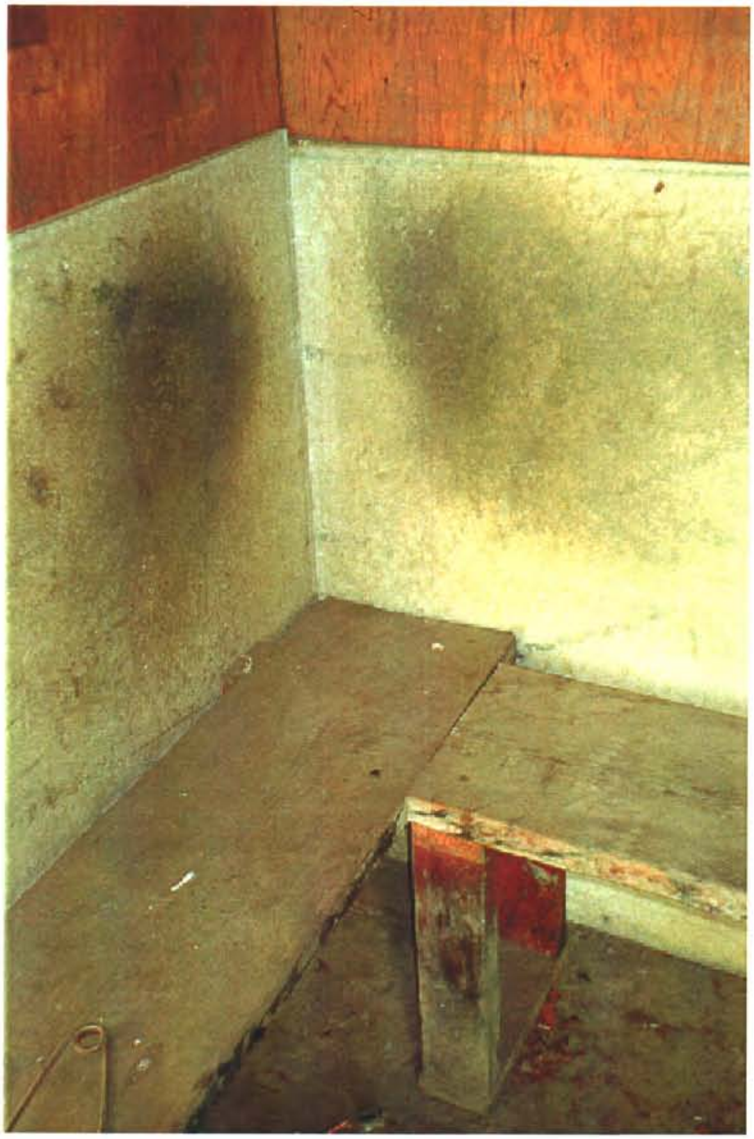


Photo 7-9: Interior of the lunchroom. Note the asbestos board on the walls.

Photo 7-10: Adit to the No Cash 100 level. Note the tramway in the background.

Photo 7-11: Dump site that contained miscellaneous metal debris. Wooden pipe can be seen in the foreground.

Photo 7-12: Kill zone below the waste rock dump.

Photo 7-13: Old adit structure that has collapsed and caved in.

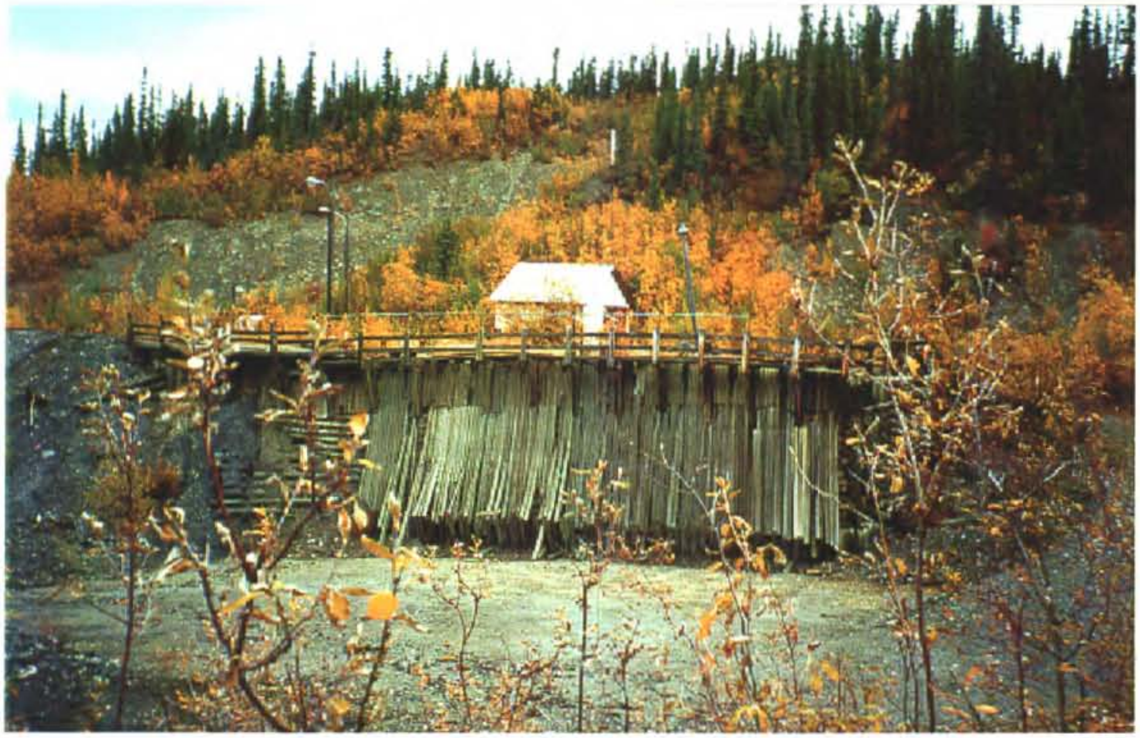


Photo 7-14: Timber retaining wall for the loading dock.

Photo 7-15: Garage structure located to the south of the adit.

Photo 7-16: Adit structure leading to the 500 level..

Photo 7-17: Rails extending from the adit.

Photo 7-18: Wood and metal track debris located near the adit.

Photo 7-19: Waste rock dump with pipe in the background providing drainage from the underground workings.

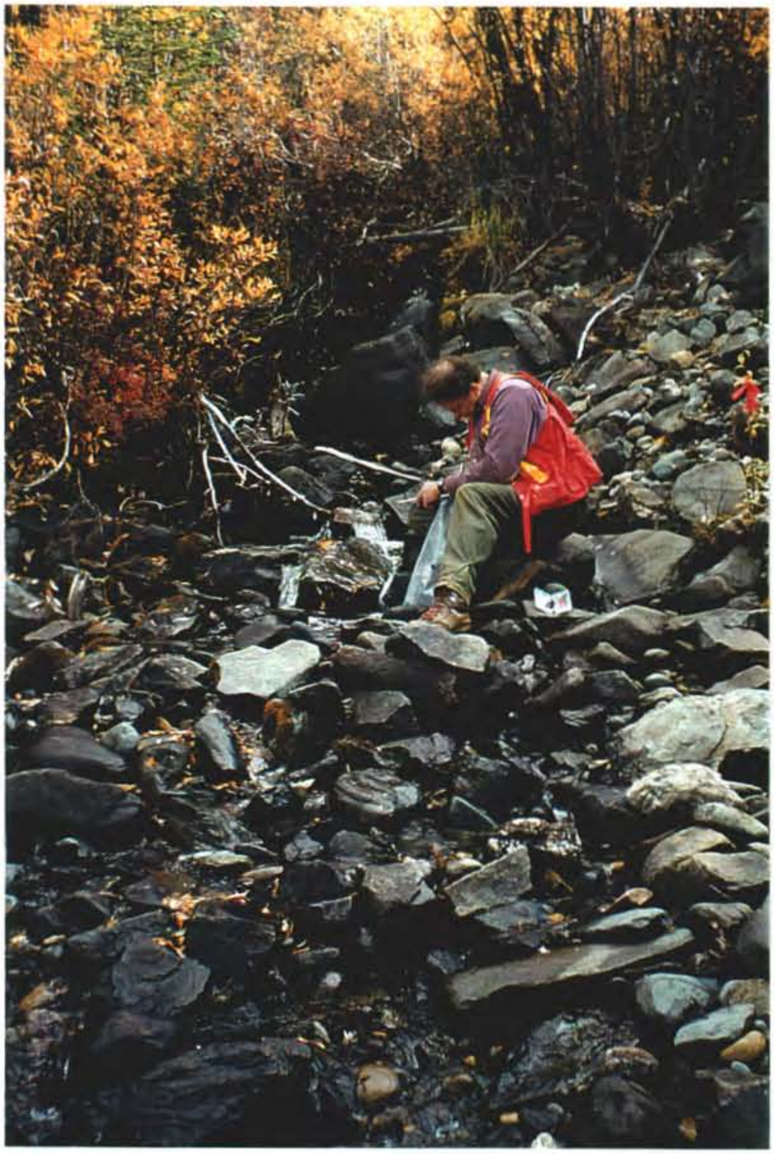


Photo 7-20: Water sample location taken upstream of the site.

BETTY (#80)

Minfile #105M 001g

1. LOCATION AND ACCESS

Access to the site is from the Elsa village, along Calumet 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 site has a latitude of 63°55'27"N and a longitude of 135°25'23"W. The UTM co ordinates are 7 088 632m N and 479 251m E.

2. SITE PHYSIOGRAPHY

The Betty mine site 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.

3. GEOLOGY AND MINERALIZATION

The narrow vein is hosted in greenstone. The vein material contains galena, sphalerite, arsenopyrite, pyrrhotite, cerussite and limonite. The vein strikes approximately 58 degrees east and dips to the southeast; it likely represents the northeast extension of the No Cash vein. Surrounding the vein the minerals considered of little value are quartz and calcite. Sphalerite is dominant in the trench floor.

4. SITE HISTORY

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

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

Portals

There were no portals associated with this site.

Open Pits

There are no open pits associated with this site.

Trenches

There is one trench that extends approximately 200 metres to the southwest. The start of the trench is southwest from the collapsed pole structure. Greenstone rubble is present surrounding the trench.

Shaft

Three shafts are present on the Betty mine site, however only one of these shafts was located during the site visit. It was an unlined shaft, approximately 2 metres deep that contained quarzite boulders, located to the southeast of the collapsed pole structure. The other two shafts were not located due to overgrown brush. No dump material was visible at the location.

5.2 Waste Rock Disposal Areas

No waste rock disposal material was visible.

5.3 Tailings Impoundments

No tailings were observed at the site.

5.4 Tailings Ponds

No tailings ponds were observed at the site.

5.5 Mine Site Water Treatment

Water at this site is not being treated.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

Two buildings were observed on the Betty mine site, including a storage shed and a caved in cabin. A collapsed pole structure and wood debris were also present.

The caved in cabin was of log construction and located to the southwest of the ridge.

The storage shed was also of log construction, located southwest of the ridge and to the north of the cabin. The wood debris is located to the northwest of the shed.

No hazardous substances were identified with the buildings, either in storage or in the construction of the buildings.

6.2 Fuel Storage

There is no fuel stored on site.

6.3 Rail and Trestle

There is no rail or trestle debris located at the site.

6.4 Milling and Processing Infrastructure

There was no milling or processing structures observed at the site.

6.5 Electrical Equipment

There are no services to the site.

7. SOLID WASTE DUMPS**

There is one small garbage dump located to the west of the buildings. It was noted to contain household refuse.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No transformers were observed at the site.

8.2 Metals and Hydrocarbons in Soil

There was no visual evidence of staining on surrounding soils that would indicate potential hydrocarbon contamination at the site.

8.3 Liquid Hazardous Materials

No hazardous materials were noted in the site visit.

8.4 Solid Hazardous Materials

No hazardous materials were noted in the site visit.

9. WATER QUALITY

There were no water quality samples taken at the site. The upper portion of Sandy Creek does pass through to the east of the site. No seepage areas were noted.

10. RECLAMATION

The site does not appear to be greatly disturbed by the historical mining activities. The area has revegetated with native vegetation that consist mostly of low shrub and lichens. This appears to be natural attenuation and no visible reclamation measures that have been carried out by past site operators.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

HECTOR-CALUMET
Site No. 9
MINFILE: 105M 001h,j

1. LOCATION AND ACCESS

The Hector-Calumet mine site is located on the northwest slope of Galena Hill, on the Calumet Road (Site # 9, Figure 1). The Hector adit and loading area are at an elevation of 4100 feet (1250m), and the remaining workings and waste rock piles are at higher elevations. The NTS co-ordinates for the adit are 7 088 300N 480 900E.

From Keno City, the site can be accessed by travelling west along Highway 2 toward Mayo to Elsa, then following the Calumet Road 6.4 km uphill to the Hector-Calumet site. Alternatively, the site can be reached by taking the Duncan Creek Road south from Keno City 3.8 km, then turning onto the Calumet Back Road and travelling approximately 7.6 km to the Hector-Calumet portal. All roads are gravel and are accessible by 4WD vehicle.

2. SITE PHYSIOGRAPHY

The Hector-Calumet mine site looks northeast over the McQuesten River Valley. The area has a moderately steep slope and is covered by thick moss, bushes and evergreen trees. The site is drained by Sandy Creek and other unnamed creeks, which flow into the McQuesten Valley.

3. GEOLOGY AND MINERALIZATION

Mineralization at the Hector-Calumet site is hosted in massive, thick-bedded Keno Hill Quartzite (Minfile report). There is some graphitic schist and greenstone associated with the deposit. The ore was contained within a siderite, pyrite, galena, sphalerite, freibergite vein. Oxidation extends 400 to 600 feet (122m to 183m) from the surface.

4. SITE HISTORY

The Hector-Calumet Mine was the largest producer in the area and was responsible for just over half of UKHM's total silver production. Extensive underground development and production occurred between 1935 and 1941, and between 1945 and 1972, and the site has more underground workings than any other mine in the district. The main portal at the present site was constructed in 1957. The total production at Hector-Calumet was 2,468,723 tonnes grading 1212g/t silver, 7.5% lead, and 6.2% zinc (Minfile report). Ore was milled at the Elsa Mill and was transported there by tram. The wooden tram towers are still standing and reportedly the cable is lying on the ground beneath them.

The Calumet C-Structure open pit was excavated in 1981. In 1984-85, the Calumet 1-15 (recovery of the pillars on the #1 an d#15 veins), the Calumet 2 (recovery of crown pillars in Hector #1 vein), and the Calumet 4-11 pits were developed. The areas around these pits also show evidence of earlier shallow trenching.

5. MINE DEVELOPMENT

5.1 Mine Openings And Excavations

Excavations at the site consist of the a shaft, the Hector adit, four open pits (Calumet 1-15, Hector, the 4-11 pit and Calumet C-Structure), and several trenches. Locations are shown on Figure 2.

Jock Shaft

Location: In the 4-11 pit area.

Dimensions (L x W x H): 1.5 m x 1.5 m. Shaft appears to be completely collapsed.

Condition: Collapsed

Supports: Wooden.

Accessibility: None.

Hector Adit (Photo 9-1)

Description: Hector adit portal at 400 level.

Location: On the Calumet Road.

Dimensions (L x W x H): 366 m (at least) x 3 m x 3 m

Condition: The adit appears to be stable but could only see to about 5 m.

Supports: Cement portal with wood retaining walls and metal doors. Adit entrance is constructed with wooden beams. There is a metal column has been placed about 1 m into adit, in the center , to support the beams.

Accessibility: The lock is off the doors. Approximately 3 m into the adit, most of the adit is blocked with rock debris to about 0.5 m of the roof.

Calumet 1-15 Pit (Photo 9-2)

Description: Open pit following the Calumet #1 and #15 veins.

Location: Above Hector portal, to the east.

Dimensions (L x W x H): 210 m x 115 m x ~43 m

Condition: The pit has very steep, relatively stable walls, although rock fall is a concern. The pit was dry at the time of the visit.

Accessibility: Can drive to pit and access by foot. There are no fences to limit access to the pit.

Hector Open Pit (Photo 9-3)

Description: Open pit primarily in quartzite with some schist. The tops of the walls are still steep despite erosion into the pit.

Location: Uphill from the Hector portal, to the west of Calumet 1-15 pit.

Dimensions (L x W x H): 100 m x 40 m x 20 m

Condition: The pit walls are steep and relatively stable. Rock fall is a hazard, however. The pit was dry at the time of the visit.

Accessibility: Can drive to pit and access by foot. There are no fences to limit access to the pit.

4-11 Pit

Description: Actually a large stripped area that was later mined selectively using a backhoe. A few small elongated "pits" remain open. These pits are reportedly connected to the underground workings (UKHM, 1996). Pits were mined to access the small crown pillar from the Hector-Calumet 1 vein.

Location: Approximately 200 m to the south-southwest of the Hector Open Pit.

Dimensions: 320m x 10 m x 10 m

Condition: Sides of pit are steep to gentle and are slumping in. There was no water in the pit at the time of the site visit.

Accessibility: Pit is accessible by road and can be accessed by foot.

Calumet C-Structure Pit

Description: Open pit primarily in quartzite with some schist. The pit is really more of a deep trench.

Location: Just off the top of Galena Hill, on the east side.

Dimensions (L x W x H): 100m x 30 m (at widest) x 10 m

Condition: The pit was approximately one third full of water at the time of the visit.

Accessibility: Can drive to pit and access by foot. There are no fences to limit access to the pit.

Trenches

Description: About 12 trenches that are largely overgrown.

Location: On the southwest corner of the mine site.

Dimensions (L x W x H): Range between 60 m to 170 m long. Each is roughly 2.5 m wide and all are shallow.

Condition: Stable. Very overgrown.

Accessibility: Can be reached by 4WD from the cat track that leaves the main Hector-Calumet Mine road near the Jock Shaft.

5.2 Waste Rock Disposal Areas

There are four main waste rock disposal areas at Hector-Calumet. These are described below. Eleven samples of the waste rock were collected by UKHM for the Site Characterisation Report (UKHM, 1996). These sample locations are shown in Figure 2 and the analytical data is listed in Appendix I. No additional waste rock samples were collected during the site visit. No seeps were seen coming from any of the waste rock dumps.

Hector Adit (400) Dump (Photos 9-4 to 9-6)

Location: Outside the Hector portal

Dimensions (L x W x H): 90 m x 60 m x ~40 m (198,000 tons).

General Description: The waste rock was produced from the Hector adit. Surface material is composed primarily of mineralized and unmineralized quartzite vein, abundant siderite, pyrite, galena, and sphalerite. Much of this material shows abundant iron and manganese oxides. There are a couple small puddles of standing water on top of pile. The pile has not begun to revegetate.

There is a zone of impacted vegetation beneath the dump (Photo 9-7) . According to UKHM (1996) this zone results from deposition of silt from mine water released during operation. The report states that there has been no drainage from the Hector 400 adit since mining ceased in October 1972.

There is abundant metal and wood debris on and adjacent to the dump (Photo 9-19). This material is described in Section 6.6 Loading Facilities.

Calumet 1-15 Dump

Location: Uphill from Hector adit, to the east. Adjacent to Calumet 1-15 Pit.

General Description: Waste rock from the Calumet 1-15 Pit was placed in two dumps adjacent to the pit. Dumps are composed mainly of quartzite and graphitic schist country rock (UKHM, 1996). Much of the material on the surface of dump has abundant iron oxide staining, including a large pile of boulders that could be a low-grade ore stockpile. UKHM (1996) also reports slumping and tensions cracks, but these were not seen during this field visit. There appears to be no impact on the vegetation at the base of the dump. A small amount of natural revegetation has taken place on the tops of the rock piles.

Dimensions (L x W x H): 280 m x 90 m x ~40 m (1,000,000 tons)

Hector Open Pit Dump

Location: Uphill from Hector adit, adjacent to Hector Open Pit.

General Description: Rock is from the Hector Open Pit. Pile is composed mainly of quartzite, graphitic schist, and greenstone country rock from the pit (UKHM, 1996). No evidence was seen of impacts on vegetation. A small amount of natural revegetation has taken place on the tops of the rock piles.

Dimensions (L x W x H): 110 m x 60 m x ~15 m (100,000 tons)

4-11 Pit Dump

Location: Uphill from Hector adit, adjacent to the 4-11 pit.

General Description: Rock is from the 4-11 trenching / pit. Pile surrounds the pit and is composed mainly of quartzite, graphitic schist, and greenstone country rock (UKHM, 1996).

Dimensions (L x W x H): Difficult to determine as waste is spread around the 4-11 pit. But waste was estimated at 10,000 tons (UKHM, 1996). More of the 4-11 waste is revegetating than in other areas. This is largely because of the selective mining that took place in this area, little development rock was removed. This means that much of the waste is actually overburden, and contains more fine-grained material in which plants can take hold.

Calumet C-Structure Dump

Location: Just off the top of Galena Hill, on the east side.

General Description: Open pit primarily in quartzite with some schist. The disturbed areas around the put are beginning to revegetate.

Dimensions (L x W x H): 85 m x 70 m x 5 m (25,000 tons)

5.3 Tailings Impoundments

No ore were processed at the site, and no tailings were encountered.

5.4 Minesite Water Treatment

There was no water treatment being conducted on site at the time of the site visit.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

Most of the buildings have been removed from the site. However, four small buildings are still standing, and three others that have collapsed or burned down are described below: A significant amount of debris is found in some areas where the buildings have all but disappeared.

Buildings 9A and 9B - Shacks

Dimensions (L x W x H): 1.5 m x 1.5 m x 2 m

Location: Building 9A is approximately 100 m west of the Hector adit and above the Calumet Road. Building 9B is approximately 200 m west of the Hector adit and is below the Calumet Road. Both buildings are west of the hector dump. Building 9B is shown in Photo 9-8, along with the remnant utilidor that connects to the structure. Building 9A is identical.

Construction: Wood frame, white tar paper siding. Both have metals pipes leading to and from them carried in utilidors.

Paint: None observed.

Asbestos: None observed.

Foundation: None.

Non-Hazardous Contents: Wood debris.

Hazardous Contents: None.

Buildings 9C - Bunk House (burned) (Photo 9-9)

Dimensions (L x W x H): 10 m x 3 m x ? m

Location: North side of road leading to the Hector Pit, near junction with the Calumet Road.

Construction: Wood

Paint: None.

Asbestos: None observed..

Foundation: None observed..

Non-Hazardous Contents: metal pipes, sinks

Hazardous Contents: None observed..

Building 9D - Water Storage Tank and Building (Photo 9-10)

Dimensions (L x W x H): 2 m x 2m x 2.5 m

Location: Directly uphill of Hector Adit, on the north side of the road from Hector Adit to the Hector Pit.

Construction: Wood and concrete with metals ties for water tank. Building has tar paper siding and what appears to be fiberglass insulation.

Paint: None observed.

Asbestos: None observed.

Foundation: The building had no foundation. The tank had a large concrete foundation.

Hazardous Contents: None observed.

Non-Hazardous Contents: Associated with the building are the remnants of a large water storage tank. Behind and uphill from the building is a large (5 m diameter) round concrete foundation (Photo 9-11). Upon the concrete and to adjacent to it are approximately 400 m of 3 cm thick steel cable, in segments of about 10 m lengths. These are the stays that held the wooden storage tank together. There is also some wood debris from the collapsed tank and part of the building.

Between the tank and the road are 6 small (1 m x 0.5 m x 0.5 m) ore carriers and 3 ore cart transport bases, and one very large ore bucket (1 m x 1.5 m x 1 m) (Photo 9-12).

6.2 Fuel Storage

No fuel storage areas were encountered on site. Two drums were found near the top of the site. See Section 6.6 Loading Facilities for details.

6.3 Rail and Trestle

Fabrication: Steel

Amount of materials: 16.5 m of two-track of rails at Hector adit.

Condition: In good condition

6.4 Milling and Processing Infrastructure

Assay lab: Located to the east of Building 9B. Dimensions (L x W x H): 2 m x 3 m (collapsed). Brick construction. Metal pipes and rusted ovens remaining (Photo 9-13). No hazardous contents observed.

6.5 Electrical Equipment

Two electrical boxes are located at the loading facility at the Hector Adit. One is probably pre-1930 and the other is more recent. Also, some electrical equipment is associated with the loading facility at the Calumet 1-15 dump (Photo 9-14).

6.6 Loading Facilities

Hector Adit Loading Facility

There are two loading facilities at the road outside the adit, to either side of the Hector dump. The west side of the dump has been buttressed to form a gully (Photo 9-4) where an old tram for transporting ore from the Hector mine to Elsa for processing. The tram towers are wooden and the cable is reportedly lying below the towers (Photo 9-15). The gully contains metal and wood debris (Photo 9-16).

On the east side of the dump, are larger loading structures with more buttressing (Photo 9-17). A coal-fired steam plant built at the loading facility at the Hector adit was used to heat the mine buildings. The concrete foundation for the plant and small pile are still on site, but the building has been removed (Photo 9-18). There is abundant metal and wood debris in this area (Photo 9-19).

The Calumet road shows signs of subsidence near the loading facility. In places, the road material has fallen through the timbers that comprise the loading facility.

Calumet 1-15 Loading Facility

The Calumet 1-15 loading facility includes a wooden buttress, an ore shute, a holding bin, and a conveyor-type structure, and a loading dock.(Photo 9-20). The structure is made of wood, except for some iron cogs that likely ran the conveyor. A small building adjacent to the conveyor holds some electrical equipment (Photo 9-14) and some fiberglass insulation (Photo

9-21). The area above the loading shute has been bull-dozed over so that the source of any ore has been removed.

Hazardous contents include three metal oil barrels are adjacent to the conveyor section of the facility (Photo 9-22). Two are empty and the third is half full of oil and water. There is a small 0.5m^2) stain on the ground near the barrels. Also present are 20 empty cans (each 10 cm tall) of Quick Start Fluid on the ground.

Non-hazardous material includes approximately 10 m of metal pipe or rail; small amount of wood, 3 ore carts (1m x 0.5 m x 0.5 m) located on the rock dump (Photo 9-23).

7. SOLID WASTE DUMPS

No solid waste dumps were encountered at the site. However, significant quantities of waste material is present near the waste rock dumps and buildings.

8. POTENTIAL CONTAMINANTS OF CONCERN

Potential contaminants of concern at the Hector-Calumet site include metals washing from the waste rock piles, and one barrel of oil (half full) located a the loading facility at the top of the site.

9. WATER QUALITY

9.1 Surface Water

There was no water flowing from any of the workings at the Hector-Calumet site. It has been reported that the site is drained at Galkeno 900 through a connection with the Galkeno workings (UKHM, 1996). The only surface water encountered at the site was in the Calumet C-Structure pit, which is approximately one third full. The water was clear with silt (likely washed from the pit walls) covering the rocks. There were no plants or algae seen growing in the pit. Results of analyses of a sample collected from this pit are listed in Table 1.

No surface water quality samples were collected in the UKHM 1996 study.

9.2 Ground Water

Three piezometers were installed below the Hector-Calumet Mine site by UKHM in 1996 to monitor any impacts on the shallow groundwater quality from the waste rock piles. These were sampled and analyzed as part of this investigation. Each sample was cloudy and contained some sediment. Samples were filtered in the laboratory. Analytical results are provided in Table 1.

10. RECLAMATION

Most of the buildings at the Calumet townsite have been removed. Some of the site is revegetating naturally with grasses and small bushes (Photos 9-4, 9-9, 9-13). However, the waste rock piles are the slowest to revegetate.

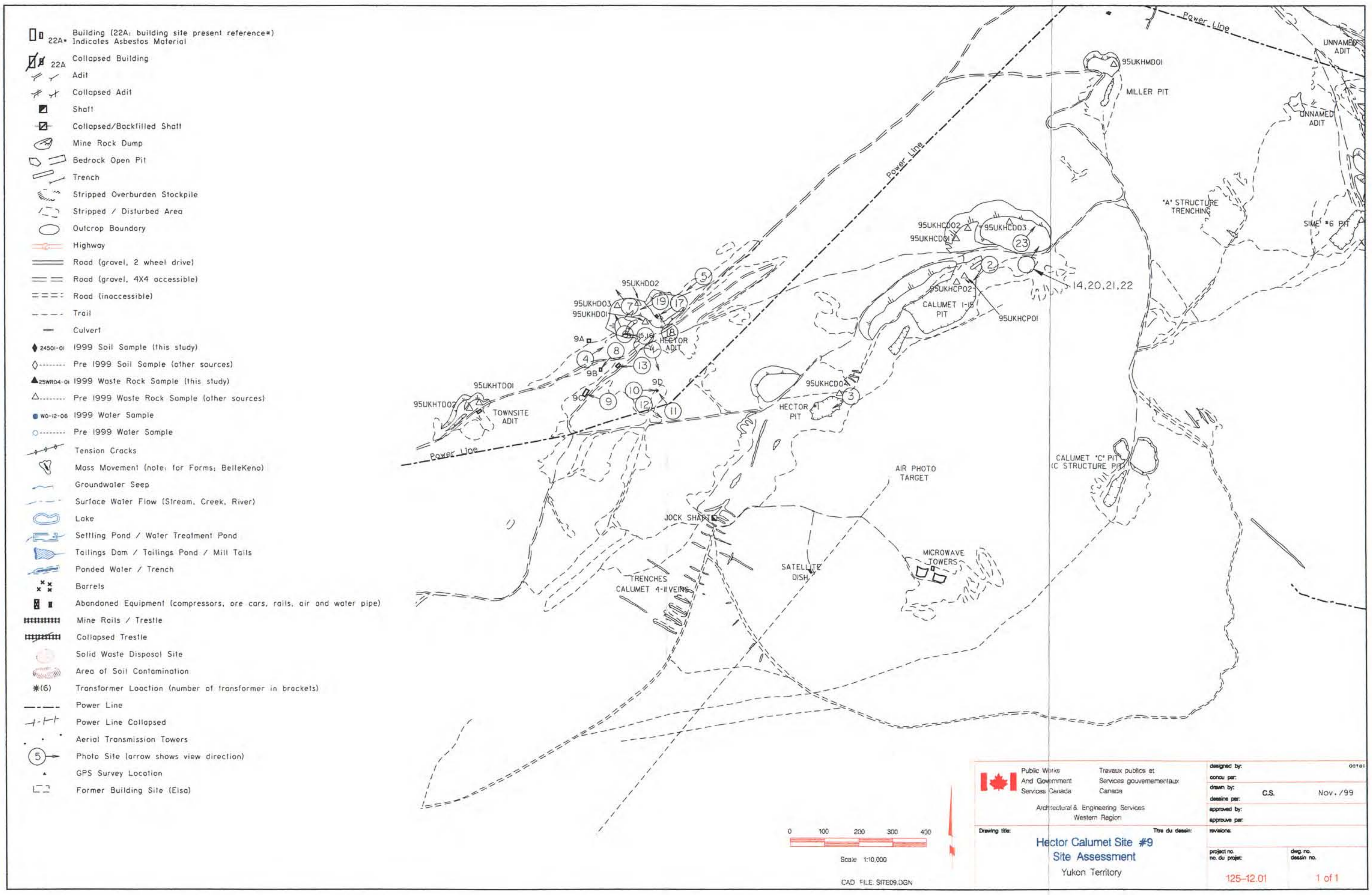
11. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Table 1. Water Quality Data

Parameter	Detection Limit	Units	9-01-Water (47711-12)	PIEZ: 95-UK-H-3 (47688-7)	PIEZ: 95-UK-H-2 (47688-8)	PIEZ: 95-UK-H-1 (47688-9)
Field pH			7.9	5.1	6.4	5.2
Field conductivity		µS	22	100	170	170
Aluminum	0.0008	mg/L	0.789	3.59	3.42	6.95
Antimony	0.005	mg/L	<0.005	<0.005	0.005	0.01
Arsenic	0.01	mg/L	<0.01	0.03	0.1	0.04
Barium	0.00004	mg/L	0.0299	0.203	0.286	0.27
Beryllium	0.00001	mg/L	<0.00001	0.00014	0.0001	0.00054
Bismuth	0.0004	mg/L	<0.0004	<0.0004	0.0011	0.0028
Boron	0.002	mg/L	<0.002	0.007	0.057	0.121
Cadmium	0.00006	mg/L	0.00076	0.00227	0.00423	0.0296
Calcium	0.002	mg/L	2.69	16.1	36.8	76.2
Chromium	0.00006	mg/L	0.00182	0.00728	0.00864	0.0132
Cobalt	0.00003	mg/L	0.00024	0.0148	0.0166	0.0181
Copper	0.00003	mg/L	0.00727	0.0178	0.0186	0.0195
Iron	0.00001	mg/L	1.29	19.9	88.6	191
Lead	0.0003	mg/L	0.103	0.0163	0.0174	0.0192
Lithium	0.001	mg/L	0.001	0.004	0.001	0.004
Magnesium	0.0005	mg/L	0.555	5.39	11.6	17.3
Manganese	0.00002	mg/L	0.0152	1.86	5.2	2.74
Molybdenum	0.00007	mg/L	<0.00007	0.00073	0.00351	0.00233
Nickel	0.00001	mg/L	<0.00001	0.0157	0.0147	0.0578
Phosphorus	0.03	mg/L	0.06	0.48	0.91	1.28
Potassium	0.4	mg/L	0.5	1.1	1.2	0.5
Selenium	0.004	mg/L	<0.004	<0.004	<0.004	<0.004
Silicon	0.004	mg/L	3.62	13.6	14	13.8
Silver	0.00005	mg/L	0.00191	0.00067	0.00143	0.00092
Sodium	0.004	mg/L	<0.4	1.4	4.1	2.5
Strontium	0.00002	mg/L	0.4	0.0674	0.107	0.0948
Sulphur	0.008	mg/L	0.278	18.2	3.41	92.7
Thallium	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Titanium	0.00002	mg/L	0.0159	0.144	0.157	0.191
Vanadium	0.00003	mg/L	0.00189	0.0171	0.0233	0.0386
Zinc	0.0002	mg/L	0.0422	0.0924	0.309	2.65
Zirconium	0.00004	mg/L				
Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic (hydride AA)	0.0002	mg/L	0.0054	<0.0002	<0.0002	<0.0002
Selenium (hydride AA)	0.0001	mg/L	0.0003	<0.0001	0.0006	<0.0001
Total Alkalinity	5	mg CaCO3/L	9	10	111	<5
Chloride	0.1	mg/L				0.34
Chloride	1	mg/L		<1		
Chloride	2.5	mg/L			<2.5	
Chloride	0.25	mg/L	<0.25			
Electrical Conductivity	0.01	µS/cm	15	170	265	600
Hardness (CaCO3 eq)	5	mg/L		66.6	123	279
Nitrate-N	0.05	mg/L	0.07			<0.05
Nitrate-N	0.2	mg/L		<0.2		
Nitrate-N	0.5	mg/L			<0.5	
Nitrite-N	0.003	mg/L	<0.003	<0.003		0.003
Nitrite-N	0.02	mg/L			<0.02	
pH	0.01	pH	6.42	5.22	6.38	3.9
Sulphate	0.5	mg/L	<0.5			
Sulphate	1	mg/L		51	7.1	260
Total Dissolved Solids	5	mg/L	35	139	225	436



Building (22A: building site present reference*)
22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WO-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
*(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
Power Line
95UKHMD01
MILLER PIT
UNNAMED ADIT
UNNAMED ADIT
'A' STRUCTURE TRENCHING
SIME #6 PIT
95UKHCD02
95UKHCD01
95UKHCD03
14,20,21,22
95UKHCP02
CALUMET 1-15 PIT
95UKHCP01
95UKHD02
95UKHD03
95UKHD01
HECTOR ADIT
9A
9B
9C
9D
95UKHTD01
95UKHTD02
TOWNSITE ADIT
95UKHCD04
HECTOR #1 PIT
CALUMET "C" PIT
(C STRUCTURE PIT)
AIR PHOTO TARGET
JOCK SHAFT
TRENCHES CALUMET 4-11 VEINS
SATELLITE DISH
MICROWAVE TOWERS
0 100 200 300 400
Scale 1:10,000
CAD FILE: SITE09.DGN
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services
Western Region
Drawing title:
Titre du dessin:
Hector Calumet Site #9
Site Assessment
Yukon Territory
designed by:
concu par:
drawn by:
dessine par:
C.S.
Nov./99
approved by:
approuve par:
revisions:
project no.
no. du projet:
125-12.01
dwg no.
dessin no.
1 of 1

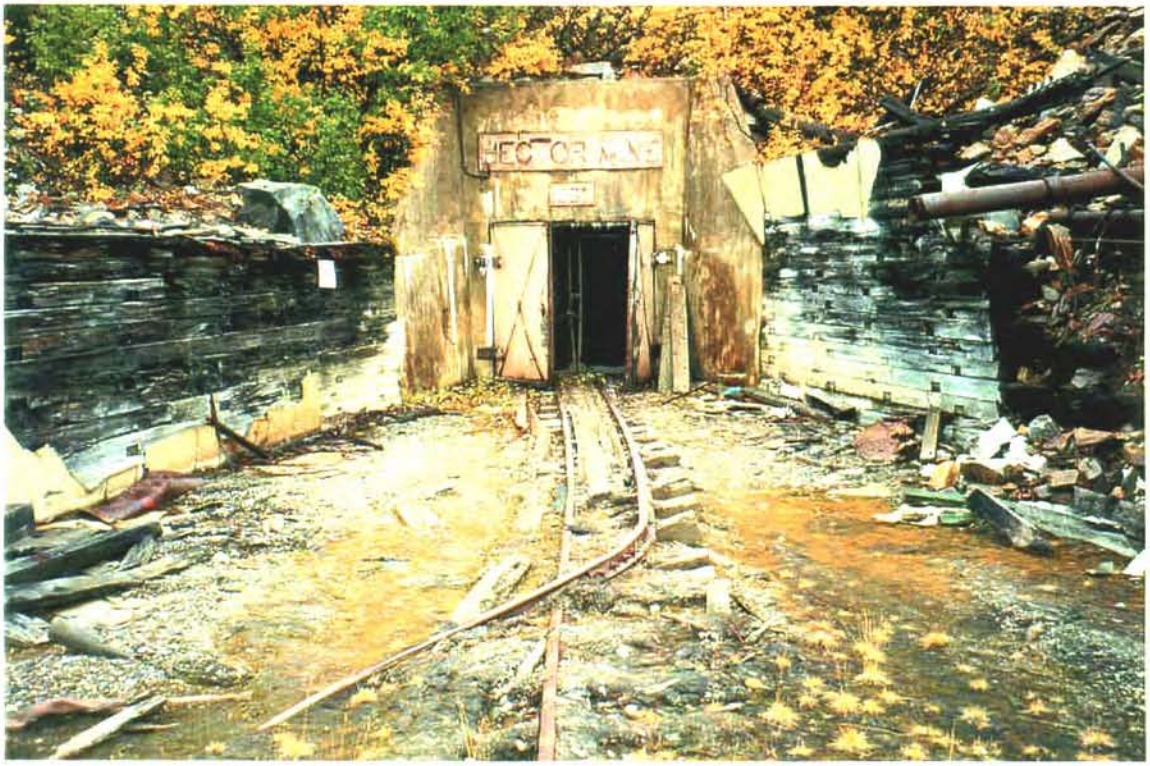


Photo 9-1. Hector Adit, showing the buttressing, old rails and debris.

Photo 9-2. Calumet 1-15 Pit, looking southwest.

Photo 9-3. Hector Open Pit, looking southwest.

Photo 9-4. Hector dump, looking northwest. Note old wooden buttresses and debris.

Photo 9-5. Hector dump, looking southwest. Note wooden buttressed and debris. Old steam plant was located at base of buttresses.

Photo 9-6. Portion of the Hector dump, looking north-northwest. This section of the dump appears to have been used as a loading point, or perhaps the waste was quarried at one time to be used as fill.

Photo 9-7. Looking downhill (northwestward) at the vegetation below the Hector dump. Note the impacted vegetation (grey patch left of center in photograph). Whether this results from high sediment content in water discharged during mining, or from runoff and seepage from the waste rock dump, is unclear.

Photo 9-8. Building 9B. Note wooden construction and tar paper siding. Also note metal piping and remnants of insulation that comprises the utilidors.

Photo 9-9. Burned out bunkhouse and wash house.

Photo 9-10. Building adjacent to the water storage tank.

Photo 9-11. Concrete foundation of storage tank with debris from storage tank. Building in the background.

Photo 9-12. Old ore carts located nears the water storage tank.

Photo 9-13. Remnants of assay laboratory. Note metal debris and concrete foundation.

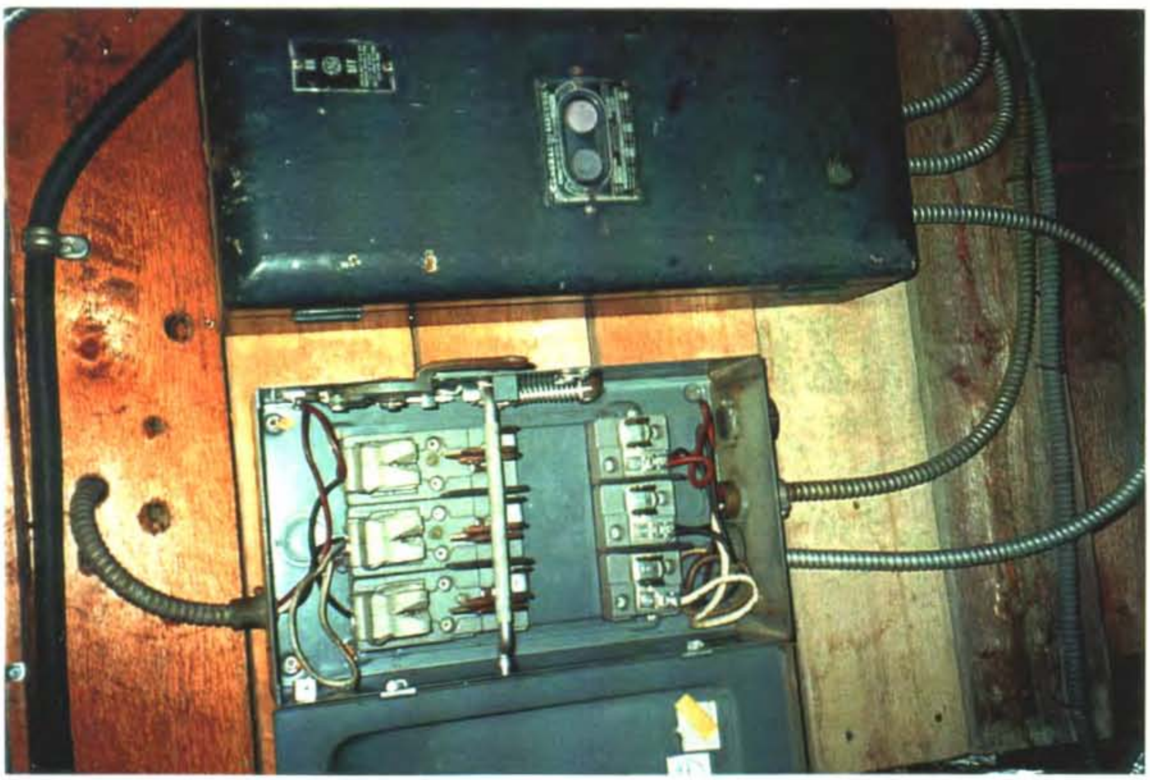


Photo 9-14. Electrical boxes in small shed near loading facility on Calumet 1-15 dump.

Photo 9-15. Old wooden tram towers. Looking west from the Hector dump.

Photo 9-16. Debris in gully adjacent to the Hector dump.

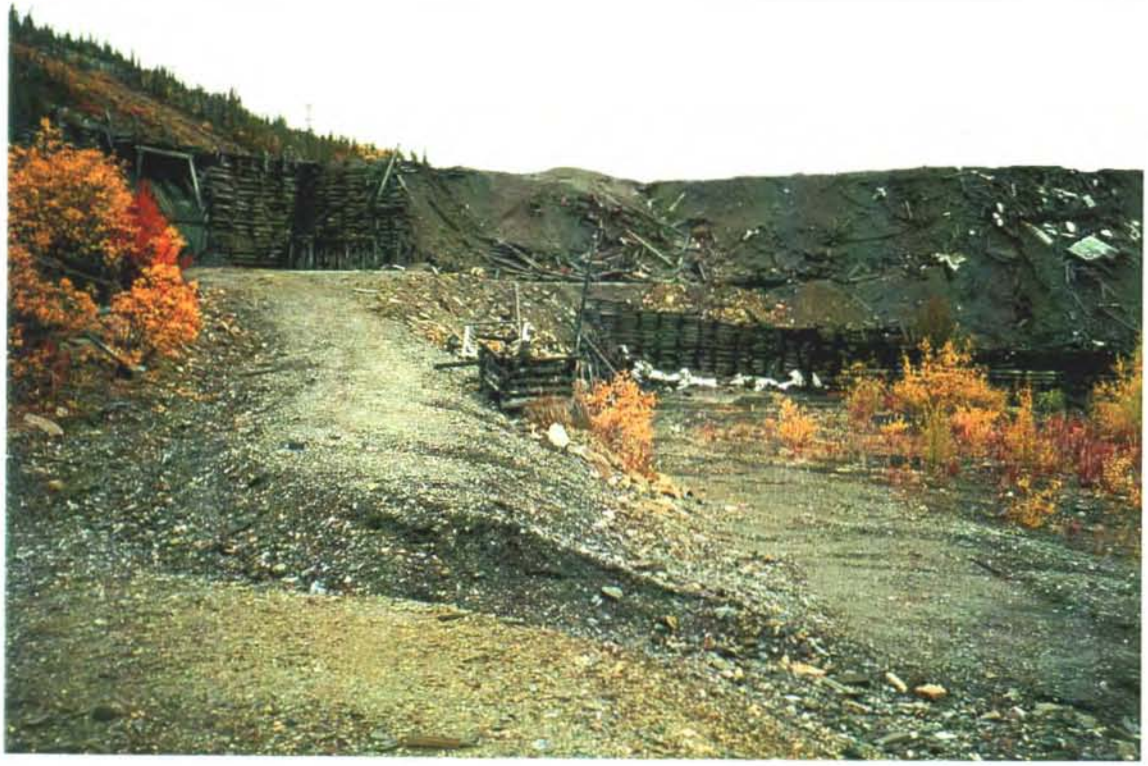


Photo 9-17. Hector dump and loading facility, looking southwest.

Photo 9-18. Coal piles at site of old steam plant. An edge of the concrete foundation of the plant can be seen on the left side of the photograph.

Photo 9-19. Metal and wood debris on the side of the Hector dump.

Photo 9-20. Loading facility on the Calumet 1-15 dump. Note the three barrels

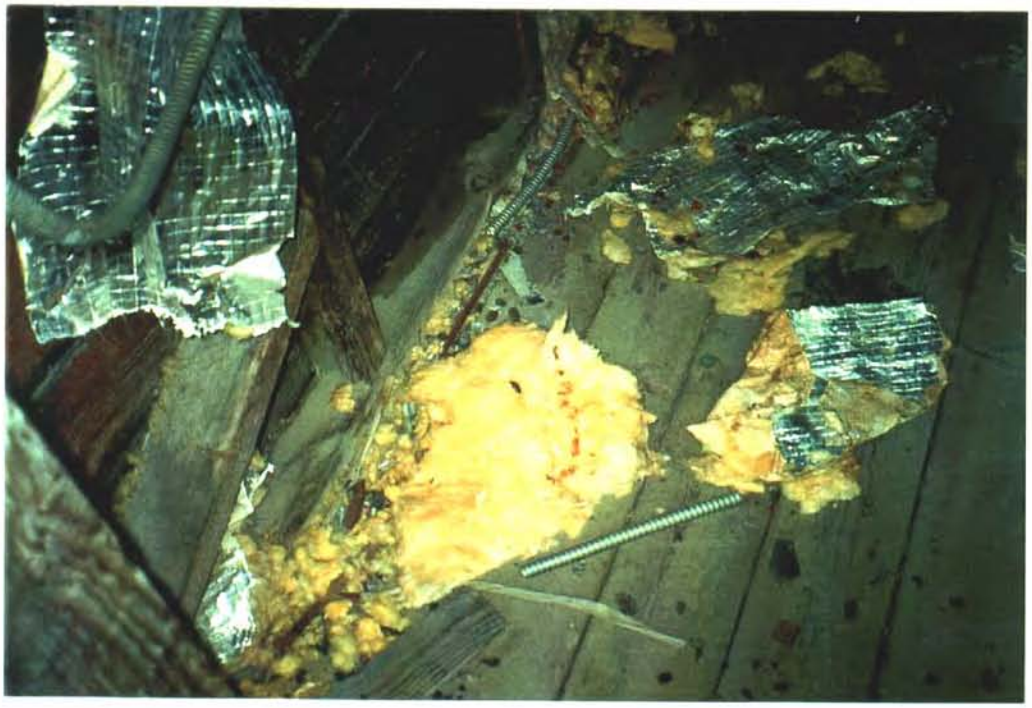


Photo 9-21. Insulation in the electricity shed, adjacent to the conveyor structure at the Loading Facility at the Calumet 1-15 dump.

Photo 9-22. Oil spillage from barrel that is half full of oils and water. The other tow barrels are empty.

Photo 9-23. Old ore carts and debris at the upper loading facility on Calumet 1-15 dump.

DRAGON (UN) & MILLER
Site No. 10
MINFILE: 105M 001j

1. LOCATION AND ACCESS

The Dragon (UN) and Miller sites are located on the north slope of Galena Hill (Site 10 Figure 1). The Dragon (UN) adit is on the Calumet Back Road at an elevation of 3900 feet (1189m). The Miller Pit is located south of the Dragon (UN) adit, at an elevation of approximately 4100 feet (1250m). The approximate UTM co-ordinates for this site are 7 088 800m N and 481 500m E.

Access to the UN adit is along the Calumet Back Road 5.0 km from the Duncan Creek Road. The portal is 10 m south of the road. The turn-off to the Miller Pit is located further along the road, 1 km past the UN adit. The turn-off cuts east-southeast to the pit, then continues on up the slope to the "C" structure of the Hector-Calumet mine.

2. SITE PHYSIOGRAPHY

The slope on which the Dragon (UN) adit and the Miller Pit lie is moderate (~20 degrees). The area is covered with a thick (~10 cm) blanket of moss, as well as bushes and evergreen trees. The site is in the Christal Creek catchment. Christal Creek is located approximately 1.5 km to the north, at an elevation 1100 (335m) feet lower than the pit.

3. GEOLOGY AND MINERALIZATION

According to the Minfile report, mineralization at the site is hosted in medium to thick-bedded Keno Hill Quartzite, with some interbedded carbonaceous phyllite and schist. The main mineralized vein is up to 2.5m wide and contains galena, freibergite, boulangerite, sphalerite, manganese oxide, cerrusite, and anglesite in a siderite-quartz gangue. There is reportedly strong oxidation but no pyrite.

The walls of the Miller Pit are composed of thick beds of resistant quartzite (Photo 10-1). The walls show no mineralization but manganese oxide staining is common. The western wall of the pit has a strong manganese oxide stain, some clay alteration and a small amount of siderite, indicating the end of the mineralized vein. There is no outcrop outside the adit; the adit was not entered.

4. SITE HISTORY

Activity on the site began before 1926, when three shafts were excavated in the Miller area to depths of 6.1 m, 7.3 m and 12.8 m (mintile report). A few small open cuts were excavated at this time. In the 1950's the UN adit was excavated to 122m with another 152 m of underground development off of the adit. This development produced 2,900 tonnes of waste. In 1981 and 1985 the Miller open pit was excavated and 57,150 tonnes of waste produced.

Total production for the site is recorded at 8,519 tonnes grading 468 g/t silver, 2.2% lead, and 0.7% zinc, all having been produced from the Miller area. Apparently, the UN adit never produced ore.

5. MINE DEVELOPMENT

Total mine development includes three shafts, one adit and one pit. The shafts appear to have been destroyed during the excavation of the pit. Details of the pit and adit are shown on Figure 2.

5.1 Mine Openings and Excavations

Dragon (UN) Adit

The UN portal is 2 m high and constructed with wood beams (Photo 10-2). The adit has a wooden door to the adit was open at the time of the site visit. The adit is blocked by ice that extends to the sides of the adit, and comes to within 20 cm of the roof. The ice block is reportedly present year round, but has never fully blocked the water flow (B.Dunn, pers. comm).

Miller Pit

The Miller Pit is approximately 90 m long, 10 m wide and 15 m deep (Photo 10-1). The walls are composed of quartzite, and the north and east walls are both steep and thick-bedded quartzite beds can be seen. In contrast, the west wall of the pit, which is more altered, has more erosion.

There is a moderate amount of manganese alteration on the pit wall rocks and on the waste rock. There was no water in the pit at the time of the site visit.

5.2 Waste Rock Disposal Areas

There are waste disposal areas associated with both the Dragon (UN) adit and the Miller open pit. The adit dump contains approximately 8,000 m^3 of waste, and consists mainly of schists and quartzite with little staining or alteration. The surrounding vegetation has not been impacted by the dump, and has begun to encroach on the dump material (Photo 10-3).

The estimated volume of material in the dump at the Miller pit is 80,000 m^3 (Photo 10-4). The waste rock consists primarily of quartzite with some schist. There is little vein material and some manganese staining.

Waste rock samples were collected by UKHM (1996). Results of analyses of these samples are listed in Table 1. No additional waste samples were collected.

5.3 Tailings Impoundments

No ore was processed at the site and no tailings were encountered.

Table 1. Waste Rock Sample Data

Parameter	Units	Miller Dump 95UKHMD01	UN Adit Dump 95UKHUD01
Paste pH		6.43	7.69
Sulphate (tot)	%	0.03	0.08
Sulphate (SO4)	%	0.02	0.06
AP	$kgCaCO_3$/tonne	0.31	0.63
NP	$kgCaCO_3$/tonne	0.38	1.65
Net NP	$kgCaCO_3$/tonne	0.1	0.9
NP/AP		1.2	2.5
Arsenic	ppm	1	1
Calcium	%	0.06	0.14
Cadmium	ppm	11.3	0.1
Cobalt	ppm	3	4
Chromium	ppm	41	35
Copper	ppm	13	48
Iron	ppm	1.55	1.94
Maganese	ppm	5094	55
Nickel	ppm	17	16
Lead	ppm	462	660
Antimony	ppm	5	11
Zinc	ppm	902	220

5.4 Minesite Water Treatment

There is no water treatment facility at the site.

6. MINE SITE INFRASTRUCTURE

There is no mine infrastructure at the site.

7. SOLID WASTE DUMPS

No solid waste dumps were encountered at the site.

8. POTENTIAL CONTAMINANTS OF CONCERN

Potential contaminants of concern include any metals found in the adit water, and metals washing from the waste rock piles.

9. WATER QUALITY

Water flows from the UN adit at <0.5 L/s, and is clear with no precipitates or sediment on the streambed. The pH of the adit seepage is 6.7 and the conductivity is 80 μS. The analytical results for this sample are listed in Table 2.

The water quality of the UN adit was measured in 1985, and the adit has been water quality monitoring point since 1990. This data was collected in UKHM (1996).

10. RECLAMATION

The waste rock pile at the UN adit and the disturbed areas surrounding the Miller Pit are beginning to revegetate (Photo 10-5). This will likely take a long time as there is mostly barren rock in these areas, and little water. Some revegetation of the waste rock dump is also beginning (Photo 10-4).

11. REFERENCES

Hawthorn, 1996. Investigation into the reprocessing of Elsa Tailings, for United Keno Hill Mines Limited. DIAND Open File 1996-3(T).

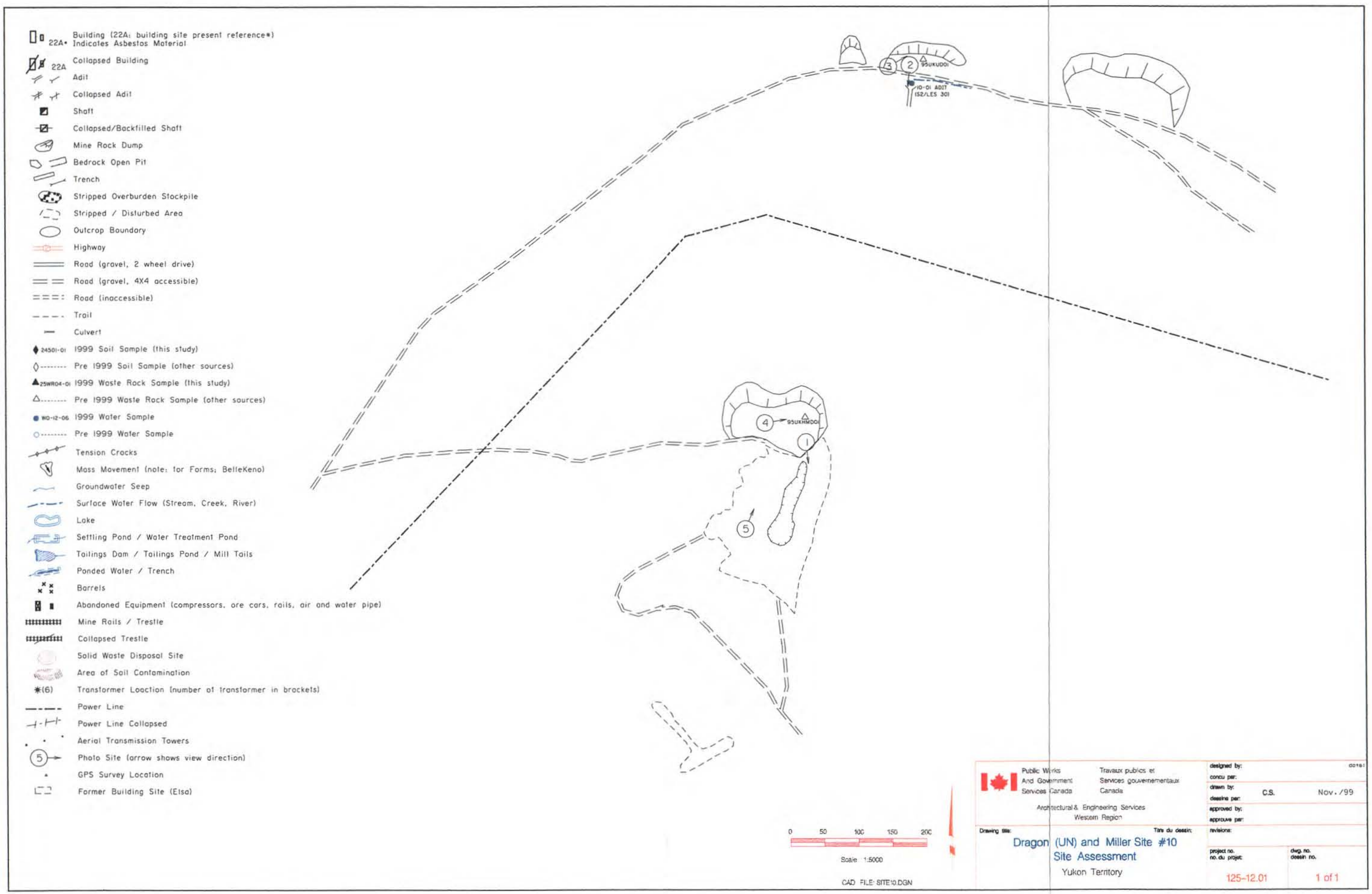
United Keno Hill Mines Limited. 1996. United Keno Hill Mines Limited – Site Characterization. Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI. Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Table 2. Water quality samples

Parameter	Detection Limit	Units	10-1-adit - Dragon & Miller (47710-10)
Aluminum	0.0008	mg/L	0.0104
Antimony	0.005	mg/L	<0.005
Arsenic	0.01	mg/L	<0.01
Barium	0.00004	mg/L	0.0149
Beryllium	0.00001	mg/L	<0.00001
Bismuth	0.0004	mg/L	<0.0004
Boron	0.002	mg/L	<0.002
Cadmium	0.00006	mg/L	0.0003
Calcium	0.002	mg/L	98.4
Chromium	0.00006	mg/L	0.00032
Cobalt	0.00003	mg/L	0.00048
Copper	0.00003	mg/L	0.00131
Iron	0.00001	mg/L	0.225
Lead	0.0003	mg/L	0.0006
Lithium	0.001	mg/L	0.01
Magnesium	0.0005	mg/L	7.75
Manganese	0.00002	mg/L	0.388
Molybdenum	0.00007	mg/L	0.00646
Nickel	0.00001	mg/L	0.002
Phosphorus	0.03	mg/L	<0.03
Potassium	0.4	mg/L	<0.4
Selenium	0.004	mg/L	<0.004
Silicon	0.004	mg/L	2.8
Silver	0.00005	mg/L	<0.00005
Sodium	0.004	mg/L	0.8
Strontium	0.00002	mg/L	0.191
Sulphur	0.008	mg/L	33.1
Thallium	0.001	mg/L	<0.001
Titanium	0.00002	mg/L	0.00014
Vanadium	0.00003	mg/L	<0.00003
Zinc	0.0002	mg/L	0.0643
Zirconium	0.00004	mg/L	
Mercury	0.0001	mg/L	<0.0001
Arsenic (hydride AA)	0.0002	mg/L	0.0053
Selenium (hydride AA)	0.0001	mg/L	<0.0001

	Detection Limit	Units	47712-28 10-1-adit - 13/09/99
Total Alkalinity	5	mg CaCO3/L	184
Chloride	0.1	mg/L	
Chloride	1	mg/L	
Chloride	2.5	mg/L	
Chloride	0.5	mg/L	
Chloride	0.25	mg/L	<0.25
Chloride	0.01	mg/L	
Chloride	5	mg/L	
Electrical Conductivity	0.01	µS/cm	540
Hardness (CaCO3 equiv)	5	mg/L	278
Nitrate-N	0.05	mg/L	<0.05
Nitrate-N	0.2	mg/L	
Nitrate-N	0.5	mg/L	
Nitrate-N	0.1	mg/L	
Nitrite-N	0.003	mg/L	<0.003
Nitrite-N	0.02	mg/L	
Nitrite-N	0.1	mg/L	
Nitrite-N	1	mg/L	
pH	0.01	pH	7.85
Sulphate	1	mg/L	94.7
Sulphate	0.5	mg/L	
Total Dissolved Solids	5	mg/L	343



22A• Building (22A: building site present reference•) Indicates Asbestos Material
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Adit
Collapsed Adit
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Collapsed/Backfilled Shaft
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Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
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24S01-01 1999 Soil Sample (this study)
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Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms; BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
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Tailings Dam / Tailings Pond / Mill Tails
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Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
3
2
95UKUD01
10-01 ADIT
152/LES 301
4
95UKHMD01
1
5
0 50 100 150 200
Scale 1:5000
CAD FILE: SITE10.DGN
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services
Western Region
Drawing title:
Titre du dessin:
Dragon (UN) and Miller Site #10
Site Assessment
Yukon Territory
designed by:
concu par:
drawn by:
C.S.
Nov./99
dessine par:
approved by:
approuve par:
revisions:
project no.
no. du projet:
125-12.01
dwg. no.
dessin no.
1 of 1

Photo 10-1. Miller Pit looking south.

Photo 10-2. UN portal showing wooden debris and open door.

Photo 10-3. Waste rock pile outside the UN adit, showing natural revegetation.

Photo 10-4. Miller waste rock pile.

Photo 10-5. Natural revegetation of area adjacent to the Miller Pit that was cleared during mining.

GALKENO MINE

(Including Sime, Mcleod, And Sugiyama)

Site No. 11

MINEFILE: 105M 001l,m

1. LOCATION AND ACCESS

The Galkeno site is located on the northeast slope of Galena Hill (Figure 1). The main (300 level) adit and loading area are at an elevation of approximately 3800 feet (1158m), and the associated #35 Vein and Sime #4 and #6 open pits are located at elevations up to 4000 feet (1219m). The NTS coordinates are 7 088 600N, 482 600 E.

Access to the site is via the Calumet Back Road north to Galkeno, approximately 3.9 km from the Duncan Creek road. Alternatively, the site can be reached from Elsa by taking the Calumet Road 3.3 km past the Hector Adit. All roads are gravel and are passable by 4WD vehicle.

2. SITE PHYSIOGRAPHY

The site is located on a moderate northeast-facing slope that is covered with a thick moss ground cover, bushes and evergreen trees. The site drains into Christal Creek located 800 feet (244m) below.

3. GEOLOGY AND MINERALIZATION

According to the Minfile report, the Galkeno deposit is hosted in the Keno Hill Quartzite, near the contact with the Lower Schist. Three main veins make up the deposit. The McLeod vein is a 3-6 m wide breccia that had late fault movement that crushed the ore. The other two veins are less than 1 m wide. All three veins contain galena, sphalerite, and freibergite in a quartz, siderite, pyrite, and minor arsenopyrite gangue. Supergene minerals include limonite, manganese oxide, anglesite, cerussite, beudanite and jarosite. Oxidation reaches to the lowest mining level in all ore shoots.

The wall rocks in the pits show little alteration or mineralization. Most of this is limited to the veins and the rock immediately adjacent to them. However, there are areas of iron oxides, particularly in the Sime Pits. Manganese oxide is common throughout the pits and waste dumps.

4. SITE HISTORY

According to the Minfile report, the Galkeno Mine site was first developed before 1930, with shafts and underground workings focussed on the Sime and McLeod veins. Between 1926 and 1949, two shafts were constructed and the first ore was produced from the McLeod vein. In the 1950's and early 1960's, the 100, 200 and 300 level adits were constructed to mine sections of the Sime, McLeod and Sugiyama veins. Also during this time, the 300 level workings were connected to the Hector-Calumet 750 level.

The Sime #4, Sime #6, and #35 vein open pits were excavated in the 1980's, and the "A" structure area was trenched.

In 1957, an adit was excavated at the 900 level of the mine, approximately 50 m above Christal Lake. This adit was constructed to intersect the McLeod vein as well as for dewatering of the underground workings. No ore was ever produced from this adit but it continues to drain much of the Galkeno workings.

Concern over zinc loadings in the Galkeno drainage led UKHM to install a hydraulic plug in the 900 adit in the Fall of 1993. The purpose of the plug was to flood the workings, thereby limiting oxidation of zinc and other sulfides in the exposed walls and reducing the amount of dissolved metals in the discharge water.

Water from the 900 adit is currently being treated with lime to reduce the zinc concentrations. Details of the Galkeno 900 level adit are provided in a separate report.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

There are two shafts, four adits, and three open pits at the Galkeno 300 site.

i) Shafts

McLeod Shaft (Photo 11-1)

Location: On a side road off of the road to the Sime #6 pit.

Dimensions (L x W x D): ~1.5 m^2 x <2 m deep(?).

Condition: The wood of which the shaft is constructed is rotting.

Supports: There is a wooden A-frame above the shaft that likely once held a pulley. The wooden supports around the shaft are in poor condition, and the ground to the NNE of the shaft is subsiding due to collapsing workings below (Photo 11-2).

Accessibility: Shaft is partially collapsed and blocked by wood debris.

Unnamed Shaft (11-3)

Location: Approximately 25 m north-northwest of the McLeod Shaft, just below the road.

Dimensions (L x W x D): ~1.5 m^2 x <2 m deep(?).

Condition: The bush has grown up around the shaft that is well hidden. The wooden supports for the shaft entrance has collapsed on one side and there are wooden timbers blocking the entrance.

Supports: The wooden supports around the shaft are in poor condition.

Accessibility: The shaft is inaccessible.

ii) Adits

300 level adit (11-4)

Location: On the Duncan Creek to Galkeno 300 road.

Dimensions (H x W): ~2 m x 2 m

Condition: Not actively used for more than 10 years.

Supports: According to the map of the underground mine (UKHM, 1996) the original adit was over 800 m long.

Accessibility: Portal has a wood frame that is in good condition and metal doors that are currently open although there has been an attempt to lock it. Adit is not blocked. There is lots of debris at the adit entrance: wood timbers, metal pipes or rail, insulation (utilidors), 15 m of 5 cm thick cable, retaining wall on either side of adit fairly stable.

200 level adit (Photo 11-5)

Location: On a southeast oriented side road off of the Calumet Back Road. The turn-off to the side road is 800 m from the Galkeno 300 adit.

Dimensions (L x W x D): The portal is ~2 m^2 but this is difficult to estimate since it is mostly collapsed. The length of the adit is approximately 75m, according to UKHM maps (UKHM, 1996).

Condition: The portal is in poor condition.

Supports: The wooden supports of the portal have mostly fallen.

Accessibility: The portal is accessible but appears unsafe. It was not entered to determine the depth.

100 level adit (Photo 11-6)

Location: Approximately 50 m northwest of the McLeod Shaft. There is no road access directly to the adit.

Dimensions (L x W x D): The portal is completely collapsed so its dimension are unavailable. According to UKHM maps, the adit extended approximately 2200 feet (670 m).

Condition: The portal is in poor condition. A large pile of wooden debris is in a nearby gully (Photo) and there are approximately rails and metal pipe outside the adit.

Supports: The wooden supports around the portal have collapsed. The buttresses to either side are in fair condition.

Accessibility: The portal inaccessible.

Unnamed adit

This adit was not found during the site visit.

iii) Open Pits

#35 Vein Pit, Sime #4 Pit, and Sime #6 Pit (Photos 11-7, 11-8, 11-9)

There are three open pits in the Sime area of the Galkeno property. The pits were excavated in thickly bedded, resistant quartzite much of which is moderately iron stained. All of the pits were dry when they were visited in September, and there was no evidence water ponding at any time of the year. The pits are very steep-sided, and walls reach from between 0 and approximately 100 m high. Therefore, they pose a substantial hazard from both the steep drop-offs and rock fall. Each pit is accessible by car and can be entered on foot.

5.2 Waste Rock Disposal Areas

Waste rock was deposited outside the 100, 200, and 300 level adits, and adjacent to the open pits. Waste rock associated with the open pits is generally composed of quartzite and schist showing little mineralization (Photo 11-10). Waste from the underground mine is generally composed of similar material, but has more alteration and mineralization. The amount of waste at each adit and pit are provided below (UKHM, 1996).

The waste rock dumps appear stable and no tension cracks or slumping were seen. However, a thorough geotechnical review of the dumps was not undertaken.

Location of Waste Pile	**Tonnage***
100 adit	11,600
200 adit	4,000
300 adit	135,000
900 adit	20,800
#35 vein pit	~400,000
Sime #4 pit	~550,000
Sime #6 pit	~120,000

*Tonnages for the adits are taken from UKHM (1996). Pit tonnages are estimates.

For the application for a water license, UKHM Ltd. assessed the potential for environmental impacts from the waste rock by collecting and analyzing samples of pit wall rock rather than samples of the waste rock itself. The reasoning behind this was that the surface samples of the waste rock limit sampling to the last material that was taken from a given adit or open pit, and are, therefore, not representative of all the material in the waste dump.

Five samples were collected from the Sime pits and the #35 vein pit. Acid Base Accounting, to determine acid generating capacity. Samples were also analyzed for total metals. Results are presented in Appendix I. No additional waste rock samples were collected during the 1999 site visit.

5.3 Tailings Impoundments

No ore was processed at this site. No tailings or dams were encountered during the site visit.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There are eight buildings at the Galkeno Mine site, all located at the 300 level portal. These are described below.

Building 11A – Quonset Warehouse (Photo 11-11)

Location: on the Duncan Creek to Galkeno 300 road
Dimensions (L x W x H): 19 m x 10 m x 6 m
Construction material: steel exterior; steel and wood frame doors; fiberglass insulation; windows boarded up from inside
Paint: None
Asbestos: None
Contents: some building material debris; 20 L empty kerosene container
Foundation: concrete; heavily stained (hydrocarbon odour)
Hazardous products: None
Surrounding area: Hydrocarbon staining was found adjacent to the north and west walls of the building. The northern stain measures 8.5 m x 2 m x 3 cm deep, and the contaminant appears to have leaked from inside between concrete and building frame. The west stain measures 6 m x 3.5 m x 3 cm deep and appears to have leaked from an above ground storage tank.

Building 11B – Loading Elevator (Photo 11-12)

This building is very unstable and poses a hazard, particularly since there is good access to the site.

Location: across the Duncan Creek to Galkeno 300 road from the 300 level adit, on the edge of the waste rock pile.
Dimensions (L x W x H): 6 m x 7.8 m x 20 m
Construction material: wood frame, tar paper/shingle covered
Condition: Poor. Very unstable as building is leaning downhill.

Paint: None observed

Asbestos: Unknown; building too unstable to enter

Contents: Unknown

Foundation: Wood (?)

Hazardous products: None observed

Building 11C – Residence

Location: on the Duncan Creek to Galkeno 300 road

Dimensions (L x W x H): 12 m x 9.7 m x 10 m

Construction material: wood frame, tar paper siding, asphalt shingle (deteriorating); foil vapour barrier with tar paper insulation; utilidor conduits (wooden structures housing utility piping to different buildings) lead into house under floorboards.

Condition: One side and roof collapsed

Paint: None observed

Asbestos: None observed

Contents: Debris from house; some electrical wiring, metal sheeting

Foundation: Wooden, built on waste rock pile.

Hazardous products: None

Buildings 11D & 11E – Demolished Buildings

Location: Just below the Duncan Creek to Galkeno 300 road, southeast of the 400 level adit.

Dimensions (L x W x H): NA

Construction material: wood frame, tar paper, shingle roof

Condition: Demolished

Paint: None observed

Asbestos: None observed

Contents: None

Foundation: Concrete

Hazardous products: None observed.

Building 11F - Storage

Location: Just above the Duncan Creek to Galkeno 300 road, approximately 50 m south of the 400 level adit.

Dimensions (L x W x H): 2 m x 2 m x 6 m

Construction material: two-storey, wood frame, tar paper, shingle roof

Condition: Poor but standing

Paint: None observed

Asbestos: None observed

Contents: None observed

Foundation: Wood

Hazardous products: None observed

Building 11G – Residence (Photo 11-13)

Location: on road above the adit. Turnoff to the road is approximately 125 m southwest of adit on the Duncan Creek to Galkeno 300 road.

Dimensions (L x W x H): 10 m x 8 m x 10 m

Construction material: two-storey, wood frame, tar paper, asphalt shingles with vapour barrier insulation. Utilidor conduit runs across front of building.

Condition: Poor. Roof has collapsed.

Paint: Yes – interior.

Asbestos: No. Probably fiberglass insulation but too unstable to sample.

Contents: None

Foundation: None

Hazardous products: None observed

Surrounding area: overgrown shrubs

Building 11H – Residence

Location: on road above the adit. Turnoff to the road is approximately 125 m southwest of adit on the Duncan Creek to Galkeno 300 road.

Dimensions (L x W x H): 8 m x 6 m x 8 m

Construction material: one-storey bungalow, wood frame, tar paper exterior (deteriorating)

Condition: Roof and several walls collapsed

Paint: None observed

Asbestos: None observed

Contents: None observed

Foundation: Wood

Hazardous products: None observed

Surrounding area: few empty 20L kerosene cans.

6.2 Fuel Storage

No stored fuel was found on site.

6.3 Rail and Trestle

300 Level Adit

There are tracks running out of adit (Photo 11-4) and along side the loading elevator (Photo 11-14).

Fabrication: Approximately 20 m of steel track attached to the wooden ties. Run out of adit, and some scrap was found on waste dump.

Condition: Rusted but intact.

100 Level Adit

Fabrication: Approximately 30 m of steel rail attached to the wooden ties runs out of adit (Photo 11-6). More rail and other metal and wood debris are deposited on platform outside adit (Photo 11-15).

Condition: Rail bent and in poor condition.

6.4 Milling and Processing Infrastructure

No milling or processing infrastructure was found at this site.

6.5 Electrical Equipment

No electrical equipment was encountered on site.

7. SOLID WASTE DUMPS

The Galkeno 300 mine site has abundant metal and wood debris at different locations.

300 Level Adit

Most debris is at the 300 level adit. There is wood debris as well as rail and track immediately outside the adit (Photo 11-4) and on the top of the waste dump (Photo 11-16).

A large pile of mainly metal debris is located adjacent to the loading elevator (Photo 11-17). Additional debris is located below the waste dump at the 300 level adit, consisting of several empty, rusted barrels, miscellaneous metal debris and tar paper from buildings and large wooden cable spools (Photo 11-18).

100 Level Adit

Some rail and metal piping, and abundant wood debris has been deposited outside this adit (Photos 11-6 & 11-15).

McLeod Shaft

Abundant wood with some metal debris (11-19) surrounds the shaft.

8. POTENTIAL CONTAMINANTS OF CONCERN

Potential contaminants of concern include metals from water discharging from the level 300 adit, and metals washed out of waste rock piles. No hazardous materials were encountered on site.

i) Soil

A few hydrocarbon stains were found around Building 11A - Quonset Warehouse. See Section 6.1, Building 11A. The staining was small in area and was only 3 cm deep. No samples were collected.

ii) Liquid Hazardous Waste (usually in 205L barrels or 20 L containers)

No liquid hazardous waste was encountered on site.

iii) POL Storage Tanks

No POL storage tanks were found on site.

9. WATER QUALITY

9.1 Surface water quality

Surface water quality samples were collected from the 300 level adit (Photo 11-4), and from upstream and downstream of the site in Christal Creek. Location of the adit sample is shown on Figure 2. Results of surface water geochemistry are listed in Table 1.

TABLE 1
Surface Water Quality Results

Parameter	Detection Limit	Units	11-1-adit - Galkeno (47711-1)	Christal Cr -01 - Water (47888-11) Upstream	Christal - WS - 100 (47886-9) Downstream
Aluminum	0.0008	mg/L	0.0837	0.0376	0.23
Antimony	0.005	mg/L	<0.005	<0.005	<0.005
Arsenic	0.01	mg/L	0.12	<0.01	<0.01
Barium	0.00004	mg/L	0.00613	0.0471	0.056
Beryllium	0.00001	mg/L	<0.00001	<0.00001	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004	<0.0004
Boron	0.002	mg/L	0.064	<0.002	<0.002
Cadmium	0.00006	mg/L	0.482	0.00162	0.00082
Calcium	0.002	mg/L	189	126	100
Chromium	0.00006	mg/L	0.0098	0.0001	0.00042
Cobalt	0.00003	mg/L	0.11	0.00022	0.00049
Copper	0.00003	mg/L	0.01	0.00103	0.00243
Iron	0.00001	mg/L	32.5	0.307	0.842
Lead	0.0003	mg/L	0.036	0.0093	0.0033
Lithium	0.001	mg/L	0.029	0.015	0.01
Magnesium	0.0005	mg/L	40.3	21.1	20.2
Manganese	0.00002	mg/L	6.25	0.34	0.198
Molybdenum	0.00007	mg/L	<0.00007	0.00027	0.00034
Nickel	0.00001	mg/L	0.379	0.003	0.0025
Phosphorus	0.03	mg/L	<0.03	<0.03	0.04
Potassium	0.4	mg/L	0.6	<0.4	<0.4
Selenium	0.004	mg/L	0.066	<0.004	0.004
Silicon	0.004	mg/L	4.32	1.93	2.74
Silver	0.00005	mg/L	0.0152	0.00068	<0.00005
Sodium	0.004	mg/L	1.5	1.6	1.2
Strontium	0.00002	mg/L	0.22	0.172	0.2
Sulphur	0.008	mg/L	438	40.1	68.1
Thallium	0.001	mg/L	0.228	<0.001	<0.001
Titanium	0.00002	mg/L	<0.00002	0.0132	0.00876
Vanadium	0.00003	mg/L	<0.00003	0.00073	0.00063
Zinc	0.0002	mg/L	23.9	0.195	0.17
Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001
Arsenic (hydride AA)	0.0002	mg/L	0.0803	0.0042	0.0033
Selenium (hydride AA)	0.0001	mg/L	<0.0001	0.0005	0.0003
Total Alkalinity	5	mg CaCO3/L	16	107	111
Chloride	0.25	mg/L	<0.25	0.57	0.65
Electrical Conductivity	0.01	µS/cm	1950	750	630
Hardness (CaCO3 equiv)	5	mg/L	682	442	335
Nitrate-N	0.05	mg/L	<0.05	<0.05	<0.05
Nitrite-N	0.003	mg/L	0.003	0.007	0.008
pH	0.01	pH	5.88	7.76	7.82
Sulphate	1	mg/L	1270	282	207
Total Dissolved Solids	5	mg/L	2010	547	470

300 level adit

A water quality sample was collected at the adit entrance. Flow was approximately 3 L/s and was bright orange (11-4). The pH of the water was 6.7 and the conductivity was 1883 µS. Approximately 10 cm of bright yellowish-orange precipitate (likely limonite) has been deposited over a 3 m^2 area outside the adit. The seepage crosses the Duncan Creek to Galkeno 300 road, divides into two streams as it flows down the waste piles near the loading elevator, and then flows into the bush down slope of the mine site (11-20).

No seepage was seen from any of the waste rock dumps, and there appears to be no impact of seepage on vegetation from most waste dump, with the exception of the dump at the 300 level adit. At the base of this dump is an area approximately 100m wide where the vegetation has been impacted. This area narrows downhill to only a meter or so wide. It is likely that this impacted zone resulted from adit drainage during mining, which would have a higher volume than current drainage. The impacted area has begun to revegetate naturally, suggesting that the zone does not result from current runoff from the waste dump.

Christal Creek

The drainage from the 300 level adit was not traced for its full extent. It is possible that the drainage empties into Christal Creek, or disappears into the groundwater before it reaching the creek. Results of water quality data from samples collected upstream and downstream of the Galkeno 300 site are provided in Table 1. However, it should be noted that there are several other mine and exploration sites in the area that are likely impacting the water quality of the creek in this area.

9.2 Groundwater Quality

Groundwater quality samples were collected from four piezometers that were installed by Keno Hill Mining in 1995. Piezometer locations are shown in Figure 2, and geochemical results are listed in Table 2.

TABLE 2
Groundwater Quality Results

Parameter	Detection Limit	Units	11-95UKG3/1-99 - Galkeno 300 (47904-16)	11-95-UKG3/2-99a - Galkeno 300 (47904-17)	11-95UKG33-99a - Galk 300 47901-3)	11-95UKG34-99 - Galk 300 (47901-2)
ICP-USN Total Metals Scan in Water						
Aluminum	0.0008	mg/L	25.9	37.5	6.19	5.47
Antimony	0.005	mg/L	0.006	0.013	0.007	0.007
Arsenic	0.01	mg/L	0.03	0.07	0.06	0.07
Barium	0.00004	mg/L	0.809	1.61	0.163	0.131
Beryllium	0.00001	mg/L	<0.00001	0.00378	0.00044	0.00024
Bismuth	0.0004	mg/L	0.0106	0.0056	0.0013	0.0007
Boron	0.002	mg/L	0.073	0.077	0.031	0.017
Cadmium	0.00006	mg/L	0.67	0.406	0.00583	0.0377
Calcium	0.002	mg/L	231	450	285	223
Chromium	0.00006	mg/L	0.0889	0.059	0.0085	0.00751
Cobalt	0.00003	mg/L	0.0339	0.00989	0.0216	0.0186
Copper	0.00003	mg/L	0.357	0.121	0.0663	0.0564
Iron	0.00001	mg/L	35.2	89.7	59.2	29.4
Lead	0.0003	mg/L	0.406	0.854	0.0519	0.166
Lithium	0.001	mg/L	0.057	0.112	0.016	0.039
Magnesium	0.0005	mg/L	53.7	85.8	64.5	49.8
Manganese	0.00002	mg/L	72.2	19.4	1.56	1.59
Molybdenum	0.00007	mg/L	0.0171	0.0209	0.00757	0.00217
Nickel	0.00001	mg/L	0.633	0.444	0.0601	0.03
Phosphorus	0.03	mg/L	1.11	2.19	1.93	0.96
Potassium	0.4	mg/L	3.4	4	1	1.4
Selenium	0.004	mg/L	0.031	<0.004	<0.004	<0.004
Silicon	0.004	mg/L	33.4	43.1	13.3	13.2
Silver	0.00005	mg/L	0.0192	0.00456	0.00107	0.00213
Sodium	0.004	mg/L	2.2	3.7	3.1	2.9
Strontium	0.00002	mg/L	0.386	0.919	0.387	0.369
Sulphur	0.008	mg/L	445	552	265	144
Thallium	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Titanium	0.00002	mg/L	0.747	1.06	0.0859	0.0952
Vanadium	0.00003	mg/L	<0.00003	0.0782	0.00804	0.00914
Zinc	0.0002	mg/L	119	88.1	1.01	1.25
Mercury	0.0001	mg/L	0.0001	0.0003	<0.0001	<0.0001
Arsenic (hydride AA)	0.0002	mg/L	0.085	0.09	0.085	0.0708
Selenium (hydride AA)	0.0001	mg/L	0.003	0.0027	0.0012	0.0004
Total Alkalinity	5	mg CaCO3/L	6	8	64	215
Chloride	0.5	mg/L	<0.5	<0.5	<0.5	<0.5
Electrical Conductivity	0.01	µS/cm	1950	2350	1500	1200
Hardness (CaCO3 equiv)	5	mg/L	965	1980	959	774
Nitrate-N	0.05	mg/L			0.4	0.7
Nitrate-N	0.1	mg/L	0.2	1.1		
Nitrite-N	0.003	mg/L	0.005	<0.003	0.006	<0.003
pH	0.01	pH	5.68	6.22	7.29	7.54
Sulphate	1	mg/L	1250	1590	800	430
Total Dissolved Solids	5	mg/L	1950	2310	1340	901

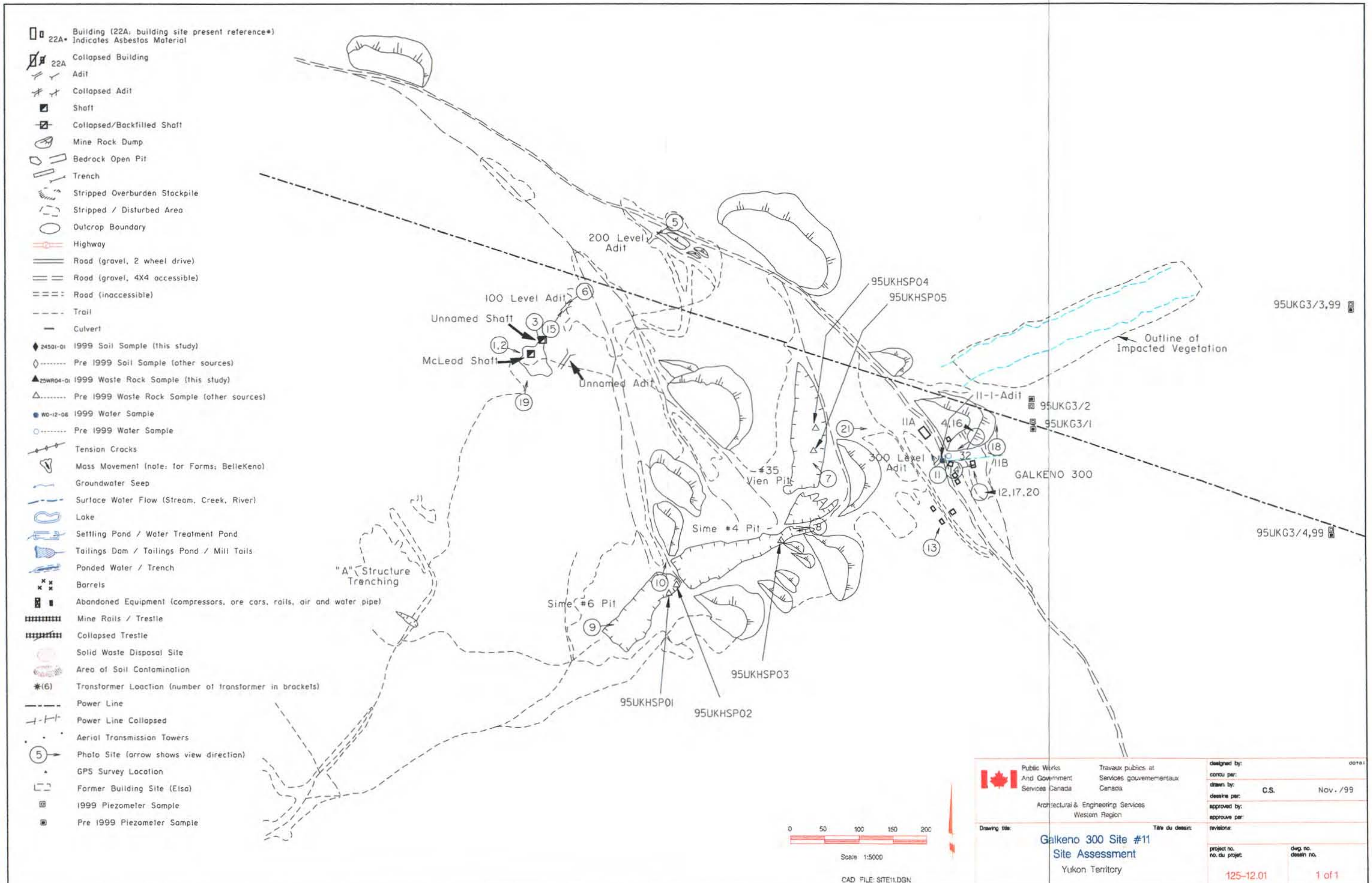
10. RECLAMATION

Many of the waste rock piles are beginning to revegetate naturally with small bushes and some grasses. This is particularly true of the waste piles surrounding the open pits (Photo 11-21). Grasses are also growing in the drainage from the 300 level adit.

11. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.



Building (22A: building site present reference*)
22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)
1999 Piezometer Sample
Pre 1999 Piezometer Sample
200 Level Adit
100 Level Adit
Unnamed Shaft
McLeod Shaft
Unnamed Adit
"A" Structure Trenching
Sime #6 Pit
Sime #4 Pit
#35 Vien Pit
300 Level Adit
95UKHSP04
95UKHSP05
95UKHSP03
95UKHSP01
95UKHSP02
II-I-Adit
95UKG3/2
95UKG3/1
95UKG3/3,99
95UKG3/4,99
IIA
IIB
4,16
32
12,17,20
GALKENO 300
Outline of Impacted Vegetation
0 50 100 150 200
Scale 1:5000
CAD FILE: SITE11.DGN
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title:
Titre du dessin:
Galkeno 300 Site #11
Site Assessment
Yukon Territory
designed by:
concu par:
drawn by: C.S.
dessine par:
approved by:
approuve par:
revisions:
date: Nov./99
project no. no. du projet: 125-12.01
dwg. no. dessin no. 1 of 1

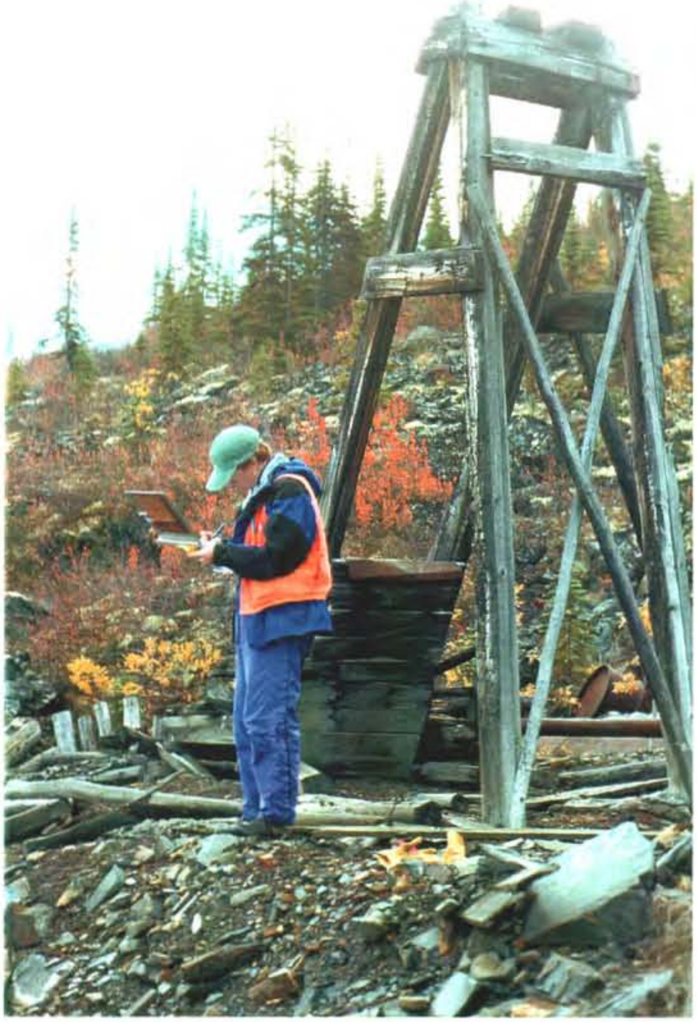


Photo 11-1. McLeod Shaft, looking southeast.

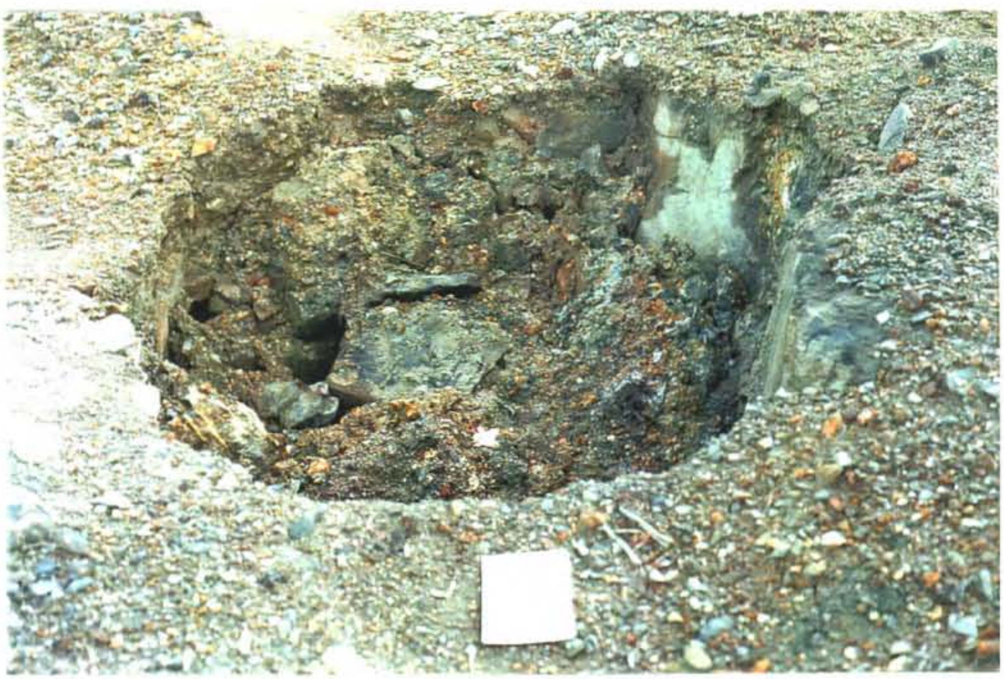


Photo 11-2. Subsidence over adit workings, near the McLeod Shaft. The collapsed area measures approximately one meter across.

Photo 11-3. Unnamed Shaft. The wood constructing the shaft is rotted and unstable, and the area around the shaft is overgrown.

Photo 11-4. Galkeno 300 level adit. Note the iron oxided (orange) laden water and precipitate. Also note the debris in the area.

Photo 11-5. Galkeno 200 level adit. Portal is open but is unsafe. The timbers of the portal are collapsing.

Photo 11-6. Galkeno 100 level adit. Portal is completely collapsed. Note rails exiting adit.

Photo 11-7. #35 Vein Pit. Note steep pit walls.

Photo 11-8. Sime #4 open pit.

Photo 11-9. Sime #6 open pit.

Photo 11-10. Waste rock dump located adjacent to the Sime #4 open pit (lower right-hand corner of photograph).

Photo 11-11. Building 11A - Quonset Warehouse, looking northwest. Located near the 300 level adit.

Photo 11-12. Building 11B - Loading Elevator, looking northwest. The building is located on the waste rock dump outside the 300 level adit. Note how the building is leaning away from the waste dump (also see Photo 11-14).

Photo 11-13. Building 11G, showing the remaining walls.

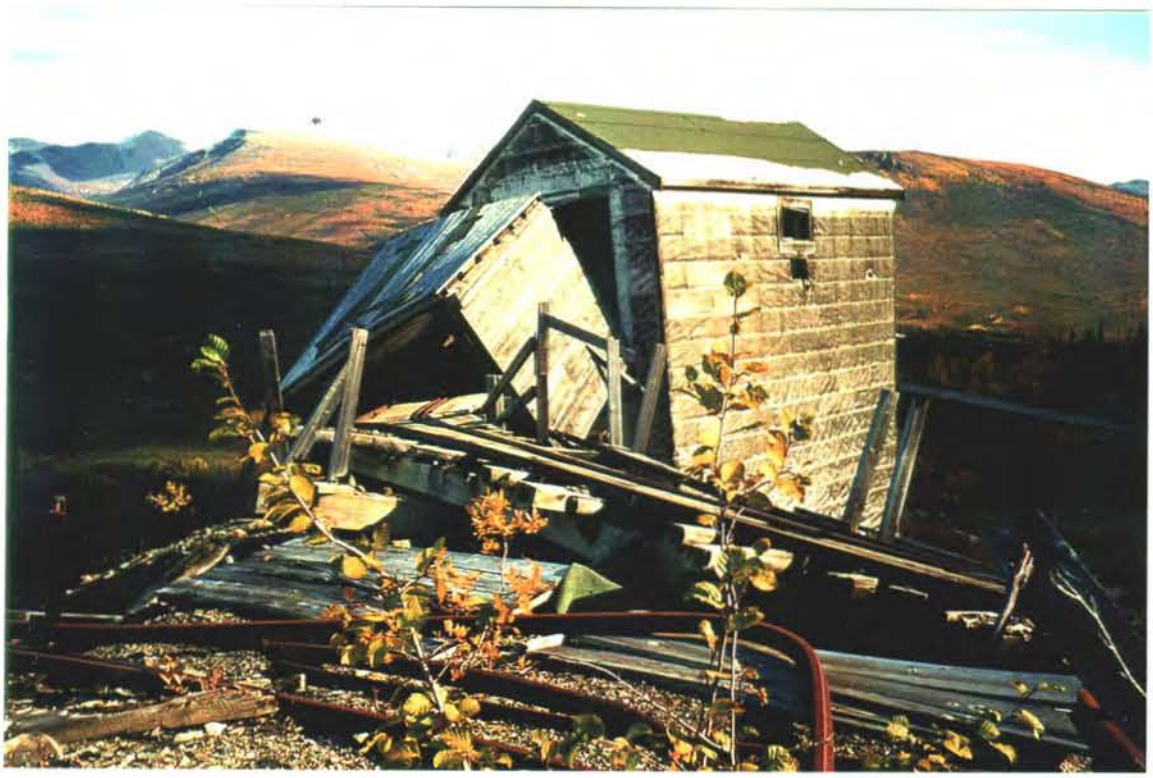


Photo 11-14. The top of the Loading Elevator, looking northeast. There is wooden boards and discarded rails out side this building.

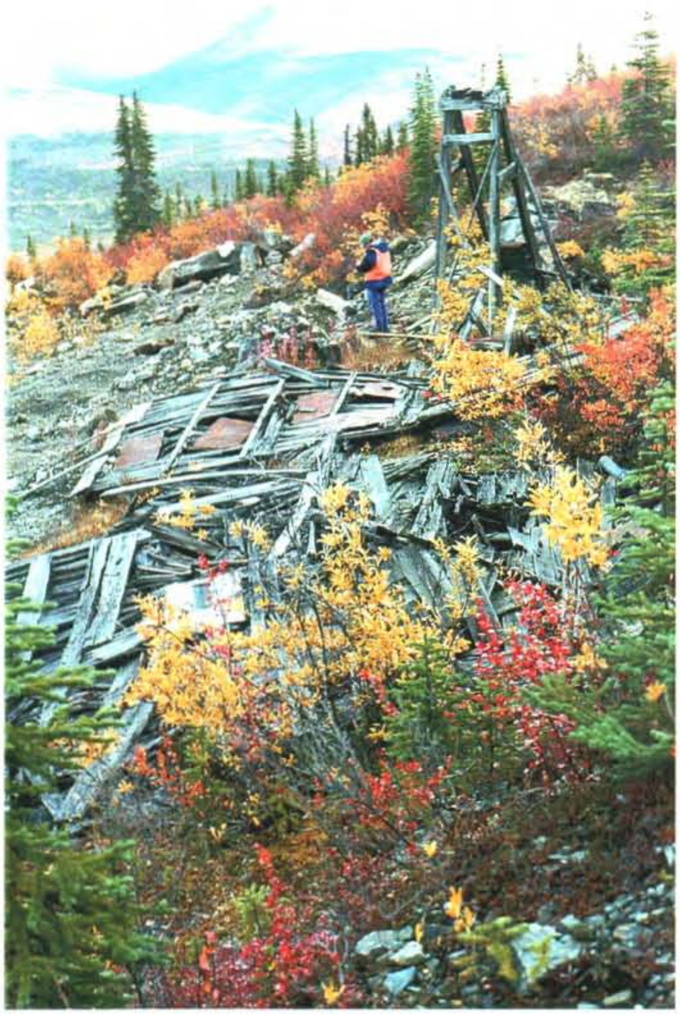
Photo 11-15. Debris outside the 100 Level adit.

Photo 11-16. Debris outside the 300 Level adit, on the dump surface.

Photo 11-17. Debris outside the 300 Level adit, adjacent to the Loading Elvator.

Photo 11-18. Debris at the bottom of the 300 level waste rock

Photo 11-19. Debris around the McLeod Shaft.



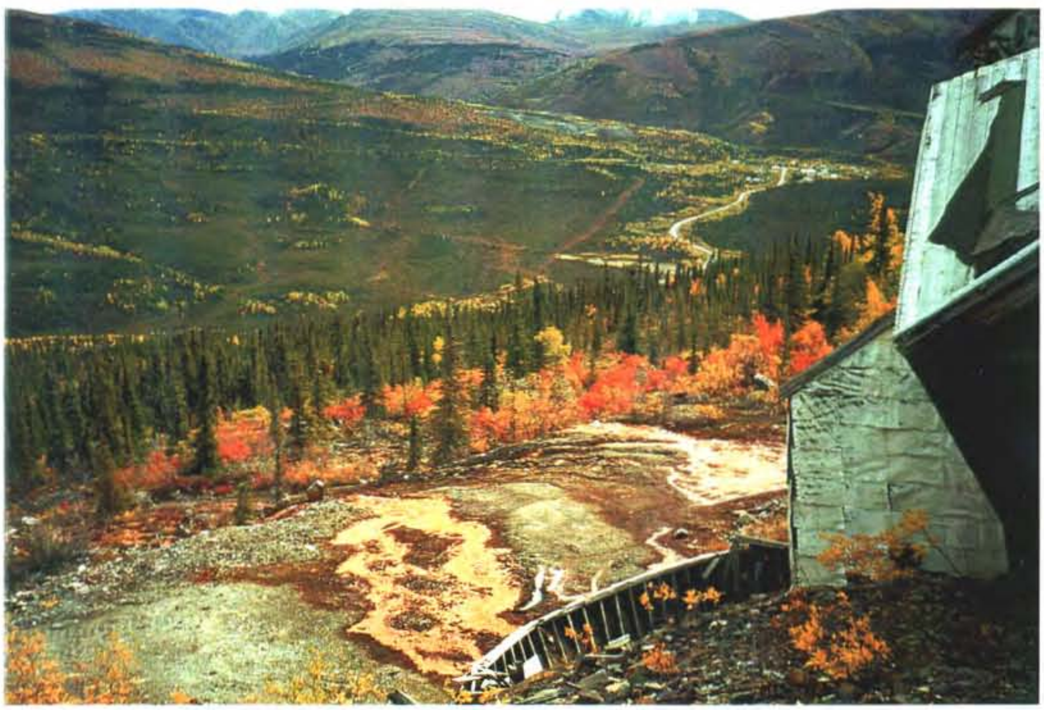


Photo 11-20. Drainage from the 300 level adit as it flows past the Loading Elevator and down below the mine site.

Photo 11-21. Natural revegetation of the some of the waste rock piles. Revegetation is more extensive in areas such as this where the material has a range of grain sizes. Contrast this with Photo 11-10 where there has been less revegetation.

GALKENO 900
SITE #12
MINFILE # 105M001m

1. LOCATION AND ACCESS

The Galkeno 900 site is at the eastern base of Galena Hill at an elevation of 880m, roughly 200m west of the north end of Christal Lake (Site #12, Figure 1). It is located at the approximate UTM co-ordinates 7 087 700m N and 483 600m E. Two wheel drive vehicle access is possible via an all-weather gravel road that branches off to the southwest from Highway 2 (2km west of Keno City). The site is about 0.6km from this junction along Galkeno 900 road.

2. SITE PHYSIOGRAPHY

The east facing Galkeno 900 site is on the gently sloping toe of Galena Hill at an elevation about 20m higher than Christal Lake. The ground around the site area contains a thick layer (>3m) of moss, soil and glacial overburden. The overburden is for the most part permanently frozen. The area is well vegetated with spruce trees and shrubs.

All surface water from this site flows into Christal Lake. Treated mine waters flow to Christal Lake from the site through a 3m deep creek gully that has formed since 1995. A small volume of untreated mine water is diverted into a constructed trial wetland. Water drains from the constructed trial wetland through a natural wetland and into Christal Lake. A seep from beside the constructed wetland also flows through the natural wetland and into Christal Lake.

3. GEOLOGY AND MINERALIZATION

The host rock is a medium to thick-bedded quartzite with graphitic schist and phyllite (Minfile #105M 001m). The vein is a zone of shearing and brecciation about 10m wide. Although open, the adit was not entered to examine the rock and mineralization types.

4. SITE HISTORY

The Galkeno 900 adit was constructed between the late 1950's and the early 1960's, and extends to a total length of 1,910m. The adit was constructed for a variety of reasons: to explore the down-dip extensions of the upper Galkeno workings, to provide a lower elevation haulage level, and to dewater the McLeod Vein workings. The adit was abandoned due to poor ground conditions, and has never entered production. The Galkeno 900 underground workings do not connect to other mine workings at higher elevations, including mined out stopes (United Keno Hill Mines Limited, 1996).

In 1994, a concrete bulkhead was installed 380m in from the portal to flood the adit and plug mine water discharge that contained high zinc concentrations. Flooding of the underground workings re-directed water to previously-dry workings located at higher elevation, most notably the Galkeno 300 adit, and to springs not associated with the underground workings. The apparent failure of the bulkhead approach has required the installation of a small water treatment facility in the portal of the Galkeno 900 adit and the construction of two settling ponds. A trial wetland was constructed 75m east of the adit during the summer of 1995 to reduce the metals content of the mine discharge waters. Results of the constructed trial wetland project are summarized in Attachment 3.

5. MINE DEVELOPMENT

Mine development at the site consists of the Galkeno 900 adit and associated waste rock piles, a constructed wetland, a small water treatment facility and two settling ponds. Site details can be found on Figure 1; see Attachment 1 for site photos.

5.1 Mine Openings and Excavations

The Galkeno 900 Adit is the only mine opening/excavation located at this site.

Galkeno 900 Adit (photo 12-1)

Location: Constructed into the base of the east side of Galena Hill, 200m west of Christal Lake.

Dimensions (L x W x H): 1,910m x 4.5m x 4.0m

Supports: A timber frame supports the portal.

Condition: The portal framing is in fair condition and appears stable.

Accessibility: The portal has wooden doors that are kept unlocked. It is possible to enter the adit beyond the treatment facility; however, the accessible length of the adit was not explored.

5.2 Waste Rock Disposal Areas

Waste rock from the adit is located in two small piles outside the adit, and was likely used to construct the settling ponds and the road. A geologist examined waste rock; no mineralised rock was found and no evidence of oxidation was observed. Based on visual observations and a previous assessment (UKHM, 1996), the waste dump consists of unmineralized development rock. No waste rock samples were collected.

Road

Waste rock was likely used in the construction of the road.

Location: The road travels east from the entrance to the adit for 45m and then turns south to the second settling pond.

Dimensions (L x W x H): 250m x 8m x 1m (estimated depth)

Waste Rock Pile #1 (photo 12-2)

The top of the rock pile has been levelled and forms a clearing along the road. The western edge of the pile slopes at a 30° angle down to the constructed trial wetland below.

Location: The waste rock pile begins 50m east of Galkeno 900 portal and ends at the western edge of the constructed trial wetland.

Dimensions (L x W x H): 20m x 28m x 4m

Stability: There is no evidence of the waste rock pile slumping. The waste rock pile appears stable.

Waste Rock Pile #2 (photo 12-3)

This waste rock pile has been levelled and a log frame structure has been built upon it.

Location: Just south of waste rock pile #1 and the constructed trial wetland.

Dimensions (L x W x H): 30m x 25m x 2m

Stability: The edges of the waste rock pile are gently sloped and there is no evidence of slumping.

Settling Pond Embankments

Waste rock has been used to reslope the eastern embankment to a 10° slope. The northern, southern and western sides of the settling ponds are roads and have been included in the volume of the roads above.

Location: The eastern side of the settling ponds.

Dimensions (L x W x H): 28m x 25m x 3m (estimated depth)

5.3 Tailings Impoundments

No tailings were reportedly processed at the Galkeno 900 site, and no tailings were encountered. The nearby MacKeno Mines mill did not process any of the Galkeno ore.

5.4 Mine Site Water Treatment

A water treatment plant is now in operation to lower concentrations of zinc and other metals in the mine water. The treatment plant is located within the portal. At the time of inspection, water was seeping around the bulkhead and being treated at a rate of 4L/s. Mine water seepage has been reported as high as 10L/s (Bill Dunn, interviewee). Treated adit water flows through underground pipes into a series of two settling ponds. The discharge water from the second settling pond has created a small creek that flows east into Christal Lake.

Wastewater treatment facility (photo 12-4)

Type: Lime treatment plant

Dimensions (L x Diameter): 10m x 1m

Location: Within the portal to the Galkeno 900 adit.

Drainage: According to site personnel, at the time of the site visit the treatment facility was treating approximately 4.5 L/s. United Keno Hill Mines Limited (1996) states that the drainage of mine water from the Hector-Calumet underground workings discharge flows to Galkeno 900 this site via the upper Galkeno workings and the McLeod vein fault.

Piping: The nature of the piping from the bulkhead to the treatment facility was not investigated. The piping is buried from the treatment facility to the settling ponds.

Settling ponds (photos 12-5, 12-6)

At the time of the site inspection, the two ponds were close to capacity with water.

Dimensions (L x W x Depth): 19m x 19m x 30cm (both ponds)

Location: 85m southeast of the adit entrance, south of the waste rock piles and the constructed trial wetland.

Drainage: The second settling pond drains to the south, creating a small creek that runs east into Christal Lake.

Stability: The eastern retaining wall has been recently resloped to increase stability. However, tension cracks in the eastern retaining wall were observed (photo 12-6). One crack (about 5 m in length) was oriented across the slope approximately 3m downslope from the settling ponds. Other cracks were seen along the edge of settling pond #2 and along the eastern edge of the resloped material. These cracks appear to be associated with the collapse of the soil adjacent to where the creek gully has formed. Tension cracks indicate the eastern retaining wall may be slumping.

Piping: A steel pipe 5m in length connects the two settling ponds. A collapsible, blue plastic pipe had been installed to direct the outflow of the water from settling pond number #2 to Christal Lake; however, only the first 10m of this pipe is currently in use, directing water flow to the creek gully. The remainder of the piping has been disconnected but remains in place.

Impacted vegetation: At the time of the site visit, the banks of the stream were stable and vegetation was healthy along the banks.

Constructed Trial Wetland (photo 12-7)

In the summer of 1995, a trial wetland was constructed to investigate the ability of the wetland to treat mine water. Sods of the sedge *Carex aquatilis* were transplanted from the reservoir that provides drinking water to Elsa and planted in an excavated plot. The wetland has one source of water input and one point of discharge. It has three plywood baffles across its width to help control the flow of water. It was designed to treat approximately 0.3L/s of the total discharge from the adit (Bill Dunn, interviewee).

Dimensions (L x W x Depth): 18.5m x 9m x 0.5m

Location: Located at the eastern side of waste rock pile #1, 75m east of the adit entrance.

6. MINE SITE INFRASTRUCTURE

Infrastructure at the Galkeno 900 site is minimal. The site mainly contains buildings and rail infrastructure. Site details can be found on Figure 1; see Attachment 1 site photos.

6.1 Buildings

There are three buildings at this site; a simple storage building that is still in use, a partial log cabin and an outhouse.

Building 12A: Storage Building (photos 12-8)

Dimensions (L x W x H): 8m x 4m x 3m

Location: 20m east of adit entrance

Construction: wood frame, wood siding, and wood roof; entrance is covered by a tarp

Stability: The building appears to be stable.

Paint: none observed

Asbestos: none observed

Contents: 4 steel pipes (8m x 6cm), 1 steel pipe (8m x 10cm), 1 galvanised/corrugated pipe (8m x 20cm), small amount of PVC piping, electrical centre for lights, pumps etc.

Foundation: none

Hazardous products: 1m^2 oil stain in the dirt

Building 12B: Log cabin frame (photo 12-9)

Dimensions (L x W x H): 5m x 5m x 1m

Location: 100m southeast of adit entrance

Construction: log frame – has only been partially completed, no roof

Stability: The logs are in good repair and the log frame appears stable.

Paint: none observed

Asbestos: none observed

Contents: filled part way with dirt

Foundation: none

Hazardous products: none observed

Building 12C: Wooden Outhouse

Dimensions (L x W x H): 1.5m x 1.5m x 2.2m

Location: 60m east of adit entrance

6.2 Fuel Storage

There were no fuel drums or storage tanks encountered at this site.

6.3 Rail and Ties

Fabrication: steel rail and wooden ties

Amount of materials: approximately 60m in length

Condition: The rails are rusted. Both the rails and ties are off of the road and pose no safety hazard.

6.4 Milling and Processing Infrastructure

There was no milling or processing done at the Galkeno 900 site.

6.5 Electrical Equipment

There is electricity supplied to the site. There is one transformer that is attached to a pole near building 12A that is currently in use.

7. SOLID WASTE DUMPS

There were no solid waste dumps observed at this site.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No out-of-service transformers were observed.

8.2 Metals and Hydrocarbons in Soil

Background information and the on-site investigation did not indicate any concerns regarding metals or hydrocarbons in the soil; therefore no soil samples were taken.

8.3 Liquid Hazardous Materials

No liquid hazardous materials were encountered at this site.

8.4 Solid Hazardous Materials

No solid hazardous materials were encountered at this site.

9. WATER QUALITY (photos 12-10 through to 12-13)

Water was seen to be discharging from two points on the site: from the adit and from a seep just north of the constructed trial wetland. As stated in Section 5.4, adit water is treated in the lime treatment plant and piped to the settling ponds. Site details can be found on Figure 1; see attachment 1 for site photos.

The seep discharges approximately 2m from the northern berm of the constructed trial wetland, at the same elevation. The seep water is slightly reddish in colour and iron oxides have precipitated onto the streambed. Water from the seep stagnates in a small natural wetland 5m east of the constructed trial wetland. The natural wetland measures 11.6m x 3.7m x 0.23m. Water quality samples were collected from the seep, settling pond #1, the stream and at the stream outlet into Christal Lake.

In addition to the mine discharge waters there are three small ponds just east of the constructed trial wetland, each measuring approximately 6m x 8m x 0.5m. These three ponds are likely settling ponds that were constructed in 1992. At that time, in order to facilitate the bulkhead construction, the adit was dewatered and the mine waters treated by a small lime treatment plant. The ponds were created to allow the precipitate to settle prior to being discharged from the system (United Keno Hill Mines Limited, 1996). There is a small steel pipe that ends in the westernmost pond that had no water flowing through it at the time of inspection: instead water enters the pond via a seep in the upper bank just above water level. The origin of the water is unknown; however, the constructed trial wetland is just upgradient of the ponds. The water from the three ponds discharge into a swampy area and eventually drains into Christal Lake. Water quality samples were collected from the first pond and from the swamp just prior to the drainage point into the lake.

A total of 6 water quality samples were collected. A complete list of samples, locations, field tests and laboratory results is attached to this report.

10. RECLAMATION

Since the site is still in use, vegetation is sparse on the roads. Some grass has grown on the sides of the waste rock piles. In August of 1996, wetland vegetation was planted in the area between Christal Lake and the constructed trial wetland. The planted vegetation as well as the surrounding vegetation appears healthy. The drainage from the settling ponds has melted the permafrost and created a creek gully with slumped soil and vegetation along its banks. The vegetation appears healthy and has continued to grow within the slumped soil.

11. OTHER SOURCES OF INFORMATION AND DATA

Further information on this site can be found in the United Keno Hill Mines Limited (1996) report. This report provides a detailed discussion on the installation of the adit bulkhead as well as the construction and monitoring of the constructed trial wetland. Ten water sampling stations were installed in the constructed trial wetland and monitored every four days during the summer of 1995. There has been no monitoring of the wetland since March of 1997. Additional water samples were collected from the adit, the natural wetland, the settling ponds, and from seeps at the site. A waste rock sample was collected from waste rock pile #2.

A table of previous samples and results from this site is provided in Part A of Appendix A.

12. REFERENCES

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

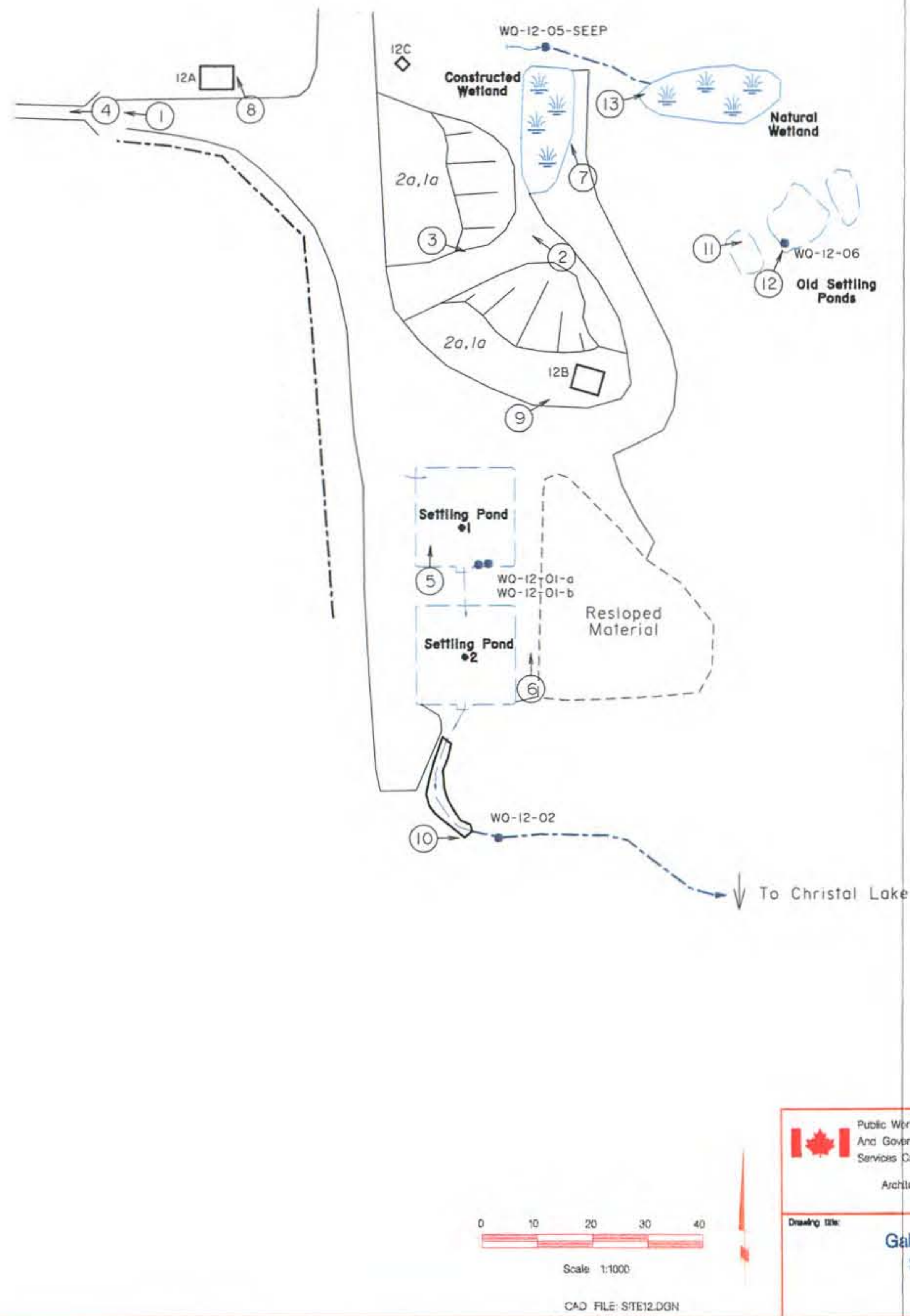
United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

<u>Interviewees</u>:

Bill Dunn, Former UKHM Mine Manager

Galkeno 900 water treatment plant operators

- 22A* Building (22A: building site present reference*) Indicates Asbestos Material
- 22A Collapsed Building
- Adit
- Collapsed Adit
- Shaft
- Collapsed/Backfilled Shaft
- Mine Rock Dump
- Bedrock Open Pit
- Trench
- Stripped Overburden Stockpile
- Stripped / Disturbed Area
- Outcrop Boundary
- Highway
- Road (gravel, 2 wheel drive)
- Road (gravel, 4X4 accessible)
- Road (inaccessible)
- Trail
- Culvert
- 24501-01 1999 Soil Sample (this study)
- Pre 1999 Soil Sample (other sources)
- 25WR04-01 1999 Waste Rock Sample (this study)
- Pre 1999 Waste Rock Sample (other sources)
- WO-12-06 1999 Water Sample
- Pre 1999 Water Sample
- Tension Cracks
- Mass Movement (note: for Forms: BelleKeno)
- Groundwater Seep
- Surface Water Flow (Stream, Creek, River)
- Lake
- Settling Pond / Water Treatment Pond
- Tailings Dam / Tailings Pond / Mill Tails
- Ponded Water / Trench
- Barrels
- Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
- Mine Rails / Trestle
- Collapsed Trestle
- Solid Waste Disposal Site
- Area of Soil Contamination
- (6) Transformer Loaction (number of transformer in brackets)
- Power Line
- Power Line Collapsed
- Aerial Transmission Towers
- 5 Photo Site (arrow shows view direction)
- GPS Survey Location
- Former Building Site (Elsa)



Waste Rock Geological Legend

This legend intended for use as a key to the observed lithological content of the mine dumps and stockpiles of surficial materials investigated.It does not represent regional stratigraphy and no stratigraphic sequence is implied.

Pyrite content as percent: eg. Py 2%. Occurs as an alteration halo adjacent to vein fault structure.

Oxidation: Weak (wOx), moderate (mOx) and intense (iOx).

Quarternary: (5) Undifferentiated, unconsolidated colluvium, glacial till.

*Veins: (4a) Quartz veins; (4b) Quartz-pyrite veins; (4c) Quartz-siderite *trace galena-sphalerite veins; (4d) Siderite-quartz *trace galena-sphalerite veins;*

Greenstone: (3) Amphibole-chlorite-plagioclase metadiorite or metagabbro.

Quartzite: (2a) Thick beded, blocky gray quartzite; (2b) Thin banded, broken, quartzite with carbonaceous phyllite interbeds; (2c) Calcareous quartzite.

Phyllite: (1a) Broken sericite-chlorite phyllite; (1b) Carbonaceous phyllite.

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Architectural & Engineering Services Western Region

Drawing title / Titre du dessin:	Galkeno 900 Site #12 Site Assessment Yukon Territory
designed by / conçu par:	
drawn by / dessiné par:	C.S.
date:	Nov./99
approved by / approuvé par:	
revisions:	
project no. / no. du projet:	125-12.01
dwg. no. / dessin no.:	1 of 1

Photo 12-1: Galkeno 900 portal with spilt lime out front, the water treatment facility is located within the adit. (Azimuth 270°)

Photo 12-2: Waste rock pile #1 with the outhouse in the background. (Azimuth 330°)

Photo 12-3: Waste rock pile #2, Christal Lake and building 12B in background. (Azimuth 135°)

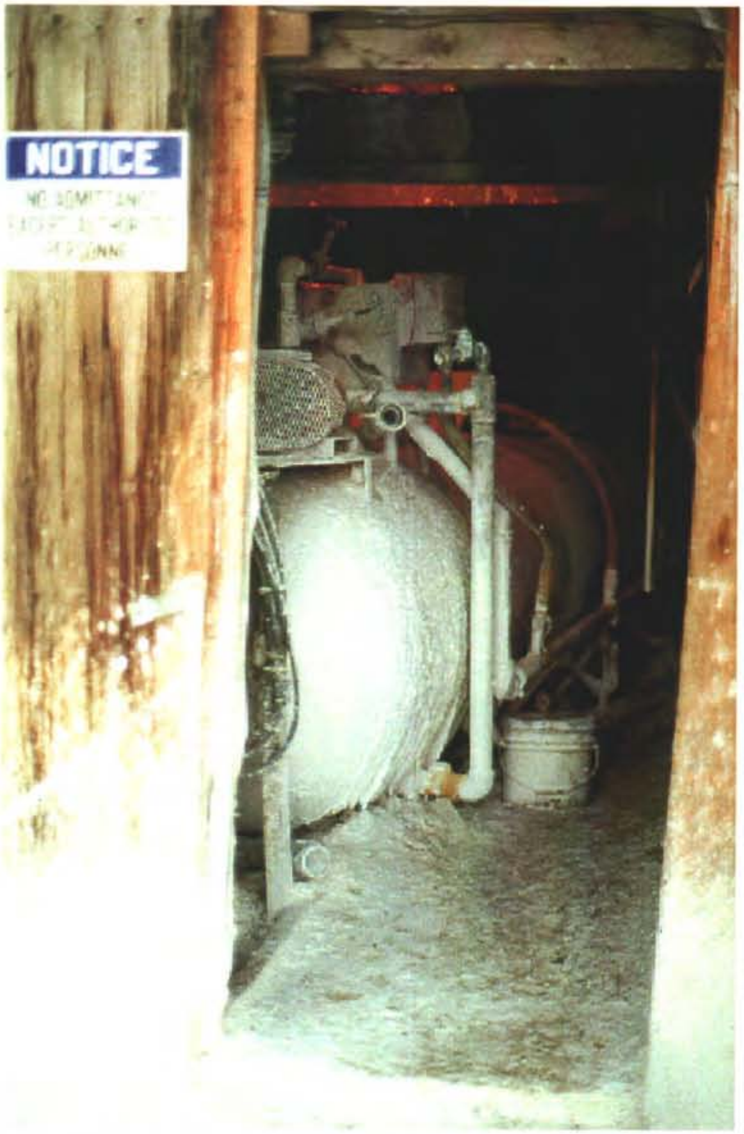

Photo 12-4: Water treatment facility within the portal. (Azimuth 270^{0})

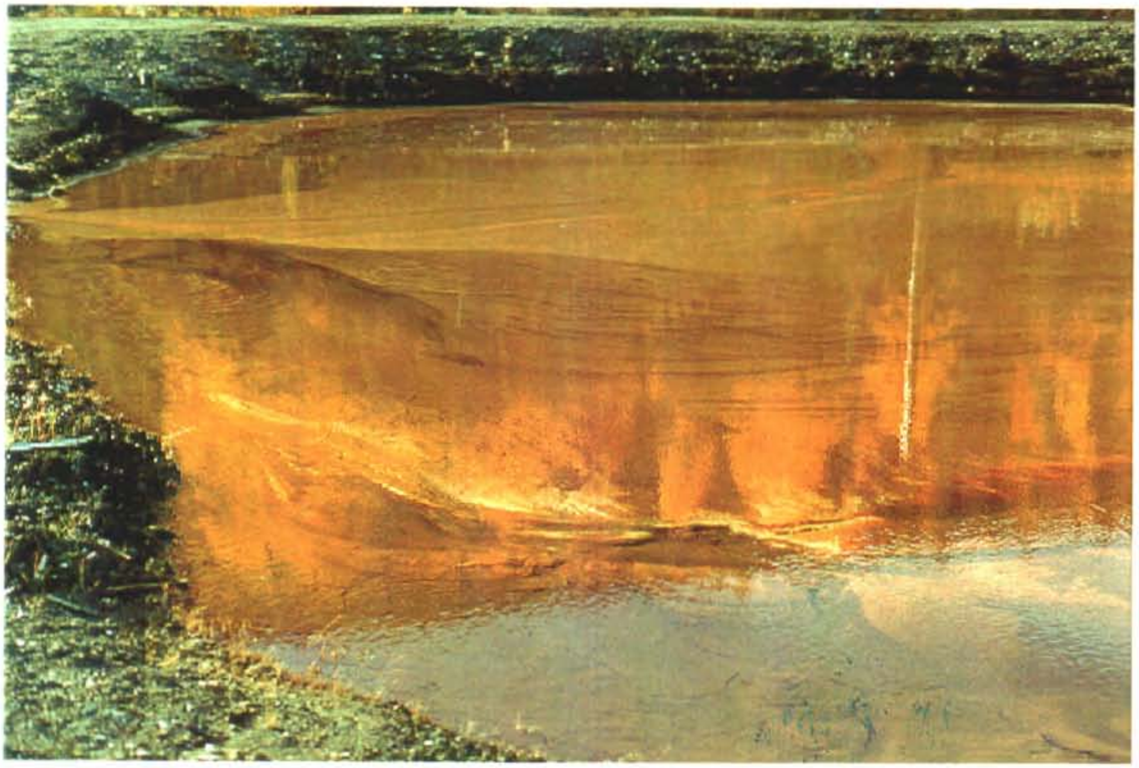

Photo 12-5: Settling pond #1, precipitate flows in from the left through an underground pipe. (Azimuth 010°)

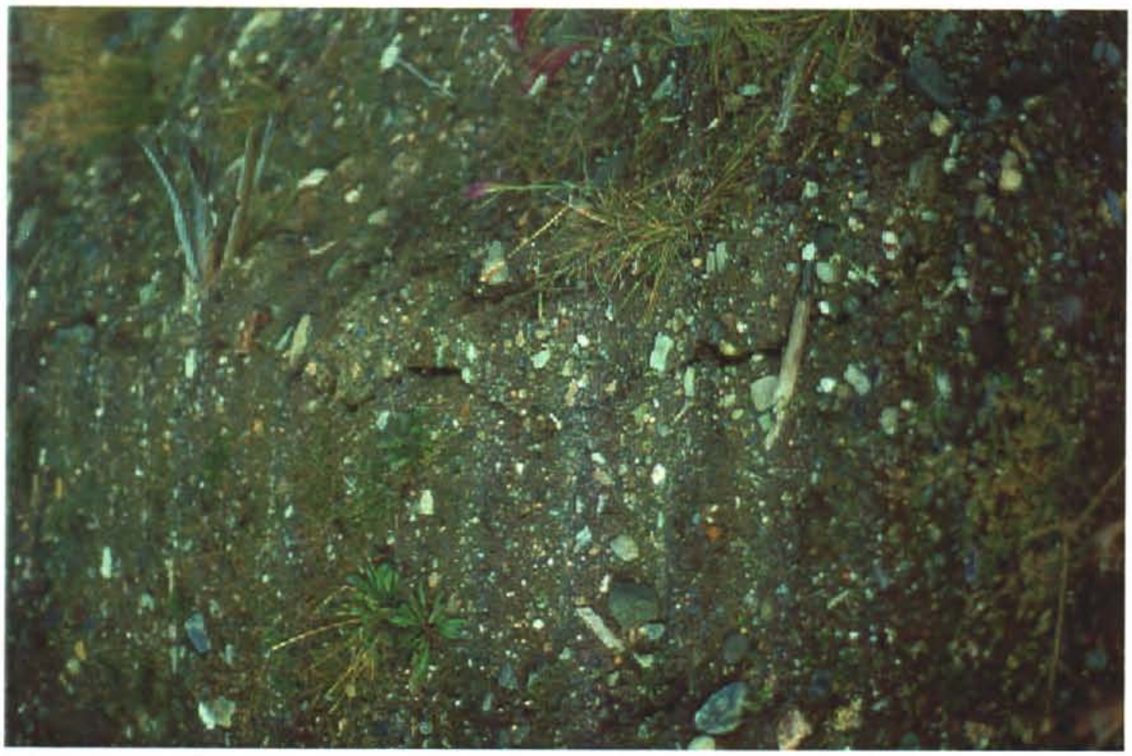

Photo 12-6: Tension cracks in the settling pond retaining wall. (Azimuth 000°)

Photo 12-7: Constructed wetland plot with wooden baffles. (Azimuth 345°)

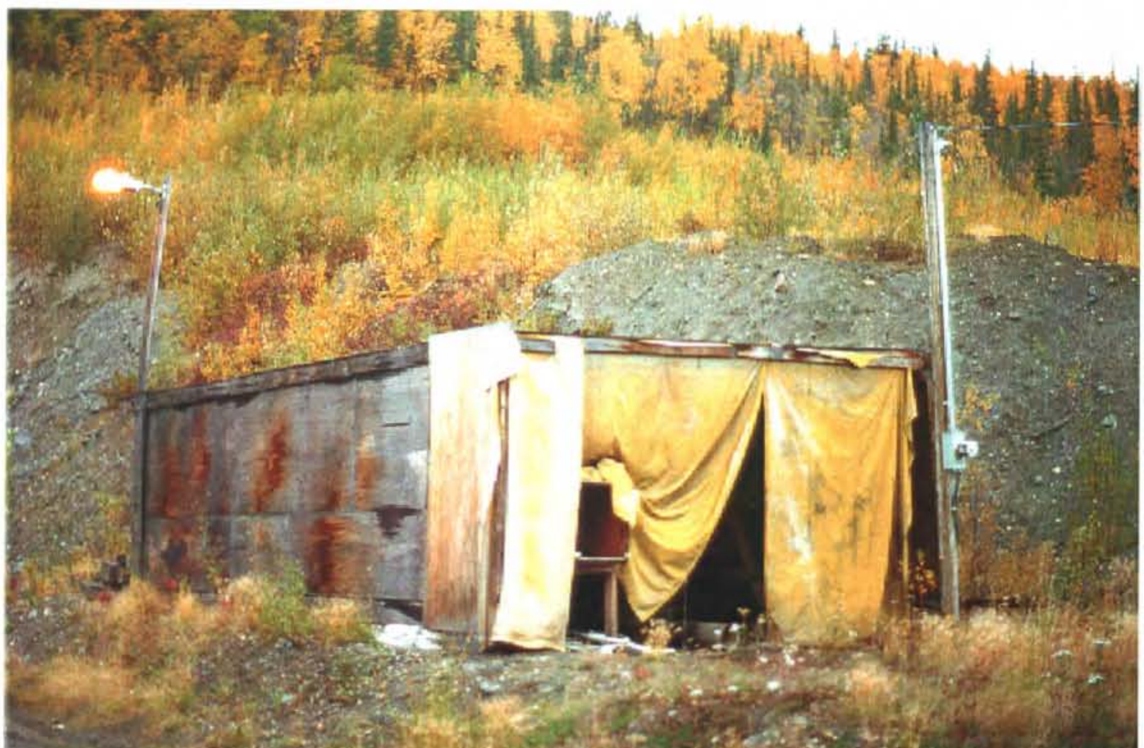

Photo 12-8: Building 12A - a storage building currently in use. (Azimuth 320°)

Photo 12-9: Building 12B - log frame structure with Christal Lake in background. (Azimuth 045°)

Photo 12-10: Blue piping heading to Christal Lake, stream gulley roughly follows piping route. (Azimuth 100°)

Photo 12-11: 3 small ponds, most likely old settling ponds.(Azimuth 070^{0})

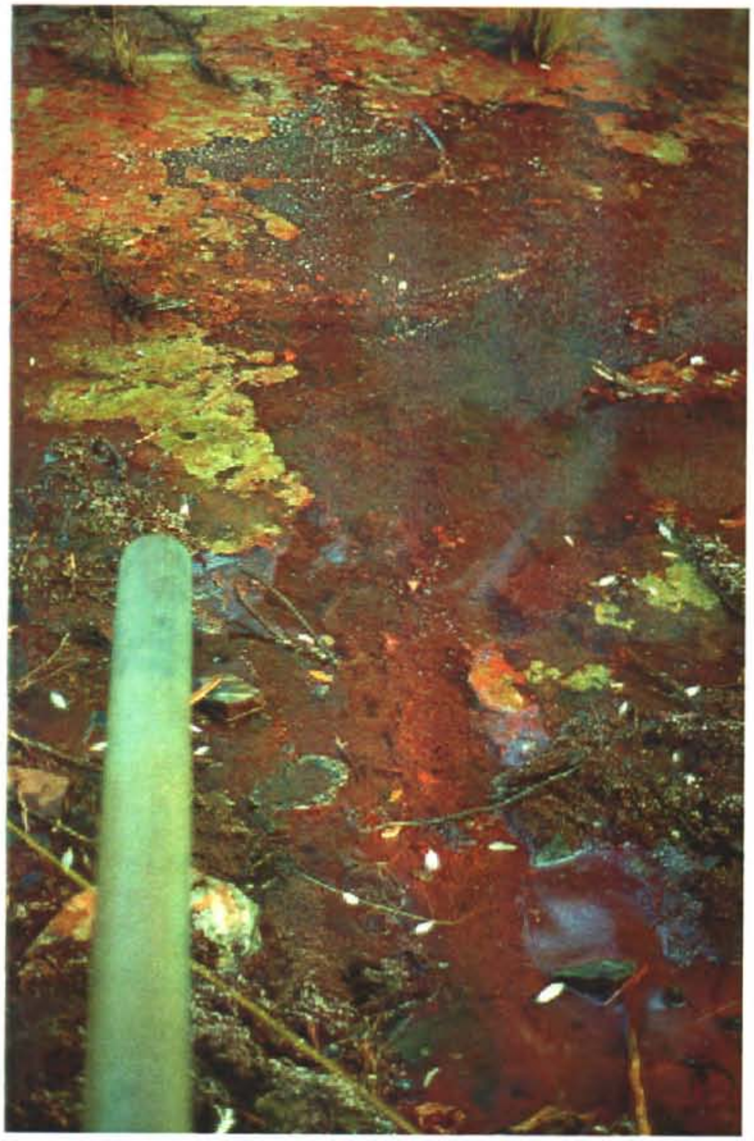

Photo 12-12: Pipe leading to the westernmost old settling pond. Note the iron precipitate in the water. (Azimuth 090^0)

Photo 12-13: Natural wetland located just east of the trial wetland. (Azimuth 075°)

ATTACHMENT 2: 1999 GALKENO 900 WATER SAMPLE LABORATORY RESULTS					
Sample Number	Detection Limit	Units	12-01-Water-a - Galkeno 900 - Sept 18/99	12-01-Water-b - Galkeno 900 - Sept 18/99	12-02-Water - Galkeno 900 - Sept 18/99
Site Description			Settling pond #1	Settling Pond #1 - Duplicate	Settling Pond #2 drainage
pH (field)	N/A	pH	9.9	9.9	10.1
Conductivity (field)	N/A	µS/cm	1866	1866	1833
pH (lab)	0.01	pH	7.6	7.48	9.08
Conductivity (lab)	0.01	µS/cm	1900	1900	1900
Total Alkalinity	5	mg CaCO3/L	18	25	12
Chloride	0.5	mg/L	<0.5	<0.5	<0.5
Hardness (CaCO3 equiv)	5	mg/L	1360	1380	1550
Nitrate-N	0.05	mg/L	0.1	na	na
Nitrate-N	0.1	mg/L	na	<0.1	<0.1
Nitrite-N	0.003	mg/L	0.003	<0.003	0.003
Sulphate	1	mg/L	1160	1170	1160
Total Dissolved Solids	5	mg/L	1710	1740	1720
Analysis by ICP					
Aluminum	0.0008	mg/L	0.0055	0.0035	0.0047
Antimony	0.005	mg/L	<0.005	<0.005	<0.005
Arsenic	0.01	mg/L	<0.01	<0.01	<0.01
Barium	0.00004	mg/L	0.00281	0.00406	0.00393
Beryllium	0.00001	mg/L	<0.00001	<0.00001	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004	<0.0004
Boron	0.002	mg/L	<0.002	<0.002	<0.002
Cadmium	0.00006	mg/L	0.00006	0.00011	0.00011
Calcium	0.002	mg/L	450	449	451
Chromium	0.00006	mg/L	<0.00006	<0.00006	<0.00006
Cobalt	0.00003	mg/L	0.00122	0.00143	0.00156
Copper	0.00003	mg/L	0.00038	0.00038	0.00043
Iron	0.00001	mg/L	0.029	0.031	0.077
Lead	0.0003	mg/L	<0.0003	<0.0003	<0.0003
Lithium	0.001	mg/L	0.06	0.061	0.059
Magnesium	0.0005	mg/L	27.8	27.9	21.6
Manganese	0.00002	mg/L	3.1	3.23	1.85
Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001
Molybdenum	0.00007	mg/L	0.0004	0.00043	0.00048
Nickel	0.00001	mg/L	0.012	0.0129	0.0097
Phosphorus	0.03	mg/L	<0.03	<0.03	<0.03
Potassium	0.4	mg/L	0.8	0.8	0.8
Selenium	0.004	mg/L	<0.004	<0.004	<0.004
Silicon	0.004	mg/L	1.2	1.2	1.14
Silver	0.00005	mg/L	0.00026	0.00028	<0.00005
Sodium	0.004	mg/L	1.8	1.8	1.7
Strontium	0.00002	mg/L	0.567	0.572	0.579
Sulphur	0.008	mg/L	422	418	414
Thallium	0.001	mg/L	0.004	0.004	0.002
Titanium	0.00002	mg/L	<0.00002	<0.00002	<0.00002
Vanadium	0.00003	mg/L	<0.00003	<0.00003	<0.00003
Zinc	0.0002	mg/L	0.135	0.149	0.491
Zirconium		mg/L			
Analysis by Hydride AA					
Arsenic	0.0002	mg/L	0.0041	0.0044	0.0037
Selenium	0.0001	mg/L	<0.0001	<0.0001	<0.0001

ATTACHMENT 2: 1999 GALKENO 900 WATER SAMPLES
LABORATORY TESTING

Sample Number	Detection Limit	Units	12-03-Water - Galkeno 900 - Sept 18/99	12-04-Water - Galkeno 900 - Sept 18/99	12-05-Seep - Galkeno 900 - Sept 18/99
Site Description			Foot of stream prior to entering Christal Lake	Downstream of Old Settling Ponds	Seep beside the Constructed Trial Wetland
pH (field)	N/A	pH	8.0	7.6	7.1
Conductivity (field)	N/A	µS/cm	1784	1991	2060
pH (lab)	0.01	pH	7.41	7.13	6.83
Conductivity (lab)	0.01	µS/cm	1900	2050	2050
Total Alkalinity	5	mg CaCO3/L	51	51	232
Chloride	0.5	mg/L	<0.5	<0.5	<0.5
Hardness (CaCO3 equiv)	5	mg/L	1620	1820	1760
Nitrate-N	0.05	mg/L	na	na	na.
Nitrate-N	0.1	mg/L	0.2	<0.1	<0.1
Nitrite-N	0.003	mg/L	0.01	<0.003	<0.003
Sulphate	1	mg/L	1120	1250	1060
Total Dissolved Solids	5	mg/L	1660	1850	1620
Analysis by ICP					
Aluminum	0.0008	mg/L	8.34	0.0023	0.0721
Antimony	0.005	mg/L	<0.005	<0.005	<0.005
Arsenic	0.01	mg/L	0.06	<0.01	0.04
Barium	0.00004	mg/L	0.41	0.00257	0.029
Beryllium	0.00001	mg/L	0.00032	<0.00001	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004	<0.0004
Boron	0.002	mg/L	0.02	<0.002	0.004
Cadmium	0.00006	mg/L	0.00227	0.00015	0.00014
Calcium	0.002	mg/L	473	449	446
Chromium	0.00006	mg/L	0.0158	<0.00006	0.00041
Cobalt	0.00003	mg/L	0.0158	0.00087	0.0245
Copper	0.00003	mg/L	0.0795	0.00062	0.00082
Iron	0.00001	mg/L	33.4	0.22	9.26
Lead	0.0003	mg/L	0.0363	<0.0003	0.0011
Lithium	0.001	mg/L	0.068	0.039	0.062
Magnesium	0.0005	mg/L	33	49.9	44.2
Manganese	0.00002	mg/L	3.15	2.27	6.96
Mercury	0.0001	mg/L	0.0001	<0.0001	<0.0001
Molybdenum	0.00007	mg/L	0.00221	0.00013	0.0022
Nickel	0.00001	mg/L	0.0512	0.0112	0.11
Phosphorus	0.03	mg/L	1.57	<0.03	<0.03
Potassium	0.4	mg/L	1.6	0.8	1.1
Selenium	0.004	mg/L	<0.004	<0.004	<0.004
Silicon	0.004	mg/L	13.3	2.77	4.7
Silver	0.00005	mg/L	0.00082	0.00012	0.00138
Sodium	0.004	mg/L	2.2	2.4	1.8
Strontium	0.00002	mg/L	0.591	0.563	0.505
Sulphur	0.008	mg/L	406	456	372
Thallium	0.001	mg/L	<0.001	0.002	0.015
Titanium	0.00002	mg/L	0.196	<0.00002	0.00169
Vanadium	0.00003	mg/L	0.0254	<0.00003	<0.00003
Zinc	0.0002	mg/L	0.616	0.326	2.68
Zirconium		mg/L			
Analysis by Hydride AA					
Arsenic	0.0002	mg/L	0.065	0.0025	0.024
Selenium	0.0001	mg/L	0.0014	0.0005	<0.0001

ATTACHMENT 2: 1999 GALKENO 300 WATER SAMPLES LABORATORY RESULTS			
Sample Number	**Detection Limit**	**Units**	**12-06-Water - Galkeno 900 - Sept 18/99**
Site Description			Drainage into Old Settling Ponds
pH (field)	N/A	pH	6.9
Conductivity (field)	N/A	μS/cm	2250
pH (lab)	0.01	pH	7.28
Conductivity (lab)	0.01	μS/cm	2350
Total Alkalinity	5	mg CaCO3/L	223
Chloride	0.5	mg/L	<0.5
Hardness (CaCO3 equiv)	5	mg/L	2090
Nitrate-N	0.05	mg/L	na
Nitrate-N	0.1	mg/L	<0.1
Nitrite-N	0.003	mg/L	0.003
Sulphate	1	mg/L	1300
Total Dissolved Solids	5	mg/L	2120
Analysis by ICP			
Aluminum	0.0008	mg/L	0.0016
Antimony	0.005	mg/L	<0.005
Arsenic	0.01	mg/L	<0.01
Barium	0.00004	mg/L	0.00588
Beryllium	0.00001	mg/L	<0.00001
Bismuth	0.0004	mg/L	<0.0004
Boron	0.002	mg/L	<0.002
Cadmium	0.00006	mg/L	0.0258
Calcium	0.002	mg/L	511
Chromium	0.00006	mg/L	0.00033
Cobalt	0.00003	mg/L	0.0139
Copper	0.00003	mg/L	0.00138
Iron	0.00001	mg/L	2.75
Lead	0.0003	mg/L	<0.0003
Lithium	0.001	mg/L	0.055
Magnesium	0.0005	mg/L	64.7
Manganese	0.00002	mg/L	6.81
Mercury	0.0001	mg/L	<0.0001
Molybdenum	0.00007	mg/L	0.0002
Nickel	0.00001	mg/L	0.0897
Phosphorus	0.03	mg/L	<0.03
Potassium	0.4	mg/L	1.6
Selenium	0.004	mg/L	<0.004
Silicon	0.004	mg/L	4.37
Silver	0.00005	mg/L	0.00136
Sodium	0.004	mg/L	2.3
Strontium	0.00002	mg/L	0.573
Sulphur	0.008	mg/L	482
Thallium	0.001	mg/L	0.015
Titanium	0.00002	mg/L	<0.00002
Vanadium	0.00003	mg/L	<0.00003
Zinc	0.0002	mg/L	4.03
Zirconium		mg/L	
Analysis by Hydride AA			
Arsenic	0.0002	mg/L	0.0032
Selenium	0.0001	mg/L	<0.0001

ATTACHMENT 3: 1995 GALKENO 900 PILOT WETLAND

1. PILOT WETLAND TREATMENT SYSTEM (from Microbial Technologies, 1995)

In the summer of *1995,* a pilot wetland treatment system was constructed downgradient from the Galkeno 900 adit. This system included a settling pond receiving untreated Galkeno 900 water and a small wetland located downgradient from and fed by the settling pond. They were fed mine water starting in July 1995 and monitored until late September for their effect on water quality. Additional on-site tests, including a settling test with untreated Galkeno 900 water and the establishment of *in situ* microcosms (i.e., columns holding cores of wetland sediments and plants), were conducted to generate more precise kinetic data on metal removal. Results from this test program provided the basis for designing a full-scale treatment system. These results are presented below.

1.1 Performance of Settling Pond

Historical data on the composition of Galkeno 900 water indicated that some metals (iron, manganese, and zinc) were present in particulate form which could be retained by a 0.45 micron filter. To determine how quickly and/or whether this material could settle out, a 4 Litres plastic container completely filled with untreated Galkeno 900 water was left to stand within the Galkeno 900 adit. Over a seven day period, the water pH (6.5), alkalinity (204 mg/L as $CaCO_3$), and most metal concentrations remained unchanged. However, iron concentrations decreased by half during this time, as shown in Figure 1.

The apparent increase in zinc concentrations on Figure 1 simply reflects sampling and analytical error: in fact zinc concentrations remained unchanged during the test. The residue filtered from the incubated mine water was found to contain some iron, minor amounts of zinc, and some calcium.

These data indicate that little removal of zinc could be achieved by letting particulates settle out of Galkeno 900 water. However, the removal of iron was of interest, as it would compete with zinc in binding onto organic matter. Therefore, a settling pond was constructed between the Galkeno 900 adit and the pilot Galkeno constructed wetland to remove iron.

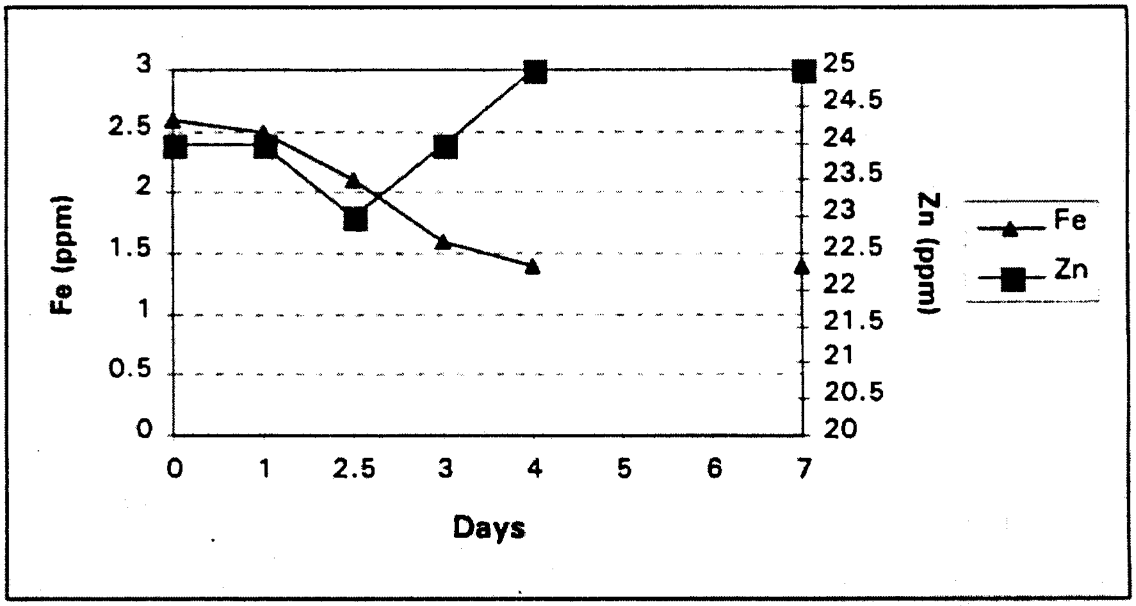

Figure 1. Iron and **zinc concentrations** (Total **metal) in standing Galkeno** 900 **water.**

The plastic-lined 7.6 x 7.0 x 2.0 m settling pond was excavated and filled with Galkeno 900 water (see Photograph 7). A pipe inserted just below the water surface supplied water to the Galkeno constructed wetland. A flow rate of 3 L/min. was used during the monitoring phase of the test program, giving a retention time of approximately 20 days. Unfortunately, no data are available to establish its effect on metal concentrations. Data from 1994 and 1995 indicate that total iron concentrations in Galkeno 900 water average approximately 4.1 ± 1.3 ppm, whereas water entering the Galkeno constructed wetland averaged 1.0 ± 0.11 ppm, consistent with its anticipated effect. Total zinc concentrations in Galkeno 900 water averaged 27 ± 1.2 ppm when measured in 1994 and 1995, but they averaged 24 ± 0.61 ppm[1] in the water entering the Galkeno constructed wetland. This indicates that only low amounts of zinc were retained in the settling pond before entering the constructed wetland. Orange deposit, obviously an iron oxide, was seen to accumulate in the settling pond, again consistent with its anticipated effect.

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[1] There is an outlier in the data set for zinc concentrations in the wetland inflow: eliminating this outlier yields an average of 25 ± 0.19 ppm.

This indirect evidence indicates that iron concentrations are substantially decreased, and zinc concentrations are little decreased when Galkeno 900 water is retained in the settling pond. Thus, the settling pond was effective in attaining its stated objective of decreasing concentrations of iron entering the Galkeno constructed wetland.

1.2 Performance of the Galkeno Constructed Wetland

A pilot-scale wetland was constructed to treatment water from the Galkeno 900 adit. The specific purposes for building this wetland were:

1. To establish the feasibility of constructing a wetland in a sub-arctic climate

2. To determine its effectiveness in improving the quality of water produced by the Galkeno 900 adit

3. To develop performance parameters for the design of a full-scale system that would discharge water of a quality that does not impact on the receiving environment

4. To determine its long-term effectiveness in removing metals

This part of the field program was successful in meeting these specific objectives, as described below.

1.2.1 Wetland construction and plant growth

Construction of the test wetland (from hereon referred to as the Galkeno constructed wetland) was initiated on May 17th 1995. A bare, exposed, South-facing plot below the Galkeno 900 adit was marked and excavated to approximately 9 x 18.5 x 0.5 metres. See and Photograph 8 Appendix 1. A very small trickle of groundwater could be seen to emerge from the excavated bank, but too little water was produced to obtain a sample for analysis. It was felt that this input of groundwater would not significantly influence the results from the test.

A donor site with a stand of the sedge *Carex aquatilis* (Taylor, 1983, or ***C.*** *Stans,* Porsild, 1973) for the Galkeno constructed wetland was identified. This site was located in the reservoir providing drinking water to the hamlet of Elsa, which is fed by the South McQuesten River and is judged to be uncontaminated by mine drainage. On May 19, 1995, sods of sedges and underlying soil/peat were dug out (down to permafrost, approximately 30 cm below the surface), loaded onto flatbed trucks, and immediately placed into the excavated plot. Fertilizer (21-7-7) was broadcast at a rate of approximately 185 kg/ha onto the ground prior to transplanting the sods. The excavated plot was filled as completely as practical with sods and filled with lime-treated mine water. Contaminated mine water was not introduced until good plant growth was seen.

Plant growth in the constructed wetland was compared with that at the donor site. Individual *Carex* clumps were demarcated at four stations in the constructed wetland and five stations in the donor site, and the height of the tallest shot at each station was measured. These measurements indicated that the onset of plant growth was slightly delayed in the Galkeno constructed wetland, but that it was otherwise comparable with that at the donor site (see Figure 4). By mid-August, (after having received contaminated mine water) plant coverage varied from 30% to 70%. Numerous side shoots were observed, indicative of healthy vegetative growth. Moreover, many plants had fruit-bearing spikelets, indicating that plant reproduction was unaffected. These data and observations indicate that a wetland could be constructed which sustains normal plant growth and reproduction in a mining environment.

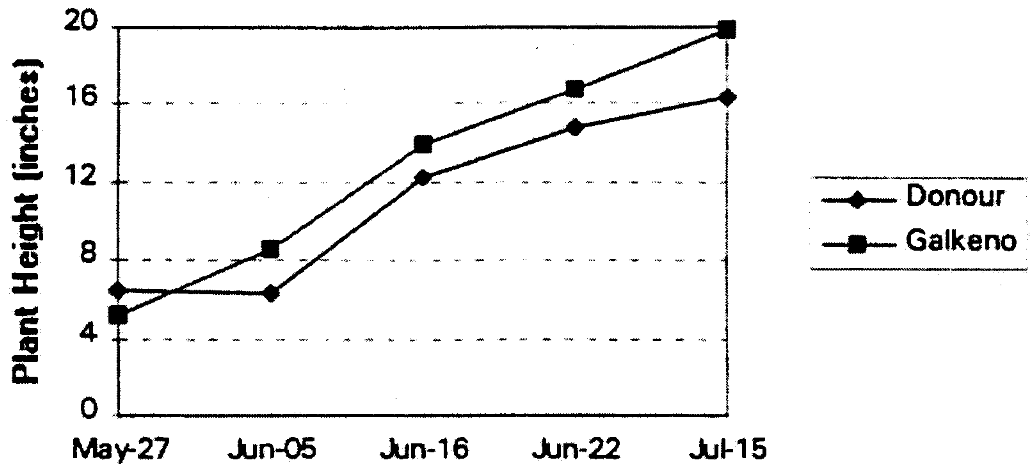

Figure 2. Plant growth at the donor site and Galkeno constructed wetland.

1.2.2 Metal removal

Lime-treated Galkeno 900 mine water was circulated into the constructed wetland until good plant growth was established. Starting in July 1995, untreated water was circulated first throughout the settling pond (Section 3.3.1), thence to the constructed wetland. The flow rate was established at 0.3 L/sec (18 *Llmin.),* giving a nominal retention time in the wetland of approximately 3 days. Until mid-August 1995, water sampled periodically indicated that little metal removal occurred in the wetland. Typical zinc concentrations in the inflow and decant measured approximately 25 and 18 ppm *(mglL),* respectively. These results indicated that water probably had an insufficient retention time, since earlier tests indicated that letting the mine water sit for seven days decreased zinc concentrations to approximately 15 ppm (Section 3.3.1).

A site visit in mid-August indicated that the inflow was likely by-passing a portion of the wetland as well[72]. Measurements of water characteristics further confirmed this view. Ten stations were established in the wetland, five on the inflow side and five on the decant side of the wetland, as shown in Figure 5. Examination of the water pH, Eh, and temperature reveals that Stations 4

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[2] This is not unusual during the first year, as sods transplanted in the excavated cell slow settle.

and 5, and probably Station 3 on the inflow side were different from the other stations (Table 7). Their distinctly higher temperature and lower Eh were indicative of stagnating water[83].

The low Eh at Stations 4 and 5 indicated that reducing substances (such as hydrogen sulphide) were produced in the water column. To corroborate this hypothesis, sediment samples were collected near these stations and tested for the presence of hydrogen sulphide (by smell), for Eli, and for the presence of sulphate-reducing bacteria (SRB). One sediment sample near Station 5 had an Eli of -147 mV (moderately reduced), had a characteristic sulphur odour and pitch black colour, indicating that sulphate reduction was occurring. Analysis of this sample for SRB indicated that it harboured a healthy population of 2.9×10^6 MPN[4]/dry g. For a comparison, sediments from an experimental constructed wetland at the former Bell Copper mine harboured SRB populations averaging $5 \times i0^3$ MPN/dry g at the onset of the growing season, and 4 x ~ MPN/dry g before the onset of the dormant season (Gormely *et al.,* 1994). Another sample taken nearby Station 3 also had a low Eli (-127 mV), but not other characteristics typical of sulphate reduction. In contrast, a sediment -sample taken from the centre of the wetland had an Eli of 42 mV. Thus, the wetland was functioning as an anaerobic treatment system.

Table 1. Water characteristics in constructed wetland, before installation of baffles.

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[3] The higher temperature would result from a greater warming from sunlight (temperature was measured at the surface in all cases), whereas the lower Eli would result from the lower mixing and more complete consumption of oxygen, both of which occur when water stagnates.

[4] MPN stands for Most Probable Number, and is essentially equivalent to the cell number in a sample.

		Station 1	*Station 2*	*Station 3*	*Station 4*	*Station 5*
	Inflow					
pH		6.45	6.76	6.80	6.86	6.5
Eh		54.7	85.4	41.0	-28.9	-18
Temperature (° C)		12.5	12.6	14.3	15.6	15.0
Alkalinity (mg/L as $CaCO_3$)		176	160	150	356	218
Zinc (ppm)		22.6	-	19.8	-	0.33
	Decant					
pH		6.69	6.76	6.69	6.61	6.78
Eh		83.2	72.3	75.8	76	92.3
Temperature (° C)		13.1	13.0	13.9	13.9	13.7
Alkalinity (mg/L as $CaCO_3$)		158	155	147	140	141
Zinc (ppm)		19.3	-	19.7	-	17.5

The data on zinc concentrations are noteworthy. The decrease in zinc concentrations between the wetland inlet and outlet is not very large, decreasing from 22.6 to 17.5 ppm. The short-circuiting suggested by the above arguments likely accounts for this poor performance. However, zinc concentrations sampled in Station 5 decreased to 0.33 ppm. Repeat sampling the following day yielded zinc concentrations of 1.44 ± 0.87ppm (0.58 ± 0.095 ppm if one outlier is excluded), which are nearing environmentally acceptable discharge concentrations. Given the above arguments that water sampled in Station *5* stagnated (i.e., had a long retention time), these results provided the first indication that the constructed wetland could remove zinc, given enough time.

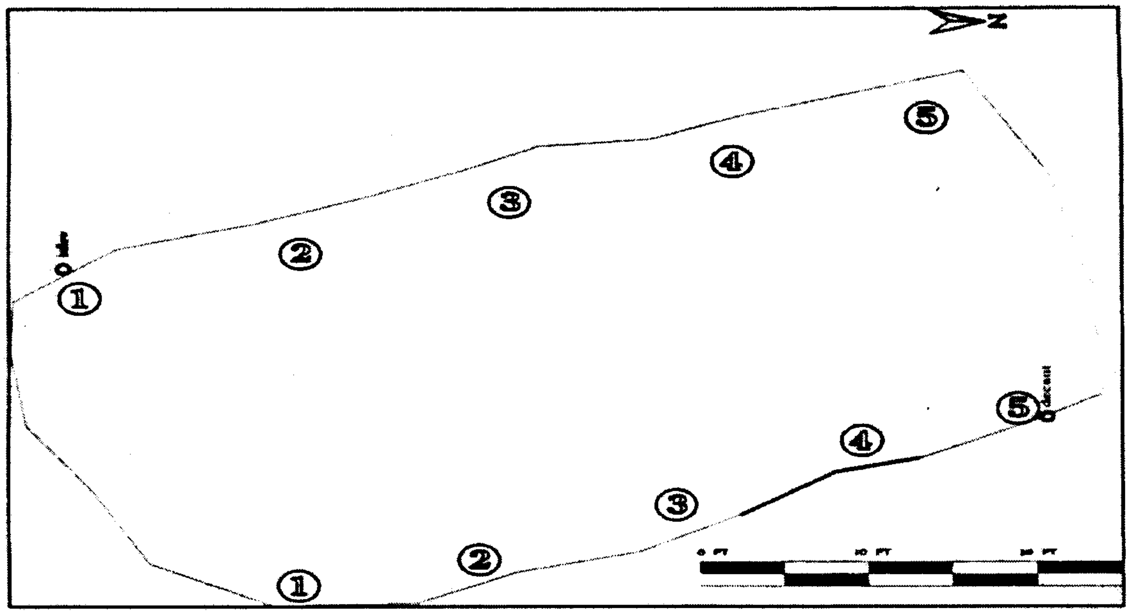

Figure 3. Sampling stations to characterize water flowing through wetland.

To remedy the problem of short-circuiting, plywood baffles were inserted across the wetland, redirecting water to flow past the high point in the wetland (Station 5 in Figure 3). These baffles (shown in Figure 6) were installed on August 22 and 23. With the baffles in place, water from the Galkeno adit was redirected to be retained within the first baffle, and its flow was re-established at 3 Ll/min. This gave a nominal retention time of 19.3 days.

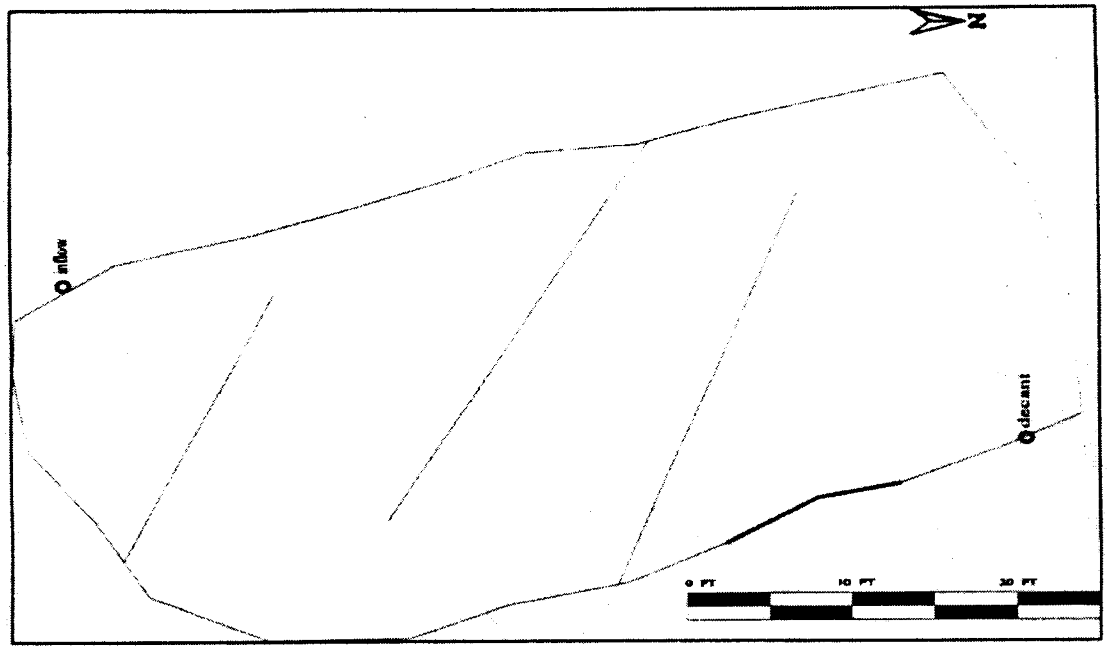

Figure 4. Placement of baffles in Galkeno constructed wetland.

Installing the baffles did not completely establish the desired flow of the water across the wetland. A zone of high permeability was found below the inflow which allowed water to escape out of the wetland. On August 24, this zone of high permeability was covered with soil and the flow of water was again redirected away from it and around the first baffle. From that time onward, water flowed around the baffles and decanted out as planned.

Zinc concentrations (total metal) measured at the wetland inflow and decant from August 26 to September 20 are shown in Figure 7.

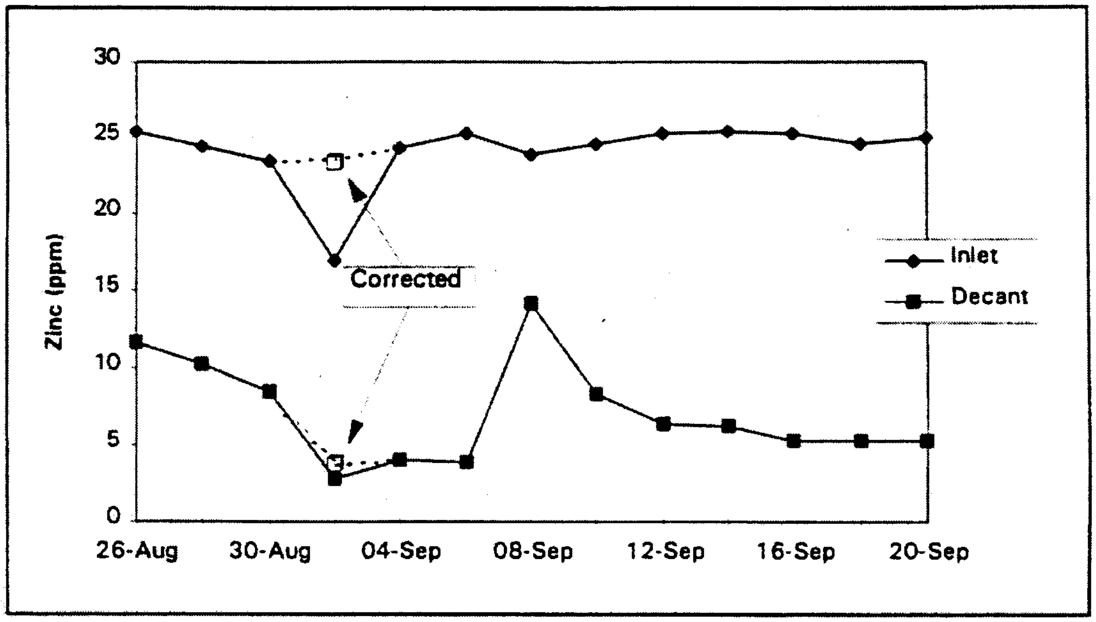

Figure 5. Zinc concentrations in inflow and decant of the Galkeno constructed wetland.

Figure 5 shows that zinc concentrations in the inflow were largely constant at 25 ppm. Concentrations in the decant initially decreased to 3-4 ppm. However, conditions in the wetland changed in early September, causing a release of zinc which peaked around September 8. Zinc concentrations in the decant decreased thereafter, but never to less than 5 ppm. Such upsets are not uncommon for newly established systems, because sediments are not completely vegetated and flow pattern are not fully developed (i.e., water channelization is common). Nonetheless, these data show that zinc concentrations were consistently reduced in the wetland by approximately 90%. They also show that the system had not yet reached a steady state, otherwise *constant* zinc concentrations would have been obtained in the decant. This precludes calculation of a metal removal rate.

A noticeable decrease in inflow concentrations of zinc occurred on September 2. This can be explained by noting a similar decrease in magnesium concentrations in the wetland inflow and decant (Figure 8)[5]. All other element concentrations decreased similarly in the inflow and decant

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[5] The steady increase observed in late September is likely due to its release by senescing plants, and other related events associated with the end of the growing season.

(e.g., Figure 9 to Figure 12). Assuming that magnesium behaves as a conservative tracer, these data suggest that heavy rainfall diluted the mine water. A dilution factor was calculated and applied to the inflow and decant zinc concentrations on September 2 (Figure 7). This correction shows somewhat more readily that zinc concentrations were leveling off at approximately 4 ppm before September 8.

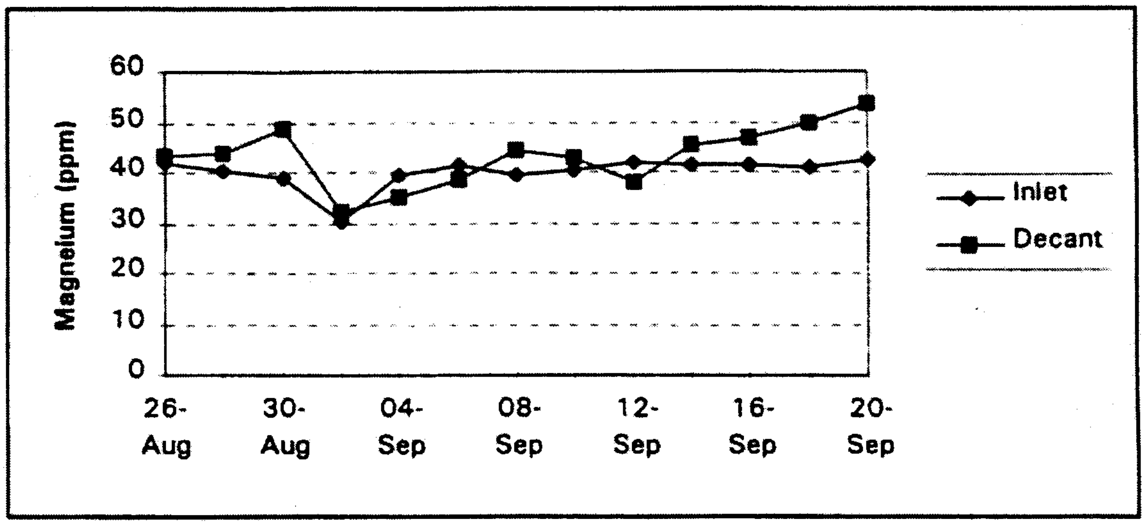

Figure 6. Magnesium concentrations in the inflow and decant of the Galkeno constructed wetland.

Nickel was also removed in the wetland (Figure 9). Inflow concentrations remained nearly constant at approximately 0.44 ppm, whereas decant concentrations appeared to stabilize at approximately 0.1 mg/L. Interestingly, the same pattern as for zinc was observed for nickel concentration in the decant: they leveled off to below 0.1 ppm until September 8, whereupon they suddenly increased. Subsequently, decant concentrations leveled off at slightly more than 0.1 ppm.

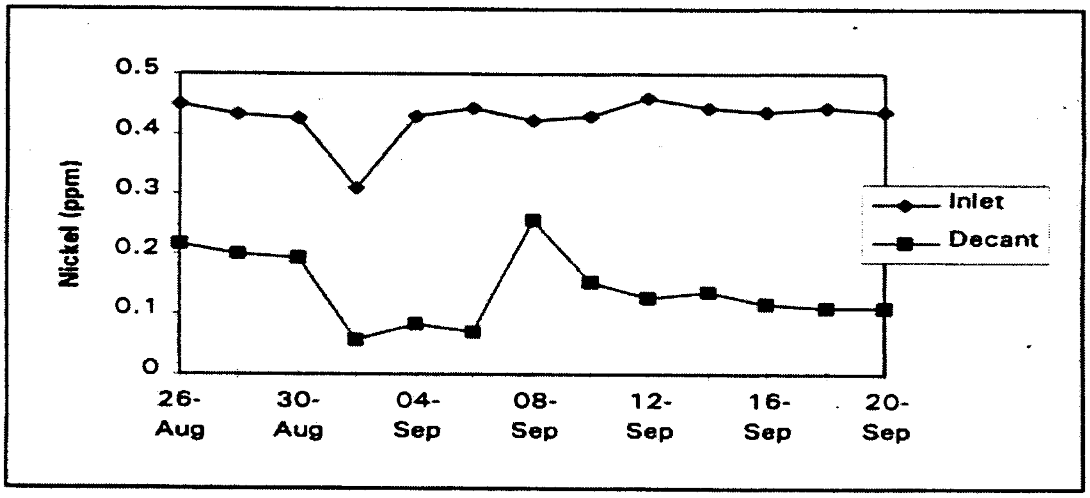

Figure 7. Nickel concentrations in inflow and decant of the Galkeno constructed wetland.

Manganese concentrations (total metal) also decreased in the wetland (Figure 10). Manganese concentrations in the decant also showed the same pattern as zinc concentrations. That is, they initially decreased to about 13 ppm until early September, whereupon they increased to a peak on September 8, leveling to about 20 ppm by the end of the sampling period.

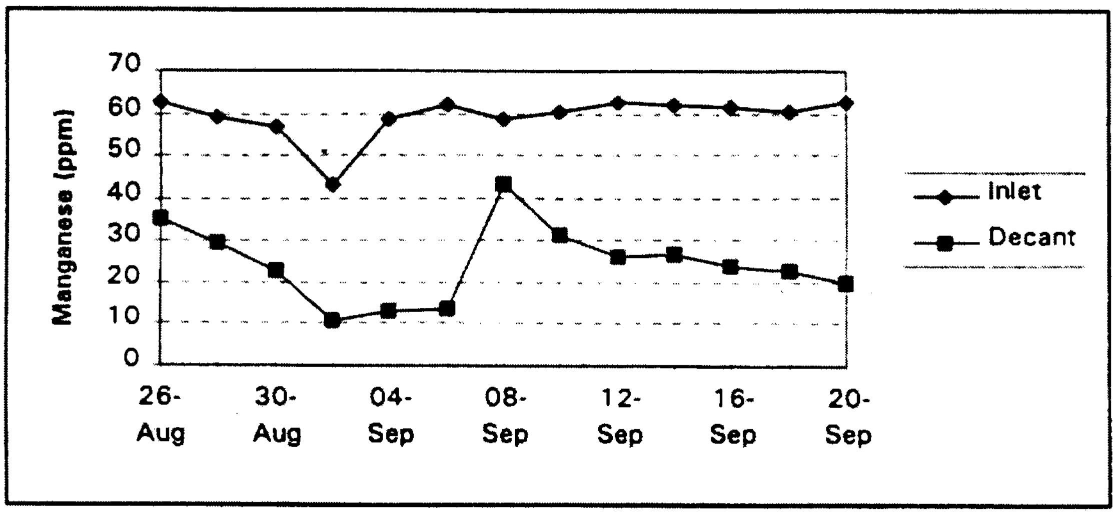

Figure 8. Manganese concentrations in inflow and decant of the Galkeno constructed

wetland.

Information about some of the processes responsible for removing these metals was obtained by conducting additional water analyses on site. The data presented in Table 7 indicated that the water pH increased slightly as it flowed across the wetland, increasing from approximately 6.5 to 6.8. Water alkalinity exhibits a decreasing trend as it flows to the decant, indicating that it is consumed. Since the water pH increases in this interval, these data suggest that acidity is being neutralized or that carbonates are retained in wetland sediments.

Another important treatment process is the formation of insoluble sulphide minerals, as indicated earlier (Sections 2.2.3 and 3.2.2) and as suggested by the data presented in Table 7. Sulphate concentrations were measured at the inflow and decant to assess how much sulphate was reduced to hydrogen sulphide and retained in the wetland (Figure 11).

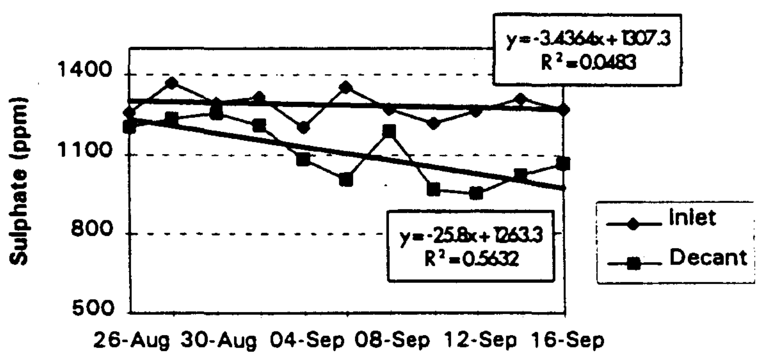

Figure 9. Sulphate concentrations in inflow and decant of the Galkeno constructed wetland.

Two observations can be made from these data.

1. Sulphate concentrations in the decant were gradually decreasing during the test period, indicating that insoluble sulphides (or, less likely, sulphur) were increasingly being retained in the wetland. This indicates that steady state conditions had *not* yet been attained, otherwise, lower, but *constant* sulphate concentrations would be expected in the decant.

2. A sudden jump of the decant sulphate concentrations observed on September 8. Such an

increase in sulphate concentrations can only mean that anoxic sediments were stirred up and that sulphides were resuspended in the water column[6]. This explanation appears quite reasonable, given that the area near the decant is relatively unvegetated and sediments there are prone to being disturbed.

The latter observation provides a reasonable explanation for the jump in zinc and manganese concentrations in the decant observed on September 8. These metals were probably retained as sulphides in sediments and they became reoxidized — and redissolved — when the sediments were stirred up.

The fact that steady state conditions were not attained probably reflects the slow maturation of the system. In this instance, the capacity to retain sulphate (as sulphur or sulphides) was increasing during the test. SRB populations were probably still increasing in the wetland sediments during the test, which would explain this increasing capacity to retain sulphate (i.e., the overall rate of sulphate reduction to sulphide was increasing throughout the test period). These observations strongly suggest that metals were (partly) retained in the Galkeno constructed wetland as insoluble sulphides.

Given that sulphate reduction produce two moles of bicarbonate for each mole of sulphate reduced, a concomitant increase in alkalinity in the decant would have been expected. The fact that a *decrease* was found instead (Table 7) suggests that insoluble carbonates were also retained within the wetland. A previous leachate test with sediments from natural wetlands indicated that they accumulated substantial quantities of carbonate (Table 5). A comparison of calcium concentrations in the inflow and decant of the Galkeno constructed wetland indicated that it was also retained in the Wetland (See Figure 12). Note that, again, the system was perturbed in early September. Specifically, a peak of calcium in the decant is measured on September 8, as was observed for zinc, manganese, and sulphate. These observations suggest that sediments were disturbed on that date, resuspending sulphates and carbonates previously deposited therein.

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[6] Unfortunately, the samples collected in September were not filtered, and it is impossible to determine whether the increased metal and sulphate concentrations measured in the decant arise from resuspended particles dissolved by the nitric acid added to preserve the sampled water or truly dissolved species.

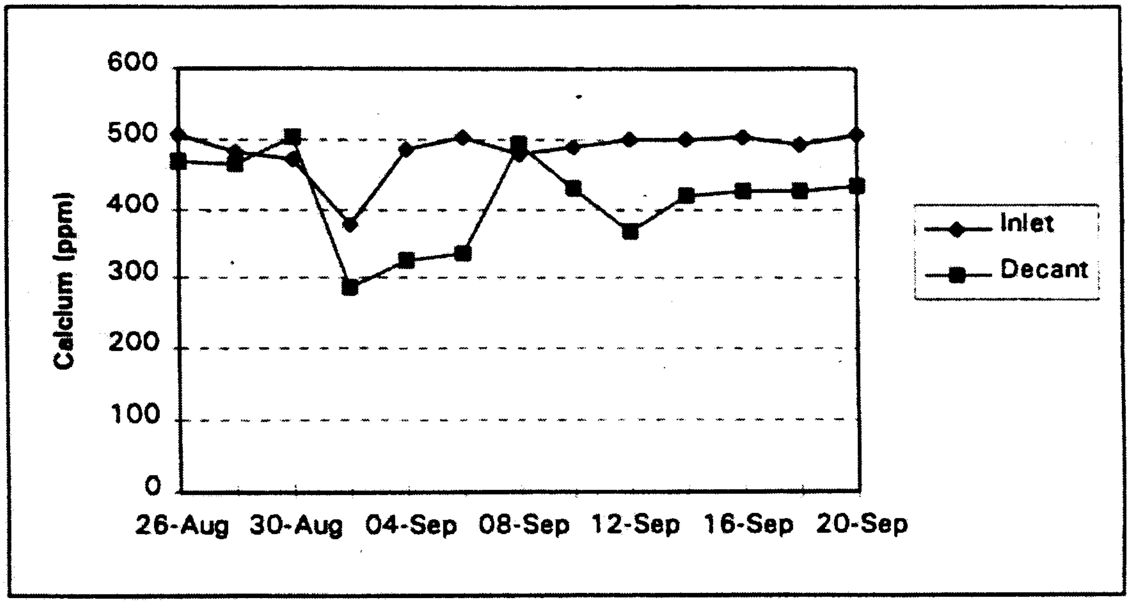

Figure 10. Calcium concentrations in inflow and decant the Galkeno constructed wetland.

These data not only confirm that the Galkeno constructed wetland functioned similarly to the natural wetlands, they indicate that a full-scale wetland treatment system is likely to store a tremendous buffering capacity in sediments. Such a buffering capacity may be important in mitigating potential increases in the acidity of the mine drainage being treated.

Cobalt and nickel concentrations at the wetland decant exhibited a pattern similar to that of zinc and manganese: and initial decrease, followed by a transient increase which peaked on September 8, and finally declining gradually until the end of the test period. Cadmium was also removed by the wetland, but it did not show the same pattern as the other metals. This is presumed to result from its low inflow and decant concentrations (15 and 5 ppb, respectively). The low inflow concentrations (in the ppb range) for cobalt and nickel indicated that they were of no environmental significance. However, the same pattern of removal observed for all these metals (except cadmium) indicate that:

1. Similar processes affected metals present in the Galkeno mine water, and

2. Metal removal was upset by some event(s) occurring in early September.

The lower metal removal rate in the later part of September could also have resulted from lower temperatures, which would slow biological processes. These processes undoubtedly play an important role in metal removal. Temperature data from the Mayo airport for September 1995 confirm this[7]. The mean temperature remained above 100 C from September 1-3, 6-13, and 19-26. The period of September 14-19 exhibited low temperatures, which would be expected to result in lower microbial activity, such as reduced sulphate reduction by SRB.

The 1995 field program has not allowed to address the question of treatment performance during the winter. A survey of the Galkeno natural wetland, nearby the pilot wetland, indicated that water was flowing under the ice in mid-November. Unfortunately, the temperature at the time was -35~~0~~°C, which thwarted attempts to sample the water to determine metal concentrations. Despite this low temperature, it is expected that some metal removal will occur through sorption onto organic matter and onto precipitated iron and manganese oxides. The lack of data prevent prediction of metal removal rates, and it is recommended that such data be developed in the future.

1.2.3 Column Study Results

One drawback anticipated with the Galkeno constructed wetland was that the short snow-free season limited the amount of data that could be collected during the field program. Several *in situ* microcosms were established on August 18 within the Galkeno constructed wetland to augment data from the pilot wetland. These microcosms consisted of translucent plastic columns (13.1 cm inner diameter x 25 cm height) containing cores of wetland sediments and. The cores were sealed at the bottom, drained, and replenished with 1.4 Litres of untreated Galkeno 900 water (Columns 4, *5,* and 6) or Galkeno 900 water diluted 1:2 with South

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[7] The temperatures at Elsa for the same month were significantly lower, as seen in the table below:

	Mayo	Elsa
Max Temp.	12.3	9.9
Mean Temp.	*6.5*	5.1
Mm. Temp.	0.7	0.3

McQuesten water (Columns 1, 2, and 3). Microcosms thus prepared were re-introduced into the wetland where they were originally obtained.

Overall zinc (total metal) removal measured in the columns was better than in the Galkeno constructed wetland (Figure 13). Metal removal during the first 6 days was recorded, but the field technician (and the sampling procedure) changed on August 26, such that the results prior to this date are not comparable with the later results. Therefore, only the data from August 26 onwards are presented and discussed:

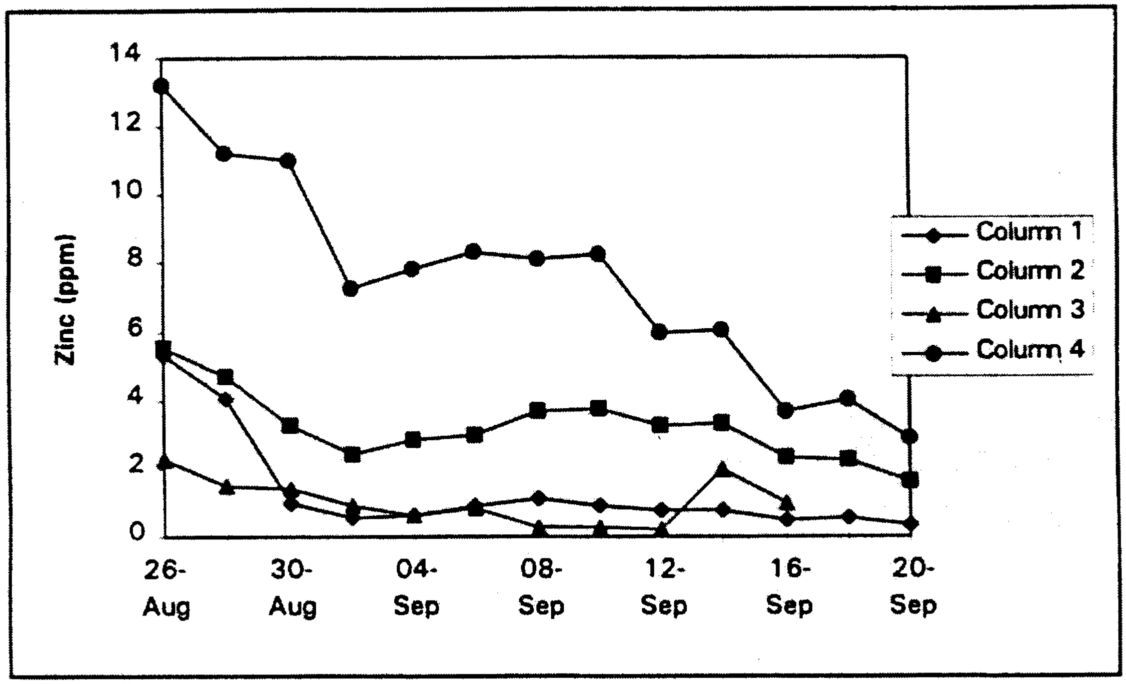


Figure 11. Zinc removal in the Galkeno constructed wetland *in situ* microcosms.

Data from columns 5 and 6 were lost because they were damaged midway through the study. In addition, the data from Column 2 are suspect, because of the increase in zinc concentrations in early September, which persisted until the end of the study. Results from these columns were removed from the data set, and only the data from Columns 1, 3, and 4 were considered further.

The results from Column 4 indicate that zinc was removed at a steady rate through the study. Similarly, zinc was constantly removed from Columns 1 and 3, except for the last two sample points for Column 3. These data were combined into a single, continuous data set to compute a zinc removal rate, and are plotted in Figure 14. That is, the zinc data from Column 4 were merged with those averaged from Columns 1 and 3 at the point where zinc concentrations coincided[8].

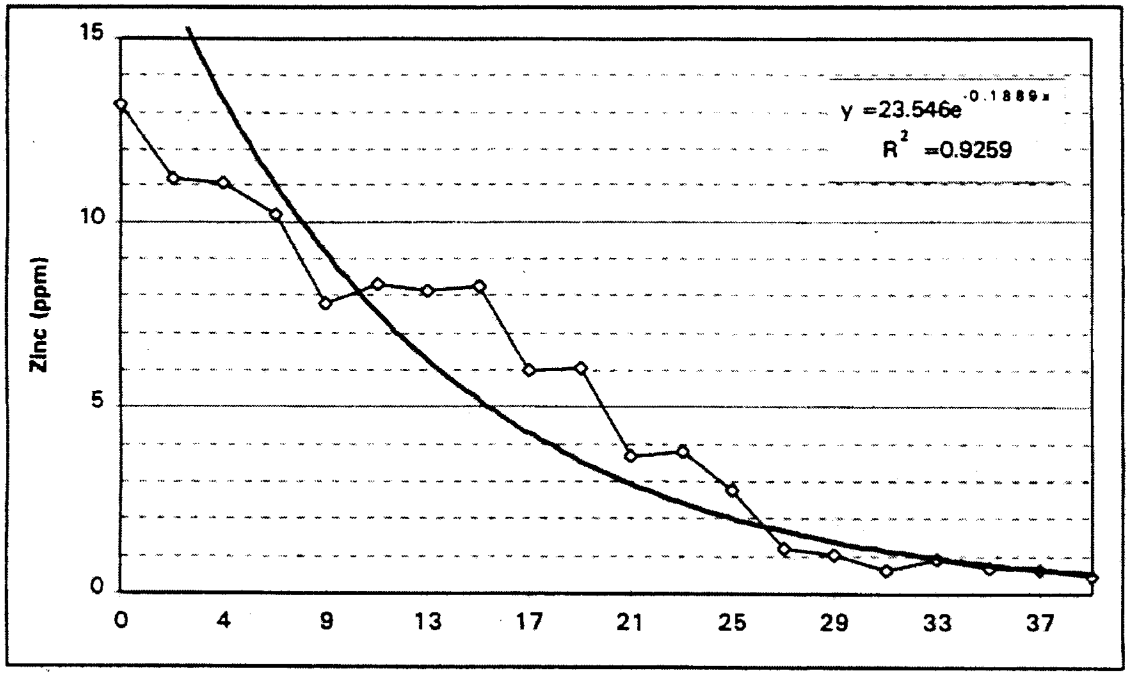


Figure 12. Combined data from Columns 1, 3, and 4 for zinc removal.

Despite the different waters used in the columns, the data obtained from combining the available data set produced a curve which fitted very well with an exponentially-decaying trendline (R^2 = 0.93). Applying the same removal rate to the zinc -concentration data from the Galkeno natural wetland (Section 3.1.3), the predicted retention time should be approximately 14 days *vs* an retention time of 11.4 days estimated from field data. This close agreement suggests that the above rate of zinc removal is reasonable. Applying this removal rate to the data from the Galkeno constructed wetland[9] indicated that it had a retention time of approximately 14.7 days *vs* a nominal retention time of 19.3 days. This is again in reasonably

---

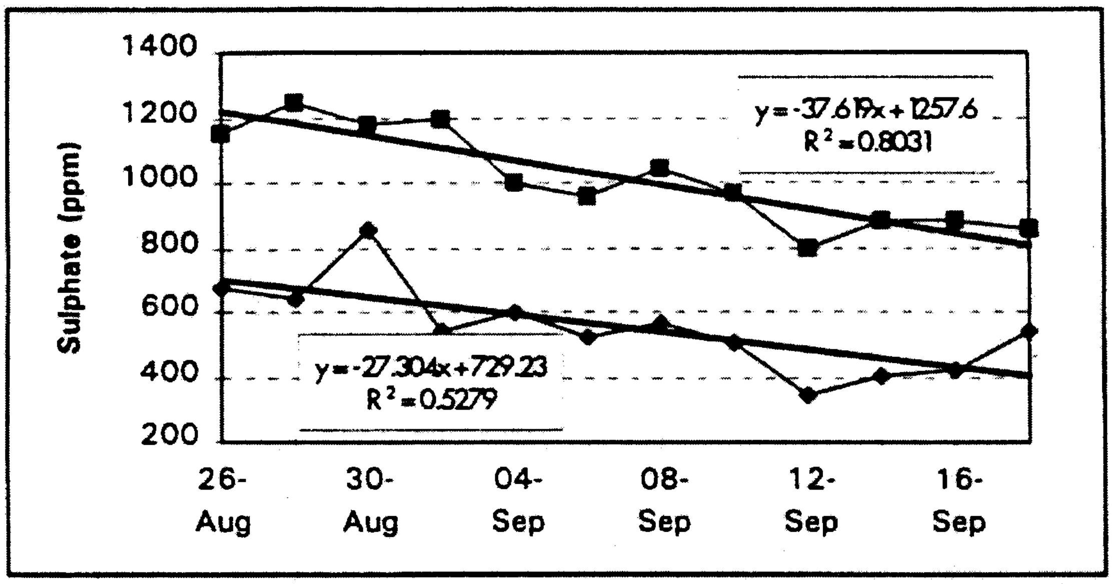
[8] This approach is justifiable if the zinc removal processes operating at high and low concentrations are the same. Data presented later in the section suggest that this is a valid assumption.

[9] Inflow concentrations of 25 ppm; decant concentrations of 3.95 ppm, before September 8.

close agreement, considering that the flow rate was changed on August 19, and that its pattern was modified by the placement of baffles in the wetland.

Water samples collected from the columns were analyzed for sulphate to determine whether sulphate reduction was taking place in the enclosed sediments. The data shown in Figure 15 indicate that cores with untreated Galkeno water and diluted Galkeno: South McQuesten water both sustained considerable levels of sulphate reduction. It is worth noting that the sudden increase in sulphate concentrations observed on September 8 in the pilot wetland (Figure 11) was not observed in the columns, indicating that sulphate reduction was relatively unperturbed for the duration of the test.

Figure 13. Sulphate concentrations in columns in the Galkeno constructed wetland.



The rate of sulphate reduction computed from the trendline fitted to the data is approximately 25 mmol/m^2/day. This rate compares favorably with rates of sulphate reduction published in the scientific literature. For instance, the average rate of sulphate reduction for 27 marshes on the Atlantic Coast and in the U.K. was 77.4 mniol/m^2/day (minimum 1.8, maximum 280 mmol/m^2 /day) (Skyring, 1987).

From the rate of sulphate reduction computed above, it is predicted that bicarbonate alkalinity will be generated from wetland sediments are a rate of 50 mmol/m^2/day. Therefore, sediments in the columns are predicted to inject 41.5 mg HCO_3/day, as in Equation 1:

$$50 \text{ mmol } HCO_3/m^2/\text{day} \times 0.013 \text{ m}^2 \times 61 \text{ mg/mol} = 41.5 \text{ mg } HCO_3/\text{day} \qquad \text{Eq. 1}$$

With a volume of 1.4 Litre/column, an increase in alkalinity of approximately 20 mg/L/day would be expected. The alkalinity measured in the columns two days after adding the mine water increased as predicted by Equation 1 (Table 8). However, the alkalinity remained at these levels thereafter, indicating that it was removed from the mine water. Some alkalinity was undoubtedly lost as CO_2[10]. but some is likely to have reacted with calcium and metals, forming insoluble carbonates. However, calculating the amount of metals lost from the water column as carbonates is very difficult (see footnote 15).

Table 2. Bicarbonate production in columns in the Galkeno constructed wetland.

	Galkeno		1:2 Galk:McQ	
	pH	Alkalinity mg/L as $CaCO_3$	pH	Alkalinity mg/L as $CaCO_3$
Day 0	6.02	139	6.04	95
Day 2	6.55	175	6.24	125
Day 5	7.01	162	6.97	130
Rate of HCO_3^- production from sediments by Day 2		25.2 mg HCO_3^-/day		21.0 mg HCO_3^-/day

Nonetheless, these results indicate that a significant amount of alkalinity will retained in the

---

[10] This was counteracted by the production of CO_2 from the decomposition of detritus. CO_2 concentrations measured in the columns concurrently with the measurements presented in Table 8 are as follows:

	Galkeno	1:2 Galk: McQ
	CO_2(aq)	CO_2(aq)
	m~/L	**mg/L**
Day O	40	18
Day2	18	43

While no there was no increase in dissolved CO_2 concentration in the [Galkeno] columns, there was a considerable increase in the [1:2 GaLkeno: McQuesten] columns. Moreover, the system is clearly very dynamic: both CO_2 and HCO_3 are continually produced microbiologically and lost physically (volatilization) and chemically (equilibration the carbonate system, reaction with dissolved species). This complicates any attempt at modelling the carbonate system or the formation of insoluble carbonates based on these data.

wetland sediments, as has been noted by others (Hedin *et at.,* 1994). This alkalinity will buffer water pH, which might be important in case the mine drainage gradually becomes acidified. For instance, it would preserve the pore water pH to a level that permits continued activity of sulphate-reducing bacteria.

The information presented above provides the basis for designing a wetland treatment system. While the field work focused on (and assumed the need for) treatment of the discharge from the Galkeno 900 adit, it is clear that such a design could be applied to other discharges on the property, should there be need for treatment.

References

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FISHER CREEK

SITE #13

MINFILE# 105M001o

1. LOCATION AND ACCESS

The Fisher Creek site is on the lower southeast slope of Galena Hill at an elevation of 990m. It is roughly 1 km north of the Duncan Creek Road, 6km southwest of Keno City. The approximate UTM co-ordinates for the site are 7 083 700m N and 481 000m E. The site can only be accessed by foot.

2. SITE PHYSIOGRAPHY

The Fisher Creek site is moderately sloped (roughly 15 to 20°) to the southeast. The area is well vegetated with spruce trees and shrubs. A thick (~10 cm) layer of moss covers the ground. The surface runoff from the mine site flows eastward into Fisher Creek, a tributary of Duncan Creek, located at an elevation of 880m over 1 km to the south. Fisher Creek was dry at the time of the site visit. No surface water was encountered at the mine site.

3. GEOLOGY AND MINERALIZATION

The host rocks are the Hyland Group schist, phyllite and psammite. The vein material consists of galena, sphalerite, freibergite and pyrite in a gangue of quartz, calcite and altered siderite (Minfile #105M001o). No outcropping of rock was found at the site.

4. SITE HISTORY

Many pits and prospect shafts were worked prior to 1962 on three veins within a 600m by 600m area. Between 1964 and 1965 bulldozer trenching was completed by United Keno Hill Mines.

5. MINE DEVELOPMENT

The only evidence of mine development that could be located during the site visit was two trenches. The site is overgrown by thick alders and it is possible that other mine workings are covered by the bush. However, access to these workings would be difficult.

5.1 Mine Openings and Excavations

Trench 1 (photo 13-1)

Trench 1 is has become overgrown with trees and shrubs.

Location: On the western side of a small valley that runs south to the Duncan Creek Road. The length of the trench is perpendicular to the small valley.

Dimensions (L x W x H): 12m x 2m x 1.5m

Condition: There is no evidence of slumping of the trench walls, which were stable at the time of the site visit.

Accessibility: The trench is accessible by foot.

Trench 2 (photo 13-2)

Trench 2 is shallow but wide. Sparse vegetation is growing within the trench.

Location: Roughly 200m to the northwest of trench 1.

Dimensions (L x W x H): 10m x 4m x 1m

Condition: There is no evidence of slumping of the trench walls.

Accessibility: The trench is accessible by foot.

5.2 Waste Rock Disposal Areas

The trenches are in overburden; no waste rock piles were observed

5.3 Tailings Impoundments

No ore was processed at this site; no tailings were observed.

5.4 Minesite Water Treatment

There is no water treatment facility at this site.

6. MINE SITE INFRASTRUCTURE

One collapsed log cabin (Building 13A) was encountered.

6.1 Building 13A (photo 13-3)

Dimensions (L x W x H): 2m x 3m x 2m

Location: The cabin is located 400m west of trench 1.

Construction: The sides and roof of cabin are constructed of logs.

Contents: The cabin was empty.

7. SOLID WASTE DUMPS

No solid waste dumps were observed at this site.

8. POTENTIAL CONTAMINANTS OF CONCERN

There are no potential contaminants of concern at this site.

9. WATER QUALITY

No creeks or streams were encountered at the site, and no water quality samples were collected.

10. RECLAMATION

The site has begun to naturally revegetate. The vegetation appears healthy.

11. REFERENCES

Minfile #105M001o

Photo 13-1: Aerial shot of trench #1. (Azimuth 180°)

Photo 13-2: Aerial shot of trench #2. (Azimuth 280°)

Photo 13-3: Aerial shot of the collapsed log cabin. (Azimuth 260°)

BLUEBIRD
SITE NO. 14
105M 001b

1. LOCATION AND ACCESS

Bluebird site is located on the lower northeast slope of Galena Hill, approximately 4km northwest along Highway 11 from the village of Keno Hill. The site is located roughly 70m upslope to the northeast from the Highway at an elevation of 945m. Access from the highway is only possible on foot through thick alder growth. UTM coordinates for the site are 482,750m east and 7,089,825m north.

2. SITE PHYSIOGRAPHY

The site occurs 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 550m southwest of Christal Creek.

3. GEOLOGY AND MINERALIZATION

Mineralization occurs at the contact between greenstone and carbonaceous phyllite. Mineralization is reported to consist of galena, sphalerite and pyrite in an ankerite, calcite, quartz, limonite and manganese oxide gangue. The shaft dumps are completely revegetated. Greenstone is exposed in outcrops a few metres west of the shafts, and in a stripped area near the cabin at the top of the hill to the west.

4. SITE HISTORY

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.

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

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.

Shafts-Lower, Lower Middle, Upper Middle and Upper Shafts (Photos 14-1, 14-2, 14-4, 14-5)

Description: Four small shafts were dug through the overburden and into bedrock. All shaft areas are completely revegetated by willow, alder etc.

Location: Spaced 12 to 15m apart along a linear geological trend of azimuth 030°. Northeast shaft located 70m from Hwy. 11.

Dimensions (L x W x H): All shafts are about 1.5 x 1.5m, with depths unknown due to collapse and water fill. Depths of 12.2m and 7m are reported by Boyle.

Supports: Some small rotten timbers are visible projecting out of some shafts. Rotten ladders are present at the upper three shafts

Condition: All of the shafts are partially to completely collapsed, and the northernmost shaft has 40 cm of standing water covering the fill material.

Accessibility: The shafts are only about 70m up a gentle slope from the Silver Trail Highway, but access is impeded by very dense bush. The shafts are not likely to be a hazard due to small size, collapse of material into the shafts, shallow water in the shafts, trees growing around the shafts, and old timbers and ladders projecting out of the shafts.

Trenches

Description: Bulldozer stripping to bedrock along the top of the hill.

Location: Located 50m to the northwest of the shafts on top of an adjacent rocky knob.

Dimensions (L x W x H): 25 x 10 x 0.5

Condition: Stable, revegetated overburden, bare rock.

Accessibility: Easy access by foot from highway. No hazards at this site.

5.2 **Waste Rock-Lower, Lower Middle, Upper Middle and Upper Waste Rock Piles** (Photos 14-3, 14-4)

General Description: Small (less than 100 tonnes) waste rock piles are associated with each of the four shafts. All of the waste piles are completely covered with dense vegetation. The waste rock is very fine material, and likely contains overburden from the first metre or two of shaft sinking. The geology is difficult to evaluate due to lack of outcrop at the shafts and complete revegetation of the surrounding area including dumps.

Location: See map.

Dimensions: (L x W x H) Maximum size about 12 x 8 x 1m (Upper Middle); difficult to measure due to revegetation.

Sampling: No waste rock samples were collected. A 30cm test pit was dug, which revealed fine grey-brown phyllite flakes with 5% bright orange siderite material.

6. MINE SITE INFRASTRUCTURE

The site has very little mining related infrastructure present. There are no fuel storage, rail or trestle, milling, or electrical equipment areas present.

6.1 Buildings

A log cabin and a small outhouse are the only buildings present on the site. The cabin appears to date from the 1980s, postdating the mine site working.

Building 14-A - Cabin (Photo 14-6)

Description and type: Log cabin with a log and sod roof.

Dimensions (L x W x H): 7m x 5m x 4m.

Paint: Some paint on windows, door etc.

Asbestos: None observed.

Foundation: Log cribbing

Non-Hazardous Contents: Some furniture, wood stove.

Hazardous Contents: No hazardous materials observed.

Samples: None collected.

7. SOLID WASTE DUMPS

Minor household waste is present scattered around the site and in the Lower Middle Shaft area.

8. POTENTIAL CONTAMINANTS OF CONCERN

Metals in waste rock is the only potential contaminant of concern on the Bluebird site. There were no transformers, hydrocarbon contaminated soils or liquid or solid hazardous material observed on the site.

9. WATER QUALITY

A single water sample was collected on the site. A sample was collected from the standing ground water in the Lower Shaft

Sample:

Sample #	Location	Field Tests
14-WQ-A-01-01	Lower Shaft	pH 7.6

10. RECLAMATION

Natural revegetation has occurred at all of the disturbed sites except for the hilltop where overburden was completely stripped to bedrock. Near the shafts the vegetation consists of very dense alders, willows, moss, spruce and other plants. No reclamation measures by the site operators are known.

11. OTHER INFORMATION AND DATA

Note: A 1920's era shaft bucket in good condition was removed from the site and delivered to the Keno City Museum.

12. REFERENCES AND PERSONAL COMMUNICATIONS

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Cockfield, W.E., 1930. The Mining Industry of Yukon, 1929; Geol. Surv. Can., Sum. Rept. 1929, pt. A, pp 1A-15A.

Stockwell, C.H., 1926. Galena Hill, Mayo District, Yukon; Geol. Survey Can., Sum. Rept. 1925, pt. A, pp 1A-14A.

ATTACHMENT 2: 1999 BLUEBIRD WATER SAMPLES LABORATORY RESULTS			
Sample Number	**Detection Limit**	**Units**	**14WQ-A01-01 - 09/22/99**
Site Desciption			Standing ground water in the lower shaft
pH (field)	N/A	pH	7.6
Conductivity (field)	N/A	µS/cm	-
pH (Lab)	0.01	pH	7.62
Conductivity (Lab)	0.01	µS/cm	580
Total Alkalinity	5	mg CaCO3/L	172
Chloride	0.25	mg/L	0.58
Hardness (CaCO3 equiv)	5	mg/L	340
Nitrate-N	0.05	mg/L	0.54
Nitrite-N	0.003	mg/L	0.004
Sulphate	1	mg/L	113
Total Dissolved Solids	5	mg/L	422
Analysis by ICP-USN			
Aluminum	0.0008	mg/L	0.0462
Antimony	0.005	mg/L	<0.005
Arsenic	0.01	mg/L	<0.01
Barium	0.00004	mg/L	0.00634
Beryllium	0.00001	mg/L	<0.00001
Bismuth	0.0004	mg/L	<0.0004
Boron	0.002	mg/L	<0.002
Cadmium	0.00006	mg/L	0.00039
Calcium	0.002	mg/L	79.3
Chromium	0.00006	mg/L	0.00031
Cobalt	0.00003	mg/L	0.00012
Copper	0.00003	mg/L	0.00457
Iron	0.00001	mg/L	0.103
Lead	0.0003	mg/L	0.0058
Lithium	0.001	mg/L	0.002
Magnesium	0.0005	mg/L	25.8
Manganese	0.00002	mg/L	0.0168
Mercury	0.0001	mg/L	<0.0001
Molybdenum	0.00007	mg/L	0.00039
Nickel	0.00001	mg/L	0.0008
Phosphorus	0.03	mg/L	<0.03
Potassium	0.4	mg/L	0.5
Selenium	0.004	mg/L	0.005
Silicon	0.004	mg/L	2.05
Silver	0.00005	mg/L	0.00013
Sodium	0.004	mg/L	1.1
Strontium	0.00002	mg/L	0.125
Sulphur	0.008	mg/L	37.3
Thallium	0.001	mg/L	<0.001
Titanium	0.00002	mg/L	0.00083
Vanadium	0.00003	mg/L	<0.00003
Zinc	0.0002	mg/L	0.0278
Zirconium	0.00004	mg/L	
Analysis by Hydride AA			
Arsenic	0.0002	mg/L	0.0026
Selenium	0.0001	mg/L	<0.0001

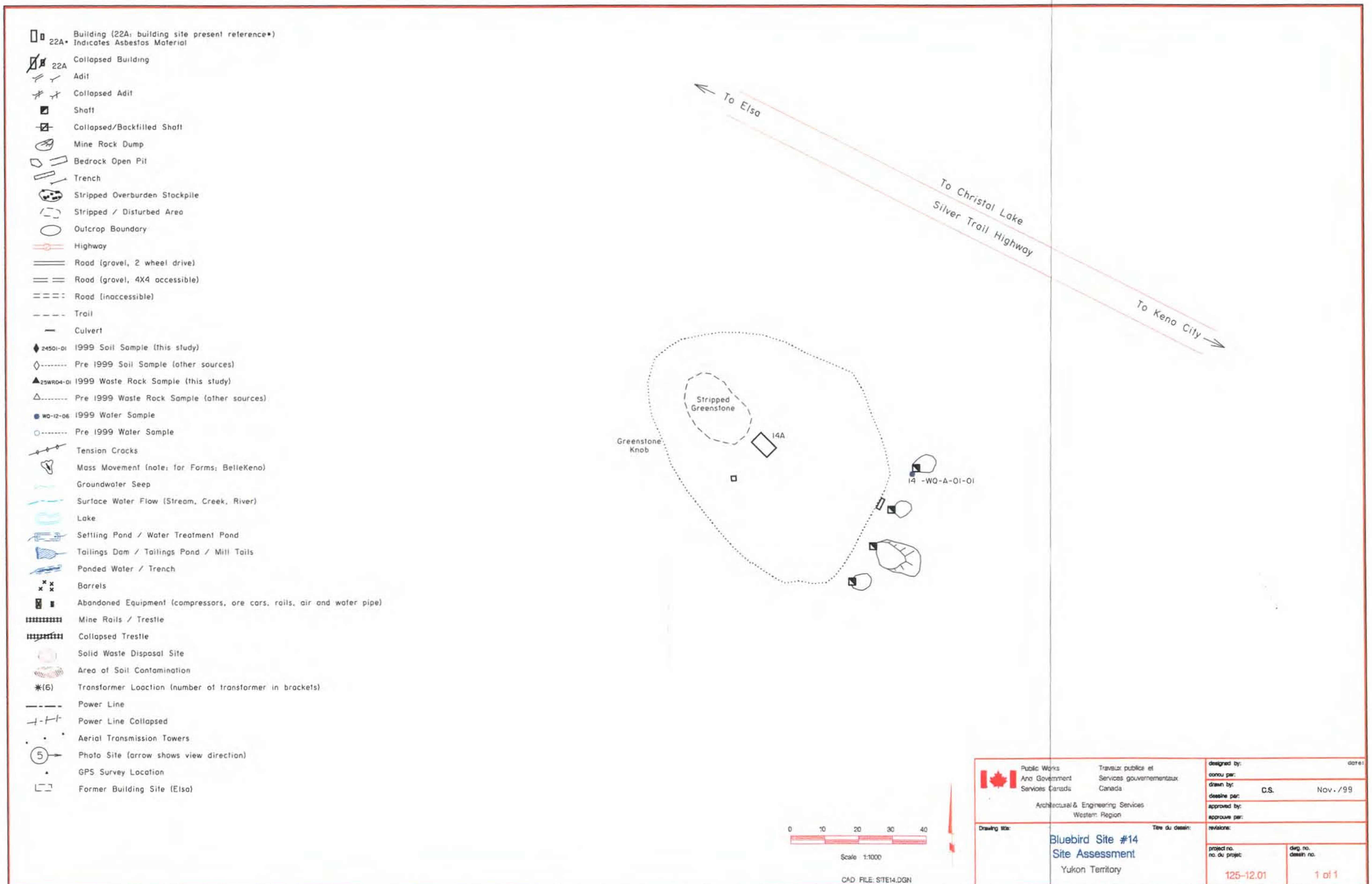

Building (22A: building site present reference•)
22A• Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WQ-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
*(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elso)
To Elsa
To Christal Lake
Silver Trail Highway
To Keno City
Stripped Greenstone
14A
Greenstone Knob
14 -WQ-A-01-01
0 10 20 30 40
Scale 1:1000
CAD FILE: SITE14.DGN
Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada
Architectural & Engineering Services Western Region
Drawing title:
Titre du dessin:
Bluebird Site #14
Site Assessment
Yukon Territory
designed by:
conçu par:
date:
drawn by:
dessiné par:
C.S.
Nov./99
approved by:
approuvé par:
revisions:
project no.
no. du projet:
125-12.01
dwg. no.
dessin no.
1 of 1

Photo 14-1: Lower shaft; openning located below flagging. (Azimuth 180^0)

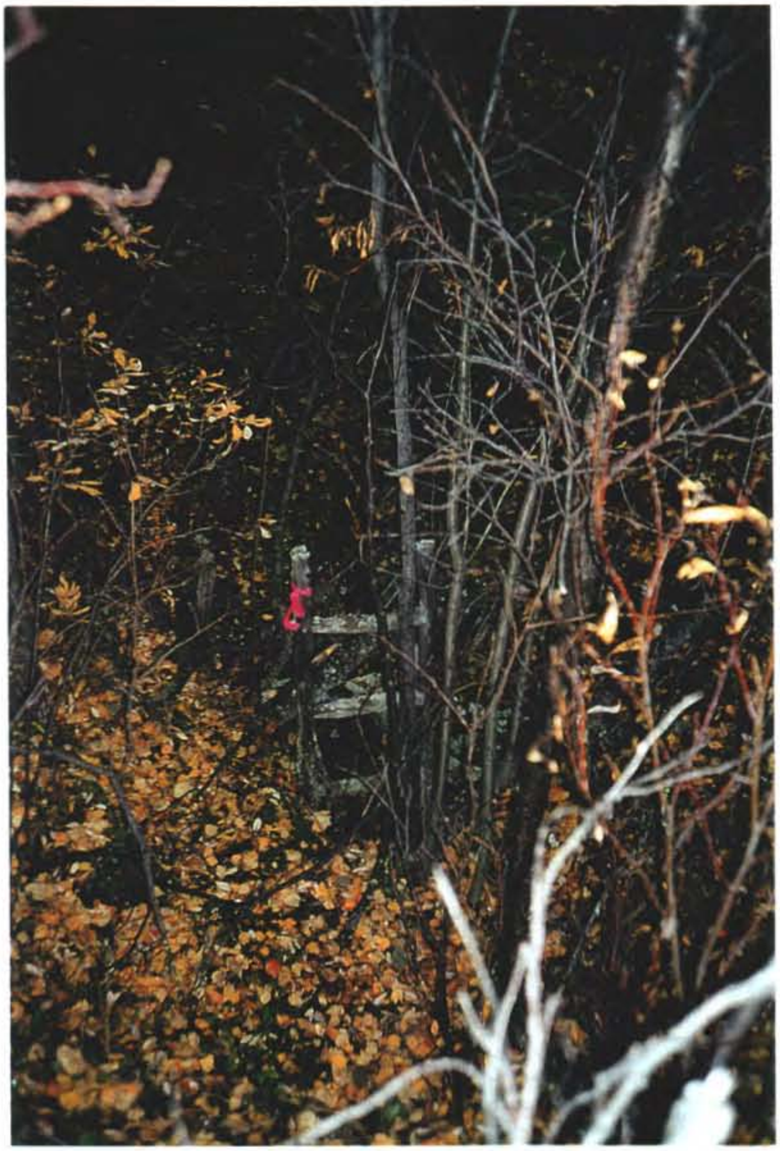


Photo 14-2: Lower-middle shaft; note ladder extending out of shaft opening. (Azimuth 040°)

Photo 14-3: Test pit in rock dump for lower-middle shaft.

Photo 14-4: Upper-middle shaft and rock dump area; note flagging on ladder extending from shaft opening and mapper standing at end of rock dump. (Azimuth 120°)

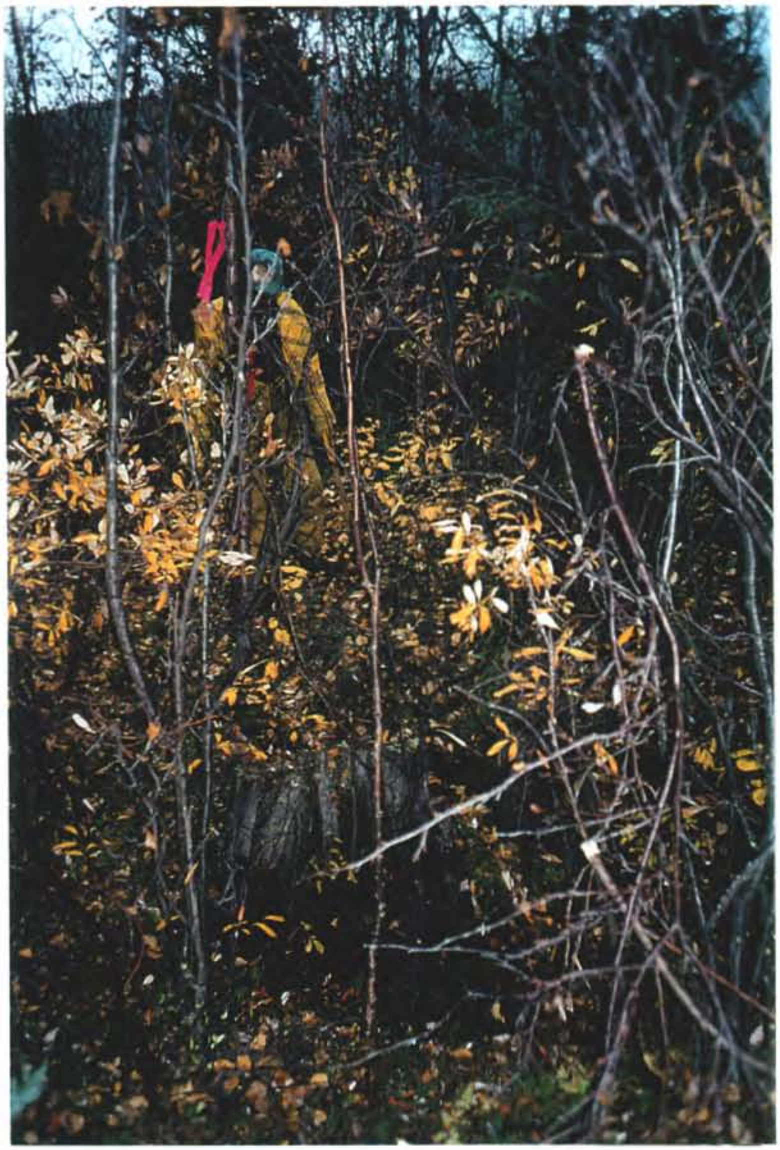


Photo 14-5: Upper shaft site. (Azimuth 050^{0})

Photo 14-6: Recent cabin (early 1980's); note collapsed sod roof structure. (Azimuth 340°)

TIN CAN (#15)
MINFILE# 105M 001q

1. LOCATION AND ACCESS

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 63° 55' 31.6" N; 135° 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 #1. The shafts are at an approximate elevation of 960 m and the test pits at 980 m. UTM co ordinates are 7088748.512m N 483743.845m E.

2. SITE PHYSIOGRAPHY

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.

3. GEOLOGY AND MINERALIZATION

The area is underlain by Earn Group schist and phyllite with greenstone lenses. The Greenstone forms ridges, and the workings at the greenstone contacts. An ankerite-calcite-quartz-siderite vein up to 1.5m wide is mineralized with sphalerite, pyrite, limonite, cerussite, anglesite and galena. The vein cuts greenstone, quartzite, phyllite and graphitic schist. The workings are all overgrown, and the site geology is therefore from literature.

4. SITE HISTORY

Two shafts, 9.8m and 4.6m 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 30m 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.

5. MINE DEVELOPMENT

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

5.1 Mine Openings And Excavations

Shaft #1 (photo 15-1)

A hole in a boggy area filled almost to the rim with water. Remains of an old ladder project from the hole.

Location: 63° 55' 31.6" N; 135° 19' 53.3" W.
Dimensions (L x W x H): 2 m x 2 m, depth unknown
Supports: None evident.
Condition: Organic material has slumped into hole. Quite stable due to water filling hole.
Accessibility: Easy access on foot. Low risk, similar to a natural pond.
Samples: No samples were collected, as no inorganic material was visible or readily accessible.

Shaft # 2(photo 15-2)

Collapsing timbered shaft, dense revegetation. Digging into waste pile located rusty greenstone with about 1% pyrite.

Location: 63° 55' 31.6" N; 135° 19' 53.3" W.
Dimensions (L x W x H): 2 m x 1.5 m x ~2.5 m
Condition: Partially collapsed, filled with debris.
Supports: Rotted timbers.
Accessibility: Access by foot, dense vegetation surrounding shaft limits hazard.
Samples: No samples were collected, as waste pile was completely overgrown.

Test Pits (photo 15-3)

A series of four small test pits were noted at the site. All of these had overgrown and were difficult to locate.
Location: Test pits are scattered throughout an area beginning approximately 100 m uphill (west-southwest) of the two shafts.
Dimensions (L x W x H): All less than 2 m x 2 m x 1 m.

Condition: The pits are extensively overgrown and there is little evidence of their former usage.
Accessibility: Only accessible up the steep hill from road approximately 300 m to the east-northeast.

5.2 Waste Rock Disposal Areas

Waste rock piles from the shafts are very small and completely overgrown and are therefore not described.

5.3 Tailings Impoundments

No tailings impoundments were observed at the site.

5.4 Minesite Water Treatment

No wastewater treatment facilities were observed on site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

No buildings are present at the site.

6.2 Fuel Storage

No fuel storage was noted at the site.

6.3 Rail and Trestle

No rails or trestles were noted at the site.

6.4 Milling and Processing Infrastructure

No milling or processing infrastructure was present at the site.

6.5 Electrical Equipment

No electrical equipment was present at the site.

7. SOLID WASTE DUMPS

No solid waste dumps were identified at the site.

8. POTENTIAL CONTAMINANTS OF CONCERN

No hazardous materials were encountered at this site.

9. WATER QUALITY

There is no surface water upstream of the site on this slope. A seasonal stream (photo 15-4), paralleling the site, surfaces downgradient from the test pits but upstream of the two shafts. A surface water sample (15-WQ-StrCD-03) and duplicate (15-WQ-StrCD-04) were collected from this stream immediately downstream of the test pit area. Stream flow was less than 1 L/s at the time of the site visit.

The seasonal stream running adjacent to the site flows into Christal Creek approximately 400 meters downstream of the site. A surface water sample was collected in Christal Creek downstream (>500 m) of the seasonal stream (Christal Cr-01-WATER).

Shaft #1 was flooded to near ground level. There was no surface runoff from this area at the time of the site visit. A water sample and duplicate were collected from the ponded water (WQ-StrCD-01 & WQ-StrCD-02).

Laboratory sample analysis data and field data is provided in Attachment B.

10. RECLAMATION

No reclamation appears to have been completed at any of the test pits. The shafts were filled into less than one meter below grade, however, it could not be determined whether the shafts had failed or were intentionally filled in.

11. OTHER INFORMATION AND DATA

No other information was identified.

12. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Sample Number		Detection Limit	Units	15-WQ-StrCD-01 - Tin Can	15-WQ-StrCD-02 - Tin Can	15-WQ-StrCD-03 - Tin Can	15-WQ-StrCD-04 - Tin Can
Site Description							
pH (field)		0.01	pH	7.8	na	7.3	na
Conductivity (field)		0.01	µS/cm	430	na	2080	na
Total Alkalinity		5	mg CaCO3/L	137	139	103	103
Chloride		0.25	mg/L	<0.25	<0.25	0.5	na
Chloride		0.5	mg/L	na	na	na	<0.5
Electrical Conductivity		0.01	µS/cm	480	460	1900	1900
Hardness (CaCO3 equiv)		5	mg/L	257	264	1290	1320
Nitrate-N		0.05	mg/L	<0.05	<0.05	0.3	0.3
Nitrate-N		0.1	mg/L	na	na	na	na
Nitrite-N		0.003	mg/L	<0.003	<0.003	0.004	<0.003
pH		0.01	pH	7.68	7.81	7.35	7.39
Sulphate		1	mg/L	99.4	104	1050	1060
Total Dissolved Solids		5	mg/L	333	332	1650	1650
ICP-USN Total Metals Scan in Water							
	Aluminum	0.0008	mg/L	0.0061	0.0106	0.0035	0.0027
	Antimony	0.005	mg/L	<0.005	<0.005	<0.005	<0.005
	Arsenic	0.01	mg/L	<0.01	<0.01	<0.01	<0.01
	Barium	0.00004	mg/L	0.0167	0.0171	0.0204	0.0202
	Beryllium	0.00001	mg/L	<0.00001	<0.00001	<0.00001	<0.00001
	Bismuth	0.0004	mg/L	<0.0004	<0.0004	<0.0004	<0.0004
	Boron	0.002	mg/L	<0.002	<0.002	<0.002	<0.002
	Cadmium	0.00001	mg/L	0.00011	0.00009	0.00175	0.00198
	Calcium	0.002	mg/L	71.2	72.8	360	367
	Chromium	0.00006	mg/L	<0.00006	<0.00006	<0.00006	<0.00006
	Cobalt	0.00003	mg/L	0.00016	0.00014	<0.00003	<0.00003
	Copper	0.00003	mg/L	0.00216	0.0015	0.00226	0.00227
	Iron	0.00001	mg/L	0.183	0.048	0.08	0.035
	Lead	0.0003	mg/L	0.0006	<0.0003	0.0009	<0.0003
	Lithium	0.001	mg/L	<0.001	<0.001	0.027	0.029
	Magnesium	0.0005	mg/L	14.3	14.7	63.3	64.2
	Manganese	0.00002	mg/L	0.0432	0.035	0.0046	0.00181
	Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
	Molybdenum	0.00007	mg/L	<0.00007	<0.00007	0.00043	0.00038
	Nickel	0.00001	mg/L	0.0007	0.0006	0.0018	0.0023
	Phosphorus	0.03	mg/L	<0.03	<0.03	0.04	<0.03
	Potassium	0.4	mg/L	0.4	<0.4	0.7	0.8
	Selenium	0.004	mg/L	<0.004	<0.004	<0.004	<0.004
	Silicon	0.004	mg/L	2.49	2.44	5.2	5.28
	Silver	0.00005	mg/L	<0.00005	<0.00005	<0.00005	<0.00005
	Sodium	0.4	mg/L	0.5	<0.4	3.5	3.5
	Strontium	0.00002	mg/L	0.116	0.119	0.577	0.584
	Sulphur	0.008	mg/L	30.7	33.4	372	378
	Thallium	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
	Titanium	0.00002	mg/L	0.00019	0.00015	<0.00002	<0.00002
	Vanadium	0.00003	mg/L	<0.00003	<0.00003	<0.00003	<0.00003
	Zinc	0.0002	mg/L	0.0241	0.0101	0.819	0.979
	Total Arsenic by Hydride AA						
	Arsenic	0.0002	mg/L	0.0005	0.0009	0.0017	0.0012
Total Selenium by Hydride AA							
	Selenium	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001

Accredited By: CANADIAN ASSOCIATION FOR ENVIRONMENTALANALYTICAL LABORATORIES (CAEAL)

na = not available

For specific tests registered with the Association

Photo 15-1: Remains of shaft #1. Note water level just below grade.

Photo 15-2: Timber-lined remains of shaft#2.

Photo 15-3: Reclaimed small test pit above shaft site.

Photo 15-4: Small creek above shaft site.

RICO

SITE #16

MINFILE# 105M001r

1. LOCATION AND ACCESS

Rico is on the lower northeast slope of Galena Hill, 450m upslope of the Galkeno 900 site at an elevation of 1025m. Approximate UTM co-ordinates for the site are 7 087 700m N and 483 300m E. Four wheel drive access is possible via an old dirt road that branches off of the Calumet Back Road roughly 2.2km north of the junction with Duncan Creek Road. The site is on the western side of the dirt road 610m from the turnoff.

2. SITE PHYSIOGRAPHY

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 150m higher than Christal Lake. No surface water was encountered at or near the site.

3. GEOLOGY AND MINERALIZATION

According to the Minfile report, the host rock is the Keno Hill Quartzite. A weak vein contained minor ankerite and small amounts of quartz and pyrite at irregular intervals (Minfile #105M 001r). Although the adit was located, it is collapsed and overgrown so that there was no rock out cropping.

4. SITE HISTORY

An adit and shaft were developed between 1924 and 1962.

5. MINE DEVELOPMENT

There is one adit and one shaft. Site photos can be found in Attachment 1.

5.1 Mine Openings and Excavations

A 37m adit is driven into Galena Hill. A shaft of unknown depth is located 30m upslope of the portal of the adit.

Rico Adit (photo 16-1)

The portal and adit were difficult to locate; they have collapsed and become overgrown with trees and shrubs. Location: The portal is located 4m from the old dirt road, on the western side. A cat track leading down to the Galkeno 900 site branches from the old dirt road 75m to the south.

Dimensions (L x W x H): 37m x 2m x 2m

Supports: The collapsed portal conceals all the original supports.

Condition: The first 20m of the portal have collapsed; the ground above the rest of the adit was stable at the time of the site visit.

Accessibility: The collapsed portal prevents access to the adit.

Rico Shaft (photo 16-2)

A small gully beside the adit leads uphill to a shaft. Log cribbing and a windless are built above the entrance to the shaft. A metal lid covers half of the shaft opening.

Location: The shaft is roughly 50m west of the adit.

Dimensions (L x W x H): 1.5m x 1.5m x 6m (at least)

Supports: The shaft is well supported by logs.

Condition: It is fair condition; the logs are beginning to rot but were stable at the time of the site visit.

Accessibility: The shaft can be accessed through the opening at the top. There is water approximately 6m below this opening.

5.2 Waste Rock Disposal Areas

There are two small waste rock piles; one is associated with the excavation of the adit and the other is associated with the excavation of the shaft. Neither pile was sampled.

Waste rock pile #1

The waste rock is from the excavation of the adit. It is overgrown with a thick layer of moss. Only a limited amount of the waste rock could be viewed. The portion of the pile that could be examined contained quartzite and some unmineralized vein material. There were no oxidation products found on the surface of the waste rock material and the pile did not have any surface water running through it.

Location: The pile is approximately 2m south of the portal.

Dimensions (L x W x H): 1.5m x 1.5m x 1.5m

Waste rock pile #2

The waste rock from the excavation of the shaft is completely overgrown with vegetation making examination difficult. No surface water runs through the pile.

Location: The pile is approximately 1m east of the shaft.

Dimensions (L x W x H): 3.0m x 1.5m x 1.0m

5.3 Tailings Impoundments

No ore was processed at this site and no tailings were encountered.

5.4 Minesite Water Treatment

There is no water treatment facility at this site.

6. MINE SITE INFRASTRUCTURE

There is one old log cabin at this site. Site photos can be found in Attachment 1.

6.1 Building 16A (photo 16-3)

There is an old log cabin with the roof and one wall collapsed. Household debris of mainly glass jars and tin containers are scattered around the cabin.

Dimensions (L x W x H): 5m x 3m x 2m

Location: The cabin is roughly 3m from the western side of the old dirt road; 48m north of the cat track leading to Galkeno 900 and 25m south of the adit.

Construction: The cabin is constructed of logs and has metal siding on the north exterior wall and roof.

Paint: The cabin is not painted.

Asbestos: There were no asbestos products observed.

Foundation: There is no foundation.

Non-Hazardous Contents: There is a small amount of household debris in and around the cabin.

Hazardous Contents: No hazardous products were encountered.

6.2 Fuel Storage

There were no fuel drums or tanks encountered.

6.3 Rail and Trestle

There are no rails or trestles at this site.

6.4 Milling and Processing Infrastructure

No ore was processed at this site.

6.5 Electrical Equipment

No electrical equipment was encountered.

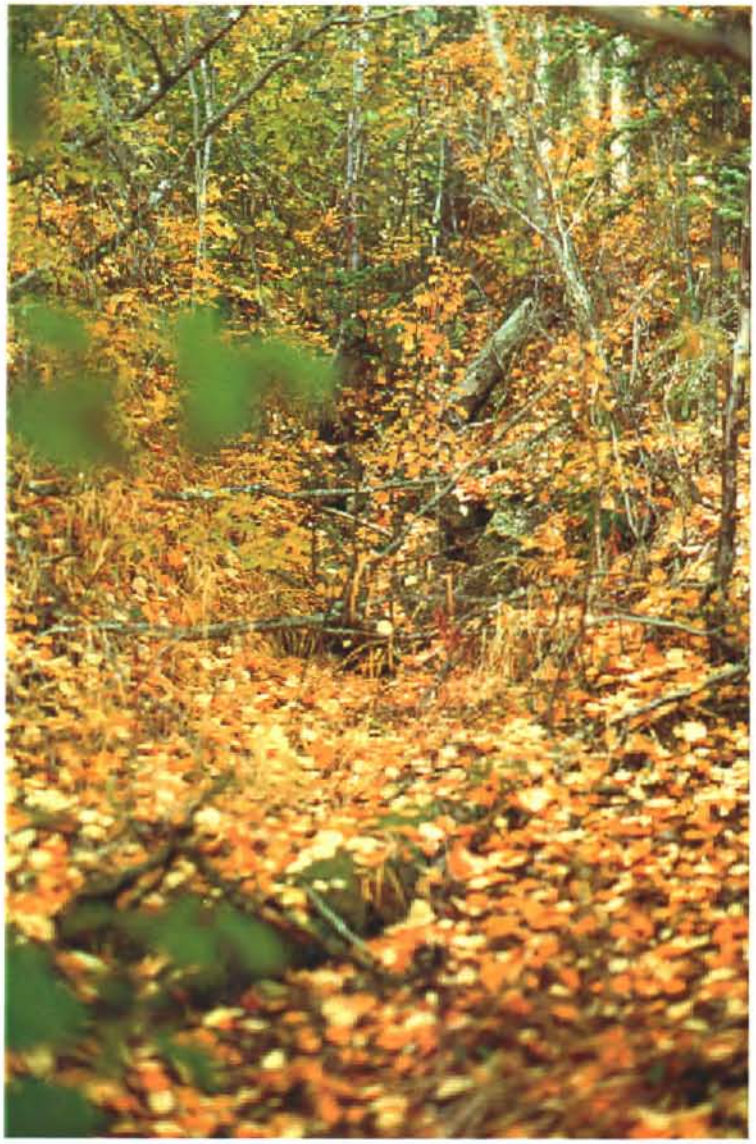


Photo 16-1: Collapsed and overgrown portal and adit are barely visible from under the leaf cover. (Azimuth 270°)

Photo 16-2: Rico shaft with windless on top. (Azimuth 210°)

Photo 16-3: Collapsed log cabin with metal sheeting which covers the north side of the cabin. (Azimuth 150°)

DUNCAN CREEK
Site No. 17
MINEFILE: 105M 001s

1. LOCATION AND ACCESS

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 (Site #17, Figure 1). 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. The UTM co-ordinates for the Duncan Creek Site are 7 084 950m N and 483 200m E.

2. SITE PHYSIOGRAPHY

The site is situated on what appears to be a plateau of glacial sediments above Duncan and Lightning Creeks. The area slopes gently westward toward Lightning Creek. A thick, wet moss, meter-high bushes and evergreen trees cover the area.

3. GEOLOGY AND MINERALIZATION

The site is completely overgrown so that no rock outcrops were observed. According to the Minfile report, the host rocks are Hyland Group schist, phyllite and psammite. An exposed vein that was the focus of the trenching contained siderite, pyrite, pyrrhotite, galena and sphalerite. A considerable quantity of pyrrohotite was reported in carbonate-quartz-pyrrhotite veins.

4. SITE HISTORY

The only thing known about the site was that bulldozer trenching and stripping was conducted, but the date is unknown. Given the amount of revegetation that has occurred, it is probable that the work took place before the 1920's.

5. MINE DEVELOPMENT

Mine development at this site consists of a grid of bulldozer trenches. There is a central trench oriented at 015 degrees and about 260 m in length. Eight trenches oriented roughly perpendicular to the centerline (105 degrees) range in length from 50 m to 150 m. All trenches are approximately 3 m wide.

6. MINE SITE INFRASTRUCTURE

No mine infrastructure was encountered at this site.

7. SOLID WASTE DUMPS

No solid waste was encountered at this site.

8. POTENTIAL CONTAMINANTS OF CONCERN

No potential contaminants of concern were encountered at this site.

9. WATER QUALITY

No creeks or streams were encountered at the site, and no water quality samples were collected.

10. RECLAMATION

The site has almost fully revegetated naturally. All trenches are well overgrown with a thick carpet of moss, and willows (1-2m high), and small evergreens up to 2 meters tall (Photos 17-1).

Photo 17-1: View of overgrown trench at the Duncan Creek site, looking northward.

FLAME & MOTH (#18)
(MINFILE# 105M 14)

1. LOCATION AND ACCESS

The main open pit area of the site is accessible from Keno City on the north side of Duncan Creek Road directly west of the Town and adjacent landfill (Figure 1). The north trench area of the site is accessed via a short bulldozed track stemming from the north end of the main pit area (Figure 2). The site is also directly south east of Christal Lake. Flame & Moth is at 63°54"30.4"N and 135°19'36.2"W and an approximate elevation of 900 m above sea level. UTM co ordinates are 7086852.994m N 483967.092m E.

2. SITE PHYSIOGRAPHY

The site is immediately west of Keno City and the main solid waste dump site. The area slopes gently towards Christal Lake approximately 750 m to the northwest (photo 18-1). Surrounding properties are heavily forested with typical subalpine features although most of the vegetation has been removed from this site. Drainage from the main pit is to the west and drainage from the trench is to the north west. Surface runoff from both areas is eventually into Christal Lake.

3. GEOLOGY AND MINERALIZATION

This site is underlain by Keno Hill Quartzite, medium to thick-bedded. The quartzite has minor beds of carbonaceous phyllite and lenticular bodies of greenstone. No greenstone was observed in the field. The mine is developed on a quartz-siderite vein mineralized with pyrite, pyrrhotite, arsenopyrite, sphalerite, galena and chalcopyrite. The vein material is significantly oxidized near surface, producing orange, yellow, brown and white secondary minerals. There is little true outcrop at the site, but there are areas where overburden has been bulldozed away to expose a rubbly subcrop.

4. SITE HISTORY

The site was initially developed in 1923. In the 1950's an inclined shaft was sunk to a depth of 31m, and there was 43 m of lateral drifting on the 75' level. Percussion drilling was conducted in the 1960's. Open pit mining was initiated on site shortly before the operation was closed. A total of 1,442 tonnes of ore was produced. The outline of the open pit is not readily apparent. One diamond drill site was observed at the southeast end of the disturbed area.

Open pit development has produced four lobes of waste rock. The two northwestern lobes are dominantly barren overburden. The northeastern lobe, site of sample 02, is composed of mixed mineralized material and overburden. The southern lobe, site of sample 03, is dominated by barren quartzite (Minfile).

A small clearing, shaft and trench in overburden is present about 100 m to the north of the main site. This site appears to be a placer mine, as a small sluice and jig are present, and no bedrock is exposed. The activity here appears to be from the 1980's or 1990's.

5. MINE DEVELOPMENT

5.1 Mine Openings And Excavations

No shafts or underground workings were observed. Any developments are thought to have been destroyed by open pit mining.

Shaft (not observed)

31m inclined shaft, 43m of drifting on the 75' level.

Location: Uncertain.
Dimensions (L x W x H): Unknown.
Supports: Unknown.
Condition: Filled; stable.
Accessibility: Not accessible.

Open Pits (photo 18-2)

Open pit mining was in progress when the operation was closed, however very little ore was produced. There are no benches cut into the rock. The boundaries of the mineralized area and pit outline are not clear.

Location: See map. The disturbed area includes considerable trenching, and is thought to extend to the southwest well beyond the open pit.
Dimensions (L x W x H): Irregularly shaped with max. length 160 m x max. width 90 m x max. depth 5 m.
Condition: The site is fairly level, and appears to be stable. Some dump slopes are steep but of minimum height.
Accessibility: Easy access from Keno City via the Duncan Creek Road.

Trenches (photo 18-3)

Trench is a long thin bulldozed pit, aligned in an east-west orientation. More development has occurred at the east end of the trench where placer mining appears to have occurred in the recent past. Only a small amount of bedrock is exposed.

Location: 250 m north of the main open pit and approximately 750 m south west of Christal Lake.
Dimensions (L x W x H): 45 m x 5 m x max. 3.5 m.
Condition: The site is level and drainage slopes towards the west end of the site. Slopes appear stable.
Accessibility: The area is accessible by a bulldozed track stemming from the open pit area to the south.

5.2 Waste Rock Disposal Areas

Waste rock piles (photo 18-4 & 18-5)

General Description: Open pit development has produced four lobes of waste rock. The two northwestern lobes are dominantly barren overburden (photo 18-4). The northeastern lobe, site of sample 02, is composed of mixed mineralized material and overburden (photo 18-5). The southern lobe, site of sample 03, is dominated by barren quartzite. The waste rock dumps are partially revegetated, except near well-mineralized areas. Vegetation is well established where there is fine-grained material or moisture traps. There is no apparent drainage at the site, as it is dominated by well-drained gravel. Oxidation related staining of the waste rock is apparent at the northeastern lobe of waste.

Location: See map. Waste rock was identified throughout the site in varying sized piles.
Dimensions: Not applicable.
Samples: Six rock samples were field tested for paste pH and conductivity, and two were sent for analysis. Sample 06, considered to be representative of near-surface mineralized rock, was repeated in the field as a duplicate, sample 07. Sample 03 was considered to be representative of un-mineralized waste rock. See Attachment B for laboratory and field test results. Note that the lab renumbered samples 06 and 07 to 01 and 02, respectively.

5.3 Tailings Impoundments

No tailings impoundments were observed at the site.

5.4 Minesite Water Treatment

No wastewater treatment facilities were observed on site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

No buildings are present at the site.

6.2 Fuel Storage

The few drums present at the site were all empty. No fuel storage was noted at the site.

6.3 Rail and Trestle

No rails or trestles were noted at the site.

6.4 Milling and Processing Infrastructure

No milling or processing infrastructure was present at the site.

6.5 Electrical Equipment

No electrical equipment was present at the site.

7. SOLID WASTE DUMPS

No solid waste dumps were present at the site.

8. POTENTIAL CONTAMINANTS OF CONCERN

No potential contaminants of concern were observed at the site.

9. WATER QUALITY

There was evidence that water had ponded in the north trench in the recent past, however, it was dry during the site visit. The north trench area drains northwest towards Christal Lake, a distance of approximately 750 m (photo 18-1). Surface runoff from the site enters a pond immediately north west of the site (photo 18-6), which discharges into a small creek flowing into Christal Lake. A water sample (18-WQ-Str-CD-01) and duplicate (18-WQ-Str-CD-02) were collected from the pond. Laboratory and field analyses are provided in Attachment B.

10. RECLAMATION

No reclamation has been attempted at either the open pit or trench areas. Portions of the pit, particularly near the northeast and southwest corners have been re-colonized by willow saplings. The remainder of the site is essentially unvegetated.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Table B1. 1999 Water Quality Results, Flaming Moth Site

Sample Number		Detection Limit	Units	18-WQ-StrCD-01 - Sept 18/99	StrCD-02 - Sept 18/99
Site Description					
pH (field)		N/A	pH	7.3	-
Conductivity (field)		N/A	uS/cm	65	-
Total Alkalinity		5	mg CaCO3/L	246	246
Chloride		0.25	mg/L	0.4	<0.25
Chloride		0.5	mg/L	na	na
Electrical Conductivity		0.01	µS/cm	580	570
Hardness (CaCO3 equiv)		5	mg/L	321	319
Nitrate-N		0.05	mg/L	0.05	<0.05
Nitrate-N		0.1	mg/L	na	na
Nitrite-N		0.003	mg/L	0.003	<0.003
pH		0.01	pH	7.43	7.41
Sulphate		1	mg/L	53	53
Total Dissolved Solids		5	mg/L	369	362
ICP-USN Total Metals Scan in Water					
	Aluminum	0.0008	mg/L	0.0118	0.0136
	Antimony	0.005	mg/L	<0.005	<0.005
	Arsenic	0.01	mg/L	<0.01	<0.01
	Barium	0.00004	mg/L	0.0895	0.0891
	Beryllium	0.00001	mg/L	<0.00001	<0.00001
	Bismuth	0.0004	mg/L	<0.0004	<0.0004
	Boron	0.002	mg/L	<0.002	<0.002
	Cadmium	0.00001	mg/L	0.00012	0.00009
	Calcium	0.002	mg/L	84.3	83.7
	Chromium	0.00006	mg/L	0.00011	0.00021
	Cobalt	0.00003	mg/L	0.00017	0.00023
	Copper	0.00003	mg/L	0.00269	0.00406
	Iron	0.00001	mg/L	0.273	0.291
	Lead	0.0003	mg/L	0.0004	0.0006
	Lithium	0.001	mg/L	0.003	0.003
	Magnesium	0.0005	mg/L	20.9	21
	Manganese	0.00002	mg/L	0.169	0.162
	Mercury	0.0001	mg/L	<0.0001	<0.0001
	Molybdenum	0.00007	mg/L	0.0002	0.00025
	Nickel	0.00001	mg/L	0.0007	0.0009
	Phosphorus	0.03	mg/L	0.03	<0.03
	Potassium	0.4	mg/L	1.1	1.1
	Selenium	0.004	mg/L	<0.004	<0.004
	Silicon	0.004	mg/L	2.1	2.08
	Silver	0.00005	mg/L	<0.00005	<0.00005
	Sodium	0.4	mg/L	1.2	1.2
	Strontium	0.00002	mg/L	0.16	0.16
	Sulphur	0.008	mg/L	18	18
	Thallium	0.001	mg/L	<0.001	<0.001
	Titanium	0.00002	mg/L	0.00032	0.00035
	Vanadium	0.00003	mg/L	<0.00003	<0.00003
	Zinc	0.0002	mg/L	0.0073	0.0093
Total Arsenic by Hydride AA					
	Arsenic	0.0002	mg/L	0.0018	0.0021
Total Selenium by Hydride AA					
	Selenium	0.0001	mg/L	<0.0001	<0.0001

ATTACHMENT B: 1999 FLAME AND MOTH WASTE ROCK SAMPLES LABORATORY RESULTS					
Site Number	**Detection Limit**	**Units**	**18_WR_TPBM_01 (On bag -06)**	**18_WR_TPBM_01 (On bag -07)**	**18_WR_TPBM_03**
Sample Desciption			Flame and Moth northwestern waste rock pile	Duplicate of Bag 6	Representative of unmineralized waste rock
Paste pH (field)	N/A	pH	-	-	-
Conductivity (field)	N/A	µS/cm	-	-	-
pH in Saturated Paste					
pH	0.1	pH	3.5	3.6	7
pH in Soil (1:2 water)					
pH	0.01	pH	3.3	3.2	7.3
ICP Semi-Trace Scan					
Aluminum	5	µg/g	10400	12600	25500
Antimony	2	µg/g	70	61	<2
Arsenic	2	µg/g	680	496	63
Barium	0.05	µg/g	322	370	564
Beryllium	0.1	µg/g	<0.1	<0.1	0.5
Bismuth	5	µg/g	40	38	<5
Cadmium	0.1	µg/g	0.9	0.5	0.9
Calcium	5	µg/g	320	240	12200
Chromium	0.5	µg/g	25.6	30.4	37.9
Cobalt	0.1	µg/g	0.6	<0.1	13
Copper	0.5	µg/g	59.7	47.2	59.4
Iron	1	µg/g	110000	92000	37000
Lead	1	µg/g	342	411	28
Lithium	0.5	µg/g	9.2	10.8	19.9
Magnesium	1	µg/g	646	526	6300
Manganese	0.5	µg/g	41.5	36	512
Mercury	0.01	µg/g	0.13	0.13	<0.01
Molybdenum	1	µg/g	4	3	7
Nickel	1	µg/g	2.9	1.7	40
Phosphorus	5	µg/g	599	376	688
Potassium	20	µg/g	4150	4650	5400
Selenium	2	µg/g	<2	<2	<2
Silicon	5	µg/g	346	597	213
Silver	0.5	µg/g	15.1	16.7	<0.5
Sodium	5	µg/g	927	677	1210
Strontium	1	µg/g	19	17	65
Sulphur	10	µg/g	6800	5400	670
Thorium	1	µg/g	<1	<1	<1
Tin	1	µg/g	68	58	2
Titanium	0.2	µg/g	206	141	402
Uranium	5	µg/g	<5	<5	<5
Vanadium	1	µg/g	38	34	63
Zinc	0.5	µg/g	390	338	163
Zirconium	0.1	µg/g	24.6	25	26.3

ATTACHMENT 2: 1999 FLAME AND MOTH WASTE ROCK LABORATORY RESULTS MODIFIED SOBEK METHOD ACID-BASE ACCOUNTING TEST								
SAMPLE	SITE DESCRIPTION	PASTE pH	S(T) %	S(SO4) %	AP	NP	NET NP	NP/AP
18_WR_TPBM_01 (On Bag - 06)	Flame and Moth northwestern waste rock pile	4.2	0.25	0.18	2.2	-1.0	-3.2	<0.1
18_WR_TPBM_02 (On Bag - 07)	Duplicate of Bag 6	4.6	0.21	0.16	1.6	-1.5	-3.1	<0.1
18_WR_TPBM_03	Representative of unmineralized waste rock	7.9	0.11	0.05	1.9	54.5	52.6	29.1

AP = ACID POTENTIAL IN TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.

NP = NEUTRALIZATION POTENTIAL IN TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.

NET NP = NET NEUTRALIZATION POTENTIAL = TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.

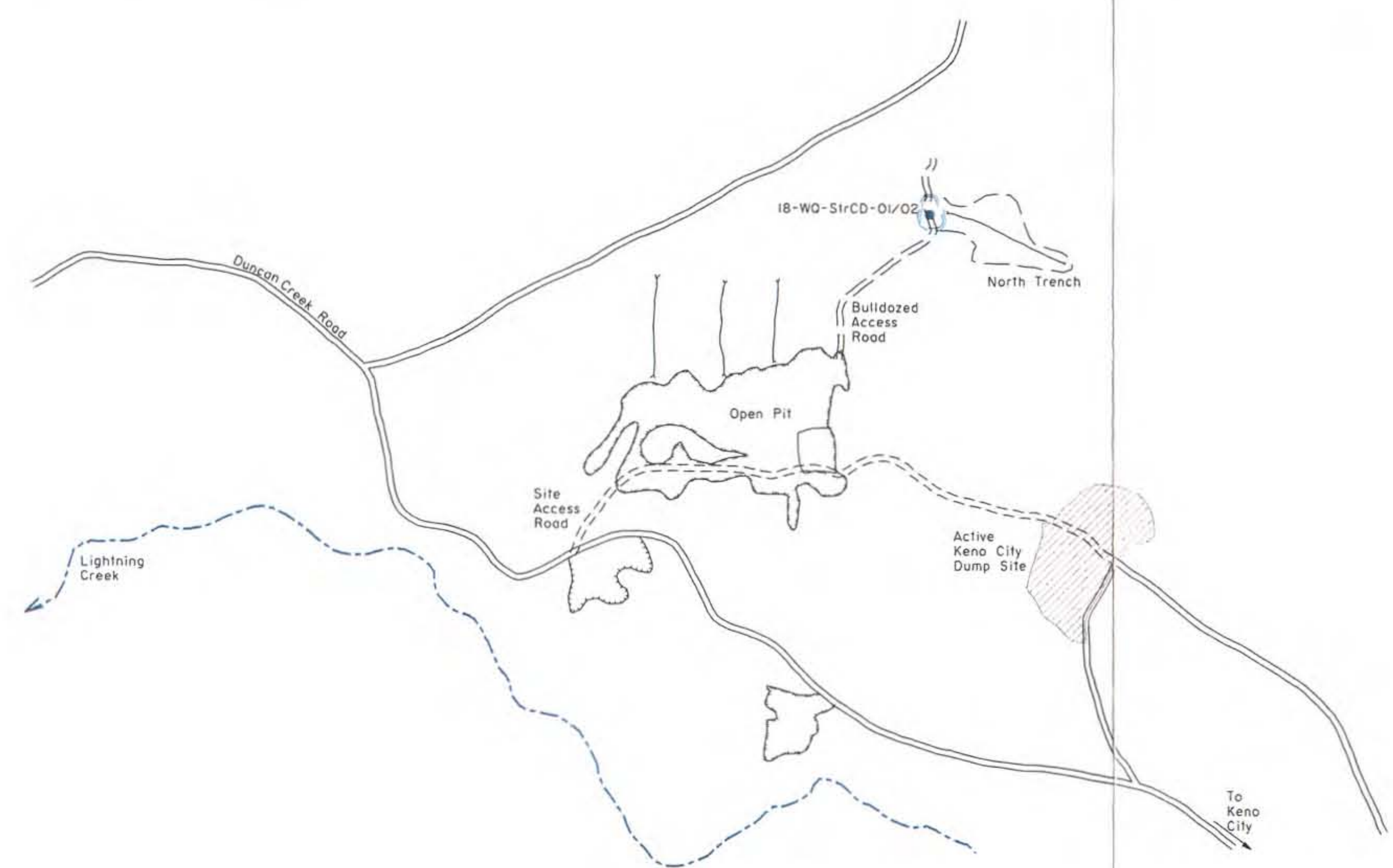
NOTE: WHEN S(T) AND/OR S(SO4) IS REPORTED AS <0.01, IT IS ASSUMED TO BE ZERO FOR THE AP CALCULATION.

N/D = NO DUPLICATE ASSAY. CALCULATIONS ARE BASED ON ASSAY RESULTS OF THE INITIAL SAMPLE.

RE = REPLICATE.

NOTE - A HIGH LEVEL OF SOLUBLE METALS (ESPECIALLY IRON) WERE OBSERVED IN MANY SAMPLES DURING THE ABA TITRATIONS.
SAMPLES WITH A NEGATIVE NET NP SHOULD BE TESTED FOR MOBILE METALS USING STANDARD SHAKE FLASK EXTRACTION TESTS.

Building (22A: building site present reference*) 22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WQ-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
*(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
(5) Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)



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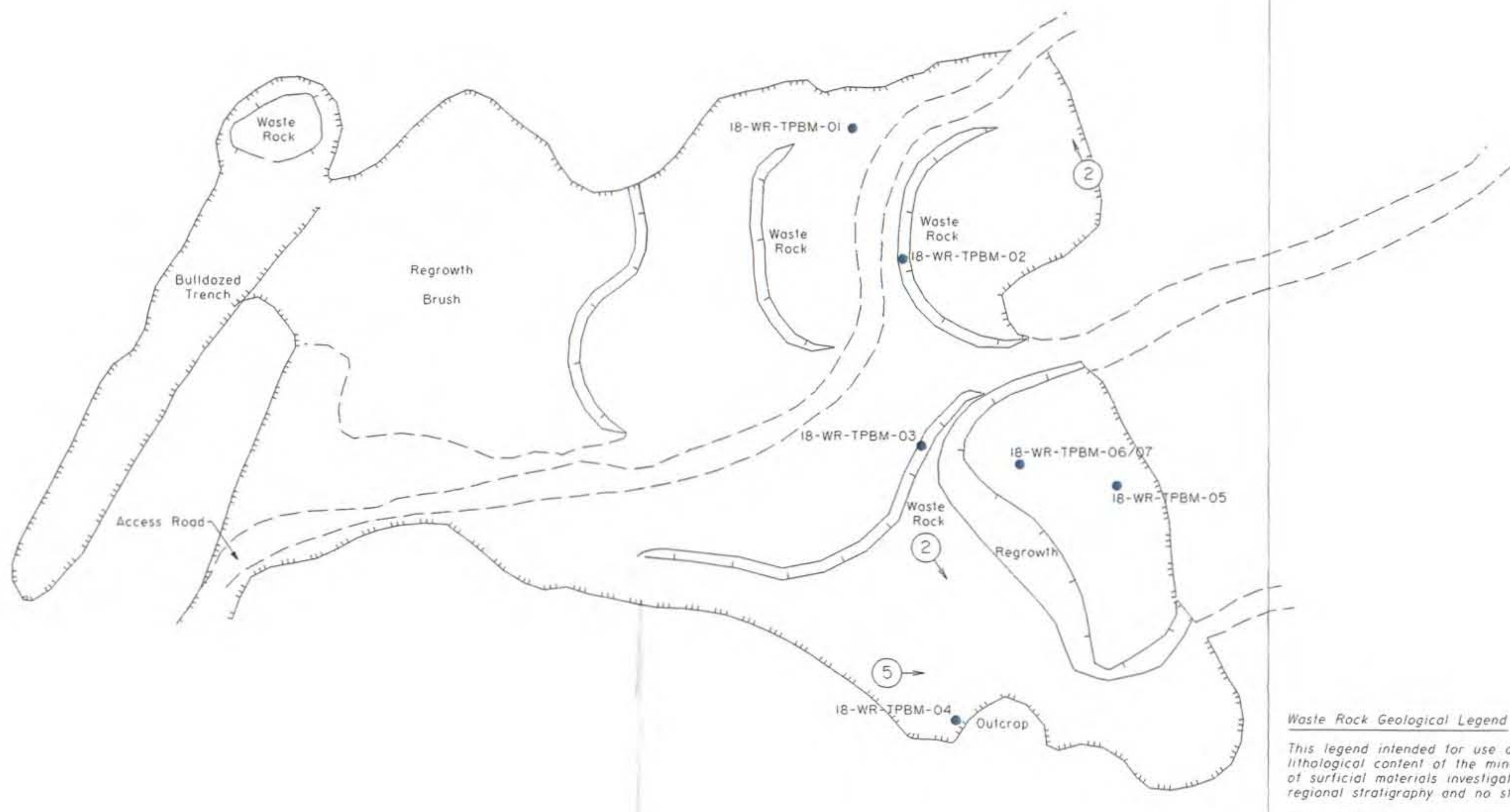
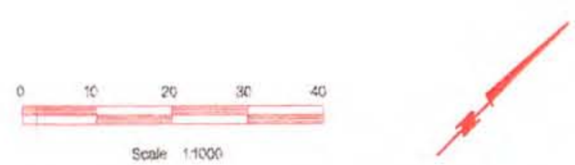
Scale 1:5000
CAD FILE: SITE_1.dgn

Public Works And Government Services Canada	Travaux publics et Services gouvernementaux Canada	designed by: / conçu par:
Architectural & Engineering Services Western Region		drawn by: / dessiné par: C.S. Nov./99
		approved by: / approuvé par:
Drawing title: / Titre du dessin: Flame and Moth Site #18 Site Assessment Yukon Territory		revisions:
		project no. / no. du projet: 125-12.01
		dwg. no. / dessin no.: 1 of 2

- Building (22A: building site present reference*) 22A* Indicates Asbestos Material
- 22A Collapsed Building
- Adit
- Collapsed Adit
- Shaft
- Collapsed/Backfilled Shaft
- Mine Rock Dump
- Bedrock Open Pit
- Trench
- Stripped Overburden Stockpile
- Stripped / Disturbed Area
- Outcrop Boundary
- Highway
- Road (gravel, 2 wheel drive)
- Road (gravel, 4X4 accessible)
- Road (inaccessible)
- Trail
- Culvert
- 24501-01 1999 Soil Sample (this study)
- Pre 1999 Soil Sample (other sources)
- 25WR04-01 1999 Waste Rock Sample (this study)
- Pre 1999 Waste Rock Sample (other sources)
- WO-12-06 1999 Water Sample
- Pre 1999 Water Sample
- Tension Cracks
- Mass Movement (note: for Forms; Bellekeno)
- Groundwater Seep
- Surface Water Flow (Stream, Creek, River)
- Lake
- Settling Pond / Water Treatment Pond
- Tailings Dam / Tailings Pond / Mill Tails
- Ponded Water / Trench
- Barrels
- Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
- Mine Rails / Tressle
- Collapsed Tressle
- Solid Waste Disposal Site
- Area of Soil Contamination
- (6) Transformer Loaction (number of transformer in brackets)
- Power Line
- Power Line Collapsed
- Arial Transmission Towers
- 5 Photo Site (arrow shows view direction)
- GPS Survey Location
- Former Building Site (Elsa)





CAD FILE: KEY.DGN

Waste Rock Geological Legend

This legend intended for use as a key to the observed lithological content of the mine dumps and stockpiles of surficial materials investigated. It does not represent regional stratigraphy and no stratigraphic sequence is implied.

Pyrite content as percent: eg. Py 2%. Occurs as an alteration halo adjacent to vein fault structure.

Oxidation: Weak (wOx), moderate (mOx) and intense (iOx).

Quarternary: (5) Undifferentiated, unconsolidated colluvium, glacial till.

Veins:
- *(4a) Quartz veins;*
- *(4b) Quartz-pyrite veins;*
- *(4c) Quartz-siderite +trace galena-sphalerite veins;*
- *(4d) Siderite-quartz +trace galena-sphalerite veins;*
- *(4e) Suphide (galena-sphalerite) +quartz+siderite veins.*

Greenstone: (3) Amphibole-chlorite-plagioclase metadiorite or metagabbro.

Quartzite:
- *(2a) Thick beded, blocky gray quartzite;*
- *(2b) Thin banded, broken, quartzite with carbonaceous phyllite interbeds;*
- *(2c) Calcareous quartzite.*

Phyllite:
- *(1a) Broken sericite-chlorite phyllite;*
- *(1b) Carbonaceous phyllite.*

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Drawing title: / Titre du dessin: Flame and Moth Site # 18 Site Assessment Yukon Territory		revisions:
		project no. / no. du projet: 125-12.01
		dwg. no. / dessin no.: 2 of 2

dates:

Photo 18-1: Forested area and Christal Lake in background north west of site.

Photo 18-2: Waste rock area near north end of main site.

Photo 18-3: Bulldozed trench at second site.

Photo 18-4: Large waste rock pile slope at north end of main site.

Photo 18-5: Leveled area at main site. Note rock outcrop on right side of photo.

Photo 18-6: Creek runoff to north west of trench site.

ONEK MINESITE (#19)
MINFILE# 105M 001u

1. LOCATION AND ACCESS

The 400 level adit discharges within City limits, with occupied residences within 100 m of the portal and is accessible via a residential streets/roads. Some of the old minesite buildings have been occupied by residents of the town. (These buildings were not included in this assessment). The site is positioned at an elevation of 1050 m. The location is given as 63°54'42"N and 135°15'24"W. UTM co ordinates are 7087196.331m N 487406.286m E.

2. SITE PHYSIOGRAPHY

The site has been developed on the south slope of Keno Hill immediately north east of Keno City. The main open pit area is located on a relatively flat plateau above the Town with the large excavations perpendicular to the hillside (photo 19-1). The north (uphill) end of the pit area is at a considerably higher elevation than the southern end and due to the site aspect and slope is not visible from the compound area immediately south of the pits. The former site has been developed down the hillside and is crisscrossed with gravel roads up to the pit area. The intermediate area has been overgrown with second growth forest and former buildings in this area are difficult to locate. The adit opens to the south at the bottom end of the slope. The adit itself is at a slightly higher elevation than the adjacent buildings and the site is forested immediately above the adit.

Site drainage from the 400 level portal (photo 19-2) and adjacent compressor building/garage site (lower site) is along a well defined discharge seep (photo 19-3) from the adit, extending south across the main site access road and flowing past residential buildings located within town limits. No clear drainage pathways were identified at the upper site. Drainage from the upper site appears to be partially downhill toward the lower (adit) site as well as down the steep slope south east towards Lightning Creek.

A portion of the minesite also occupies an area south of the town road that accesses the site. This area is partially overgrown and is downhill from the lower site. Drainage from the portal runs to the north of this location.

3. GEOLOGY AND MINERALIZATION

The host rocks are Keno Hill Quartzite, medium to thick-bedded, with carbonaceous phyllite and greenstone lenses. The vein is a fault breccia zone 3 m to 6 m wide. Near surface galena, freibergite, chalcopyrite, anglesite, cerussite and oxidized siderite are the ore minerals. Sulphide minerals were noted to be very rare during inspection of the open pit and its waste dumps, due to intense weathering prior to mining. Limonite and manganese oxides are common.

On the 400 level, sulphides are common, and the vein is dominated by sphalerite in a siderite gangue. Galena, freibergite, and pyrite are present.

4. SITE HISTORY

In the period 1920 to 1924 two shafts were sunk at the site, one to a depth of 41 m. Drifting was done on two levels. Between 1950 and 1952, the shafts were rehabilitated and an adit was driven in at the 400 level. 396 m of drifting, raising and mining of development ore was done through this adit. In 1987 and 1988, open pit production was completed from the crown pillars and around the shafts. This mine is scheduled for future underground production. The adit is subject to ice plug formation and damming, with at least three plug failures in the past.

5. MINE DEVELOPMENT

5.1 Mine Openings And Excavations

The site consists of the 400 level adit at the lower area and two large joined pits above the upper camp. A shaft formerly present within the pits was destroyed during development of the pits. See map in Figure 1.

400 Level Portal (photo 19-2)

The portal was constructed circa 1950 and has been damaged by ice plug damming. Recent rehabilitation includes excavation of rotten timbers and removal of the track to improve flow of water away from residences. The adit has been sealed to restrict air-flow and a heat-traced pipe was installed to prevent future ice plug damming.
Location: See map. North east edge of Keno City.
Dimensions (L x W x H): About 2 m x 2 m, over 1000 m of underground development.
Supports: Wooden timbers in fair condition.
Condition: The portal timbers appear to be sound, recent rehabilitation.
Accessibility: Adit is sealed with boards. Nearby residents can inspect regularly.

Lone Star Shaft

The shaft is mostly filled with open pit rock. Some timbers and pipes are visible from the pit.
Location: See map.
Dimensions (L x W x H): Unknown dimensions; originally depth approximately 100m.

Supports: Timbers are present, however, they have been extensively filled in and do not appear to be supporting the structure.
Condition: Appears to be stable. The material inside the shaft may be settling.
Accessibility: Inaccessible, except for 5 m deep hole within open pit. Material filling shaft may settle. Low risk site, hazard similar to adjacent open pit walls.

Open Pits (photo 19-1)

The Lone Star and Fisher pits are joined to form one open-cut pit. There is a highwall to the northeast, with level access from the southwest.
Location: See map.
Dimensions (L x W x H): The pit is approximately 600 m long and averages approximately 75 m wide. Maximum depth is 56m at the northeast end.
Condition: Pit walls appear to be stable, with some sloughing of loose material (especially from the northwest wall).
Accessibility: The pit is easily accessible by road from below or above the pit. It is possible to drive into or around the pit.

5.2 Waste Rock Disposal Areas

Waste rock pile – Open Pit (photo 19-4)

Pit waste is stored in approximately six major dumps around the perimeter of the pit. These dumps total 544,300 tonnes, and are described in the Access Site Characterization report. In addition to the waste rock, there are several small (approx. 1000 tonnes) piles of low grade ore stockpiled on the tops of the waste dumps. These dumps are siderite-rich, and highly oxidized. The waste rock has local natural revegetation where there is enough fine-grained material and water. The waste rock was highly oxidized prior to mining, and has only trace amounts of sulphide minerals (less than 0.1% average). Overburden material is a small percentage of the waste dump. Water does not flow on surface in the pit area, and is likely funneled through the underground workings.
Location: See map.
Dimensions (L x W x H): Not applicable.
Sampling: No samples of open pit material were collected (see Access data). A sample of the low grade/oxide ore was tested for paste pH and conductivity (19_WR_TPBM_05).

Waste rock pile – 400 Level Portal (photo 19-3)

Waste rock from underground was dumped along the rail tracks on surface, and spread around the work area. There is approximately 5000 to 10,000 tonnes of mine waste in this area. Much of this material is mineralized with iron sulpides, with traces of sphalerite and galena. Most of this area is not revegetated despite clearing ca. 1950. There is local evidence of vegetation mortality. There is local staining related to sulphide oxidation, with yellow and orange colours developed on originally grey rock. Analytical results show high metal levels and indicate Acid Rock Drainage, however sulphide sulphur levels are moderate to low (1.69%, 0.29%).

Location: See map.

Dimensions (L x W x H): About 100m x 50m (measure from map). Estimated average depth of mine waste 1 m.

Samples: Four sites were tested for paste pH and conductivity in the field (19_WR_TPBM_01, 10_WR_TPBM_02, "03" and "04") and two of these samples were analyzed.

Laboratory and field results are provided in Attachment B.

5.3 Tailings Impoundments

No tailings impoundments were observed at the site.

5.4 Minesite Water Treatment

No water treatment facilities were observed at the site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

The buildings have been constructed down the steep slope of Keno Hill at five separate locations. There are: four buildings located at the upper camp site; the remains of four buildings located at the lower site; a small explosives shed at the top end of the site above the pit; the remains of three large warehouse type buildings approximately half way between the two main sites; and the remains of approximately two buildings at the loadout area below the lower site.

Building 19A (photo 19-5)

With the exception of the trailer, this is the largest building at the upper site. The building appears to have been used for miscellaneous storage including some hazardous material.

Location: Southernmost building on gravel pad at upper camp (adjacent to open pits).

Dimensions (L x W x H): 7 m x 2 m x 2.5 m.

Construction: Painted wood frame; unpainted wood floor interior; rolled asphalt roof; building was formerly electrified.

Paint: Weathered green painted exterior (not sampled).

Asbestos: None.

Non-Hazardous contents: Small maintenance materials; miscellaneous supplies; filters; stretcher; safety clothing.
Foundation: None; building on metal skids.
Hazardous products: 22 L pail lube oil; small vol. waste oil; 2 – 22 L pails antifreeze; < 1 L unidentified clear liquid in large acid bottle.
Surrounding area: 205 L barrel containing high grade ore; empty barrel; 2 used oil filters; 1 used car battery.

Building 19B (photo 19-5)

Structure is a smaller version of building #1 and appears to have been used exclusively as POL storage shed. Gravel under shed was stained and had a strong hydrocarbon odour.
Location: 3 m north of building #1 on gravel pad at upper camp (adjacent to open pits).
Dimensions (L x W x H): 3 m x 2 m x 2.5 m.
Construction: Painted wood frame; unpainted wood interior; no floor; rolled asphalt roof; non-electrified.
Paint: Weathered green painted exterior (not sampled).
Asbestos: None.
Non-Hazardous contents: 2 used air filters; 1 empty 22 L lube oil pail.
Foundation: None; building directly on ground surface.
Hazardous products: 3 L waste oil; 8 L chain lube oil.
Surrounding area: 2 empty 22 L pails; miscellaneous non-hazardous materials (plastic pipe; plywood).

Building 19C (photo 19-6)

Structure is a larger shed directly adjacent to the trailer. South area of building appears to have been used by electrician or other trade. North area formerly contained furnace but has since been gutted.
Location: 25 m north of building 19A on gravel pad at upper camp (adjacent to open pits).
Dimensions (L x W x H): 6 m x 2 m x 2.5 m.
Construction: Painted wood frame; partially painted plywood interior; plywood floor; partitioned into 2 rooms one of which formerly contained a furnace; formerly electrified.
Paint: Weathered green painted exterior (not sampled).
Asbestos: None.
Non-Hazardous contents: None.
Foundation: Building on metal skids.
Hazardous products: None.
Surrounding area: Small amount of miscellaneous non-hazardous debris.

Building 19D (photo 19-6)

Structure is a mobile trailer formerly used as both an office and living quarters at the upper camp. Interior is water damaged.
Location: 30 m north of building 19A on gravel pad at upper camp (adjacent to open pits). Building is the northernmost structure at the site.
Dimensions (L x W x H): 10 m x 3 m x 3 m.
Construction: Metal clad; newer linoleum flooring; pressboard walls; tile ceiling; fibreglass insulated walls and ceiling; two furnaces; formerly electrified.
Paint: Yellow painted exterior (not sampled); painted interior walls.
Asbestos: None.
Non-Hazardous contents: Miscellaneous non-hazardous materials (office materials and maps).
Foundation: Building on metal rails on wood blocks.
Hazardous products: None.
Surrounding area: Adjacent outhouse; small amount of miscellaneous non-hazardous debris; flat-bed trailer in storage in clearing north of the trailer.

Building 19E (photo 19-7)

Building appears to have formerly served as a combination storage and compressor building but has partially collapsed and much of the former heavy generator equipment has since been removed.
Location: Building is located in the extreme north west corner of the lower site approximately 70 m west of the 400 portal and immediately north of Building 19F.
Dimensions (L x W x H): 14 m x 7 m x 3 m.
Construction: Wood frame; formerly with wood roof and rolled asphalt roofing; roof has now collapsed; exterior walls clad in asbestos tar paper.
Paint: No painted surfaces remain.
Asbestos: Asbestos tar paper on entire exterior of building.
Non-Hazardous contents: metal pipes; wood debris (some burned); fibreglass insulation; old pump; two compressors; compressed gas cylinder; 6" pipe entering concrete; various supplies including electrical, carpentry and mechanical equipment.
Foundation: concrete; many pipes encased in concrete; concrete sumps (with hydrocarbon staining) (photo 19-8) and stands for compressors and other heavy equipment.
Hazardous products: Used six-volt battery. Partially full barrels and pails (photo 19-9). Note: all partially full pails and barrels at the lower site were placed in this building prior to sampling.
Surrounding area: Large amount of debris including discarded construction materials from this building; adjacent building (19F); metal and wood debris; barrels (empty and partially full); oil stains to the east.

Building 19F (photo 19-7)

Only a concrete pad remains. The former usage of the building could not be ascertained, however, a large amount of obsolete equipment remains on the pad.

Location: Building is located in the extreme north west corner of the lower site approximately 70 m west of the 400 portal and immediately south of Building 19E.

Dimensions (L x W x H): 10 m x 7 m.

Construction: Only concrete pad remains; formerly wood frame construction.

Paint: None.

Asbestos: None.

Non-Hazardous contents: obsolete mine equipment; miscellaneous wood and metal debris.

Foundation: Concrete.

Hazardous products: Partially full barrels and pails. Note: all partially full pails and barrels at the lower site were placed in this building prior to sampling.

Surrounding area: Large amount of debris including discarded construction materials from this building and building 19E; metal and wood debris; barrels (empty and partially full); oil stains to the east.

Building 19G (photo 19-11)

All that remains is a concrete foundation that appears to have formerly been used as a multi-bay garage.

Location: Building is located on the level area adjacent to buildings 19E and 19F approximately 55 m west of the 400 portal.

Dimensions (L x W x H): 13 m x 10 m.

Construction: Only a concrete pad remains; former building construction unknown.

Paint: None.

Asbestos: None.

Non-Hazardous contents: Wood and metal debris; empty barrels.

Foundation: Concrete.

Hazardous products: Partially full barrels and pails. Note: all partially full pails and barrels at the lower site were placed in this building prior to sampling.

Surrounding area: Large amount of demolition debris in a single pile (metal cladding, small equipment, wood) (photo 19-12) that has been extensively burned; metal and wood debris; vehicle hulk; barrels and pails (empty and partially full).

Building 19H

Building is a five-stall outhouse.

Location: Approximately 15 m east of 400 portal at lower site.

Dimensions (L x W x H): 3 m x 2 m x 2.5 m.
Construction: Wood frame.
Paint: None.
Asbestos: None.
Non-Hazardous contents: None.
Foundation: None.
Hazardous products: None.
Surrounding area: Rail and trestle adjacent to the 400 level portal.

Building 19I (photo 19-13)

Building appears to be a small explosives storage shed a considerable distance from nearest infrastructure.
Location: Approximately 100 m north of pits at top end of property.
Dimensions (L x W x H): 1 m x 1.5 m x 2.5 m.
Construction: Heavy wood frame; door is solid metal; walls filled with sand; stainless steel roof.
Paint: None.
Asbestos: None.
Non-Hazardous contents: Unknown (locked); possibly still contains explosives.
Foundation: None; building mounted on timbers.
Hazardous products: Unknown (locked); possibly still contains explosives.
Surrounding area: Bare level gravel surface.

Buildings 19J –19M

Only the collapsed wood frame remains for all three of the buildings. The area has extensively overgrown and the buildings are difficult to locate.
Location: Approximately 300 m north of the lower site; below the upper camp site.
Dimensions (L x W x H): All approximately 25 m x 5 m (collapsed).
Construction: Wood frame walls and roofs (all that remains).
Paint: None.
Asbestos: Portion of one building still has asbestos tarpaper clading.
Non-Hazardous contents: None.
Foundation: None.
Hazardous products: None.
Surrounding area: Overgrown thicket.

Building 19N (photo 19-14)

Large collapsed building at loadout area probably used as the loadout building.

Location: Approximately 200 m downhill from the lower site.

Dimensions (L x W x H): Approximately 12 m x 10 m (collapsed).

Construction: Wood frame with wood floor and metal roof.

Paint: None.

Asbestos: None.

Non-Hazardous contents: Building debris strewn throughout area including construction waste from the former loadout ramp (photo 19-15).

Foundation: None noted but probably on wood piles

Hazardous products: None.

Surrounding area: Debris from other loadout facility building; abandoned vehicles; miscellaneous wood and metal debris; two empty barrels.

Building 19O (photo 19-16)

Building located at loadout facility but former usage unknown. Only concrete foundation of building remains. Large amount of debris in area may have formed portions of other former buildings.

Location: Approximately 225 m from the lower site; approximately 25 m from the loadout facility.

Dimensions (L x W x H): 15 m x 12 m (only foundation remains).

Construction: Former construction unknown; only concrete foundation remains.

Paint: None.

Asbestos: None.

Non-Hazardous contents: Some construction waste wood debris.

Foundation: Concrete.

Hazardous products: None.

Surrounding area: Metal and wood debris; empty barrels and pails; small piles of coal.

6.2 Fuel Storage

There is currently no fuel in stored at the site. A number of barrels and pails containing waste hydrocarbon products were noted throughout the lower site.

6.3 Rail and Trestle (photo 19-17)

Location: South of 400 level portal. Much of the material has been removed and is piled south east of the portal.

Fabrication: Metal rail; wood trestle.

Amount of materials: Approximately 80 m of material (from portal to adjacent compressor/garage site).

Condition: Most of this infrastructure has been demolished; rail has been piled to south east of portal and trestle has been pushed aside to the north of original location.

6.4 Milling and Processing Infrastructure

There is no milling or processing infrastructure currently present at this site.

6.5 Electrical Equipment

No electrical equipment was identified at the site. Transformers were noted on a utility line that runs uphill parallel to the upper camp site.

7. SOLID WASTE DUMPS

Location & access: Immediately west (below) waste rock pile comprising upper camp site (photo 19-18).
Dimensions (L x W x H): 30 m x 10 m (surface only).
Drainage: South towards lower site. No defined drainage from area.
General composition: Used oil and filters; empty barrels and pails; miscellaneous wood and metal debris. No hazardous wastes noted.
Impacted vegetation: None noted.
% covered: 0
Sampling: Due to an absence of hazardous materials and obvious runoff pathways from the site, no samples were collected.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No out-of-service transformers were noted at the site. A utility line adjacent to the upper camp site did contain a number of transformers, however, it could not be determined whether this line remained in usage.

8.2 Metals and Hydrocarbons in Soil

A number of hydrocarbon stained surfaces that appeared to be attributable to waste oil disposal were identified at both the upper camp and lower sites.

Extensive staining was also noted under the POL shed at the upper camp that appeared to be attributable to leakage and spillage from various hydrocarbon based liquids stored in the building in the past (photo 19-19). The surface area of the stain was approximately 6 m^2.

Due to the limited extent and lack of potential receptors in the area, none of the upper camp stains were sampled. Seven stains were identified to the east of buildings 19A to 19C and to the south of building 19D. The total area of the stained surfaces was estimated at approximately 20 m^2. Faint hydrocarbon odours associated with waste oil were noted at each of the locations. Soils at the site are extremely thin or nonexistent since the site was constructed from waste rock removed from the adjacent pits.

Approximately five large waste oil stains were also noted at the lower site. Four of these were present to the north of building 19G and one stain immediately to the south. The total surface area of these stains was approximately 30 m^2. Soils within unlined sumps in building 19G (garage) were also heavily stained and appeared to be representative of the staining at the site (photo 19-20). One sump was excavated to a depth of approximately 0.6 m. Staining was noted to depth and a composite sample was taken from the excavation. A duplicate sample was also collected. PCBs were not detected in either sample. Elevated concentrations of heavy metals were noted in both samples. Laboratory analysis are provided in Attachment B.

Sample ID	Location	Sample Depth
19-SLCD-01	Sump in building 19G	Composite; 0 – 60 cm
19-SLCD-02	Duplicate	Duplicate

8.3 Liquid Hazardous Materials

One 205 L barrel and 10 - 22 L pails containing varying quantities of liquid were noted at the lower site. The contents of most of these barrels were easily identifiable and did not appear to have been contaminated. Three full 205 L barrels identified to the east of this site contained Aviation gas only. These barrels were not moved from their original location. Many other barrels and a few pails were noted in the surrounding brush and all were found to be empty.

Four containers, including three 22 L pails and one 205 L barrel contained unknown liquids. Two of the pails contained similar contents and only one of these, as well as the other pail and barrel, were sampled.

Location(s): All pails and barrels containing liquids that were identified at the lower site, were moved to the storage area of the compressor building for storage and sampling. See Table 1 below for waste container ID#'s, locations and volumes.

Table 1: Hazardous Liquid Waste Information

Sample ID	Drum/pail ID & Location	Volume
19-WaCD-01	Compressor bldg. (01)	10 L pail
19-WaCD-02	Compressor bldg. (02)	50 L barrel
19-WaCD-03	Compressor bldg. (03)	12 L pail

Laboratory analyses are provided in Attachment B.

8.4 Solid Hazardous Materials

No solid hazardous materials were identified at the site, however, the explosives storage shed at the upper (north) end of the site was locked and its contents were not inventoried.

9. WATER QUALITY

The runoff channel from the 400 level adit has formed a permanent channel from the portal. Water flow from the adit was estimated at approximately 5 L/sec. This water was sampled (19-WQ-ACD-01). The water disappeared into the ground within 120 m of the adit. At the time of the site visit, water was flowing at surface only for approximately the first 120 m. The channel was followed for approximately 400 m and it appears to enter Christal Lake, greater than 1 km downstream.

Samples were also collected from Christal Lake, however, other mine sites and activities would impact on the quality of the lake including the Mackeno tailings which were disposed of directly into the lake.

Laboratory analyses are provided in Attachment B.

10. RECLAMATION

There has been no reclamation at the upper camp site and pits and it is possible that this site may continue to be mined in the future. Buildings at the lower area have deteriorated over the years and there appears to have been significant salvaging of materials from the property. Materials from building 19G have recently been burned and only buildings 19E and 19H remain intact. Rail and trestle at the portal have been removed and the rail stockpiled at the site. Much of the surrounding area is covered in thick second growth, however, the site itself remains unvegetated. The middle area of buildings 19J to 19M does not appear to have ever been extensively used. This area is covered in extensive second growth.

11. OTHER SOURCES OF INFORMATION AND DATA

Note that people live very close to the 400 level portal, in old mine buildings within approximately 100 m of the portal.

12. REFERENCES AND PERSONAL COMMUNICATIONS

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

		Detection Limit	Units	19-WaCD-01	19-WaCD-02	19-WaCD-03	19-SLCD-01	19-SLCD-02	19-SLCD-03 - Onek
PCBs									
Total PCBs		0.1	ppm	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH in Saturated Paste									
pH		0.1	pH	na	na	na	5.9	6.8	6.5
pH in Soil (1:2 water)									
pH		0.01	pH	na	na	na	6.31	6.5	6.6
ICP Semi-Trace Scan - Metals									
	Aluminum	10	µg/g wet	<10	42	<10	53000	39000	10100
	Antimony	4	µg/g wet	<4	<4	6	160	55	160
	Arsenic	4	µg/g wet	<4	<4	<4	422	691	1040
	Barium	0.1	µg/g wet	8.2	3.44	12.9	858	576	111
	Beryllium	0.2	µg/g wet	<0.2	<0.2	<0.2	1	1	0.5
	Bismuth	10	µg/g wet	<10	<10	<10	10	<10	31
	Cadmium	0.2	µg/g wet	0.7	7.3	1	37	1220	1300
	Calcium	10	µg/g wet	970	229	1420	5150	21200	670
	Chromium	1	µg/g wet	1	2.2	1	80.5	68.7	13.2
	Cobalt	0.2	µg/g wet	<0.2	0.7	<0.2	12	19	10
	Copper	1	µg/g wet	55.4	389	51.2	315	488	714
	Iron	2	µg/g wet	490	570	43	87000	55000	27000
	Lead	2	µg/g wet	10	29	8	11700	2110	3980
	Lithium	1	µg/g wet	<1	<1	<1	33.2	24.9	2.9
	Magnesium	2	µg/g wet	7	32	10	4650	4080	546
	Manganese	1	µg/g wet	2.4	11	1	7580	3220	2490
	Mercury	0.02	µg/g wet	<0.02	<0.02	<0.02	<0.02	<0.02	2
	Molybdenum	2	µg/g wet	<2	<2	<2	6	9	5
	Nickel	0.4	µg/g wet	0.7	5	<0.4	36.5	47.4	9.7
	Phosphorus	10	µg/g wet	1530	503	1260	1170	1220	345
	Potassium	40	µg/g wet	<40	<40	<40	15000	10000	3290
	Selenium	4	µg/g wet	<4	<4	<4	<4	<4	<2
	Silicon	10	µg/g wet	910	590	<10	802	348	3670
	Silver	1	µg/g wet	<1	<1	<1	93.6	27.3	79.4
	Sodium	10	µg/g wet	<10	10	<10	3010	1500	198
	Strontium	2	µg/g wet	3	<2	3	99	130	9
	Sulphur	20	µg/g wet	5180	2390	4860	3340	69900	69000
	Thorium	2	µg/g wet	<2	<2	<2	<2	4	4
	Tin	2	µg/g wet	7	10	8	57	310	380
	Titanium	0.4	µg/g wet	1	3.1	3.2	549	96.7	32.5
	Uranium	10	µg/g wet	<10	<10	<10	<10	<10	<5
	Vanadium	2	µg/g wet	<2	<2	<2	96	67	16
	Zinc	1	µg/g wet	1570	337	1520	3950	93500	115000
	Zirconium	0.2	µg/g wet	<0.2	<0.2	<0.2	31.3	36.9	10.6

1999 Water Quality Results, Onek Site

Sample Number		Detection Limit	Units	19-WQ-ACD-01-Onek
Site Description				
pH (field)		0.01	pH	6.9
Conductivity (field)		0.01	µS/cm	830
Total Alkalinity		5	mg CaCO3/L	102
Chloride		0.5	mg/L	0.6
Electrical Conductivity		0.01	µS/cm	1200
Hardness (CaCO3 equiv)		5	mg/L	683
Nitrate-N		0.1	mg/L	<0.1
Nitrite-N		0.003	mg/L	0.003
pH		0.01	pH	7.28
Sulphate		0.5	mg/L	537
Total Dissolved Solids		5	mg/L	999
ICP-USN Total Metals Scan in Water				
	Aluminum	0.0008	mg/L	0.0074
	Antimony	0.005	mg/L	0.008
	Arsenic	0.01	mg/L	0.05
	Barium	0.00004	mg/L	0.00489
	Beryllium	0.00001	mg/L	<0.00001
	Bismuth	0.0004	mg/L	<0.0004
	Boron	0.002	mg/L	<0.002
	Cadmium	0.00006	mg/L	0.998
	Calcium	0.002	mg/L	204
	Chromium	0.00006	mg/L	<0.00006
	Cobalt	0.00003	mg/L	0.00922
	Copper	0.00003	mg/L	0.00364
	Iron	0.00001	mg/L	0.847
	Lead	0.0003	mg/L	0.0027
	Lithium	0.001	mg/L	0.021
	Magnesium	0.0005	mg/L	18.7
	Manganese	0.00002	mg/L	3.85
	Mercury	0.0001	mg/L	<0.0001
	Molybdenum	0.00007	mg/L	0.0003

Waste Rock Field Data Table

Location	Sample ID	paste pH	Conductivity
30 m NW of adit	19_WR_TPBM_01	5.3	5.30 mS
50 m NW of adit	19_WR_TPBM_02	3	0.97 mS
75m WSW of adit	"03"	6.1	1.28 mS
50 m S of adit	"04"	6.1	0.85 mS
Top of main SW pit dump	19_WR_TPBM_05	7.6	0.10 mS

		Detection Limit	Units	19-WaCD-01	19-WaCD-02	19-WaCD-03	19-SLCD-01	19-SLCD-02	19-SLCD-03 - Onek
PCBs									
Total PCBs		0.1	ppm	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH in Saturated Paste									
pH		0.1	pH	na	na	na	5.9	6.8	6.5
	Nickel	0.00001	mg/L	0.0268					
	Phosphorus	0.03	mg/L	<0.03					
	Potassium	0.4	mg/L	0.4					
	Selenium	0.004	mg/L	0.018					
	Silicon	0.004	mg/L	4.81					
	Silver	0.00005	mg/L	0.00031					
	Sodium	0.004	mg/L	1.2					
	Strontium	0.00002	mg/L	0.202					
	Sulphur	0.008	mg/L	188					
	Thallium	0.001	mg/L	0.006					
	Titanium	0.00002	mg/L	<0.00002					
	Vanadium	0.00003	mg/L	<0.00003					
	Zinc	0.0002	mg/L	24.2					
Total Arsenic by Hydride AA									
	Arsenic	0.0002	mg/L	<0.0002					
Total Selenium by Hydride AA									
	Selenium	0.0001	mg/L	<0.0001					

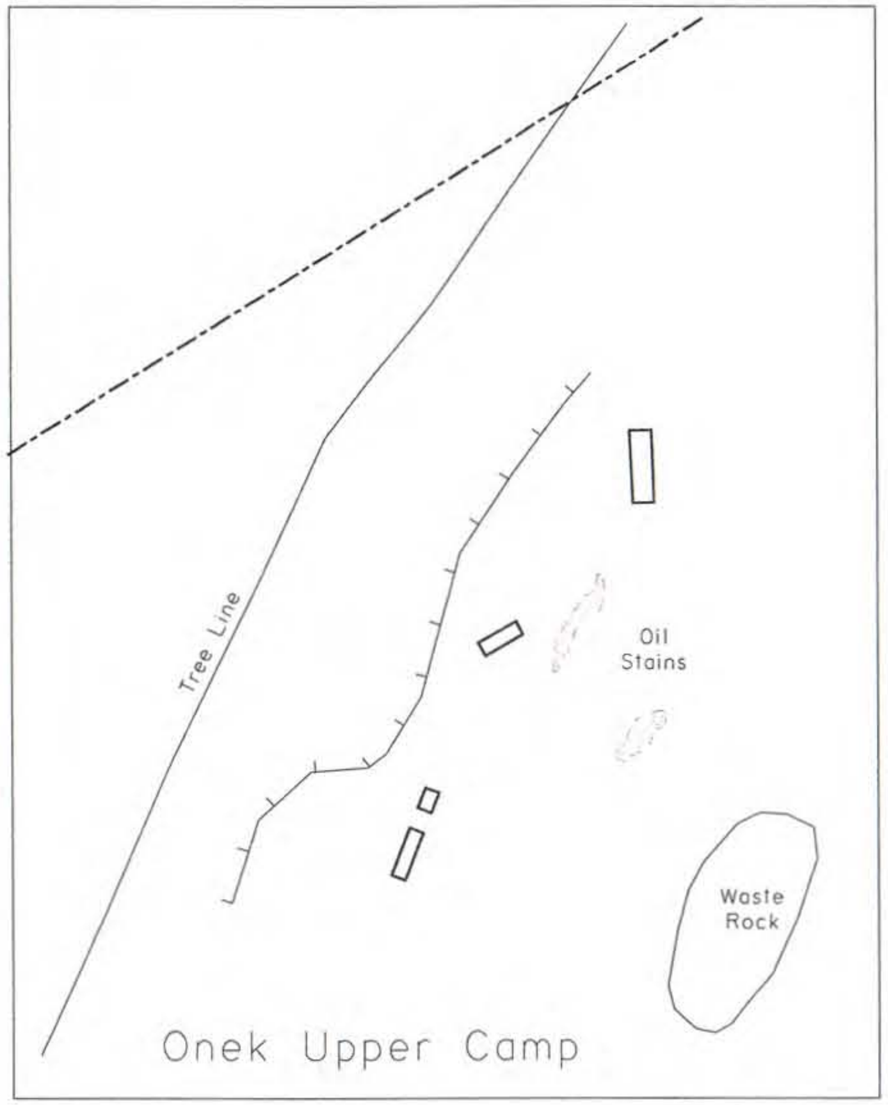
ATTACHMENT B: 1999 ONEK WASTE ROCK SAMPLES LABORATORY RESULTS				
Site Number	**Detection Limit**	**Units**	**19_WR_TPBM_01**	**19_WR_TPBM_02**
Sample Desciption			Waste rock pile associated with the 400 Level portal	Waste rock pile associated with the 400 Level portal
Paste pH (field)	N/A	pH	-	-
Conductivity (field'	N/A	µS/cm	-	-
pH in Saturated Paste				
pH	0.1	pH	4.7	3.6
pH in Soil (1:2 water)				
pH	0.01	pH	4.2	3.4
ICP Semi-Trace Scan				
Aluminum	5	µg/g	23800	19600
Antimony	2	µg/g	200	13
Arsenic	2	µg/g	1220	1230
Barium	0.05	µg/g	332	171
Beryllium	0.1	µg/g	<0.1	0.5
Bismuth	5	µg/g	27	8
Cadmium	0.1	µg/g	765	13.1
Calcium	5	µg/g	724	1050
Chromium	0.5	µg/g	30.8	33.2
Cobalt	0.1	µg/g	6.6	2.5
Copper	0.5	µg/g	1020	51.1
Iron	1	µg/g	110000	28000
Lead	1	µg/g	3860	670
Lithium	0.5	µg/g	6.4	10.4
Magnesium	1	µg/g	1290	766
Manganese	0.5	µg/g	15700	535
Mercury	0.01	µg/g	4.2	0.11
Molybdenum	1	µg/g	3	<1
Nickel	1	µg/g	10	7.9
Phosphorus	5	µg/g	494	520
Potassium	20	µg/g	8400	5400
Selenium	2	µg/g	<2	<2
Silicon	5	µg/g	250	414
Silver	0.5	µg/g	188	10.1
Sodium	5	µg/g	595	462
Strontium	1	µg/g	22	23
Sulphur	10	µg/g	43300	3950
Thorium	1	µg/g	<1	5
Tin	1	µg/g	360	41
Titanium	0.2	µg/g	53.8	28.2
Uranium	5	µg/g	<5	<5
Vanadium	1	µg/g	37	32
Zinc	0.5	µg/g	53800	1610
Zirconium	0.1	µg/g	19.8	11.9

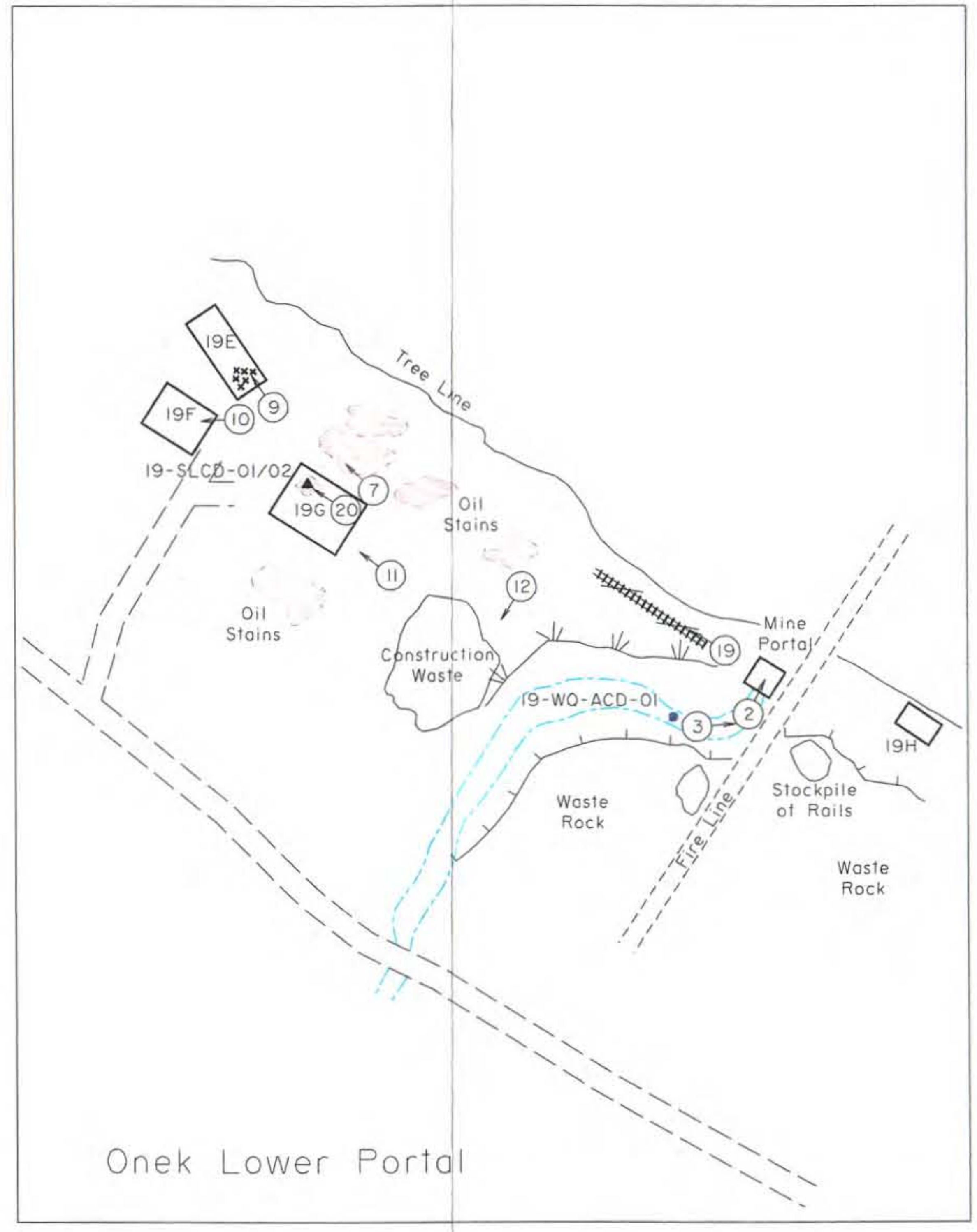
ATTACHMENT B: 1999 ONEK WASTE ROCK LABORATORY RESULTS MODIFIED SOBEK METHOD ACID-BASE ACCOUNTING TEST								
SAMPLE	**SITE DESCRIPTION**	**PASTE pH**	**S(T) %**	**S(SO4) %**	**AP**	**NP**	**NET NP**	**NP/AP**
19_WR_TPBM_01	Waste rock pile associated with the 400 Level portal	5.3	1.85	0.16	52.8	2.8	-50.1	0.1
19_WR_TPBM_02	Waste rock pile associated with the 400 Level portal	4.5	0.38	0.09	9.1	-0.9	-9.9	<0.1

AP = ACID POTENTIAL IN TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.
NP = NEUTRALIZATION POTENTIAL IN TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.
NET NP = NET NEUTRALIZATION POTENTIAL = TONNES $CaCO_3$ EQUIVALENT PER 1000 TONNES OF MATERIAL.
NOTE: WHEN S(T) AND/OR S(SO4) IS REPORTED AS <0.01, IT IS ASSUMED TO BE ZERO FOR THE AP CALCULATION.
N/D = NO DUPLICATE ASSAY. CALCULATIONS ARE BASED ON ASSAY RESULTS OF THE INITIAL SAMPLE.
RE = REPLICATE.

NOTE - A HIGH LEVEL OF SOLUBLE METALS (ESPECIALLY IRON) WERE OBSERVED IN MANY SAMPLES DURING THE ABA TITRATIONS.
SAMPLES WITH A NEGATIVE NET NP SHOULD BE TESTED FOR MOBILE METALS USING STANDARD SHAKE FLASK EXTRACTION TESTS.

Building (22A: building site present reference*) 22A* Indicates Asbestos Material
Collapsed Building
Adit
Collapsed Adit
Shaft
Collapsed/Backfilled Shaft
Mine Rock Dump
Bedrock Open Pit
Trench
Stripped Overburden Stockpile
Stripped / Disturbed Area
Outcrop Boundary
Highway
Road (gravel, 2 wheel drive)
Road (gravel, 4X4 accessible)
Road (inaccessible)
Trail
Culvert
24501-01 1999 Soil Sample (this study)
Pre 1999 Soil Sample (other sources)
25WR04-01 1999 Waste Rock Sample (this study)
Pre 1999 Waste Rock Sample (other sources)
WO-12-06 1999 Water Sample
Pre 1999 Water Sample
Tension Cracks
Mass Movement (note: for Forms: BelleKeno)
Groundwater Seep
Surface Water Flow (Stream, Creek, River)
Lake
Settling Pond / Water Treatment Pond
Tailings Dam / Tailings Pond / Mill Tails
Ponded Water / Trench
Barrels
Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
Mine Rails / Trestle
Collapsed Trestle
Solid Waste Disposal Site
Area of Soil Contamination
(6) Transformer Loaction (number of transformer in brackets)
Power Line
Power Line Collapsed
Aerial Transmission Towers
5 Photo Site (arrow shows view direction)
GPS Survey Location
Former Building Site (Elsa)





0 10 20 30 40
Scale 1:1000
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Public Works And Government Services Canada / Travaux publics et Services gouvernementaux Canada	designed by: / conçu par:	date:
Architectural & Engineering Services, Western Region	drawn by: / dessiné par: C.S.	Nov./99
	approved by: / approuvé par:	
Drawing title: / Titre du dessin: Onek Site #19 Site Assessment, Yukon Territory	revisions:	
	project no. / no. du projet: 125-12.01	dwg. no. / dessin no.: 1 of 1

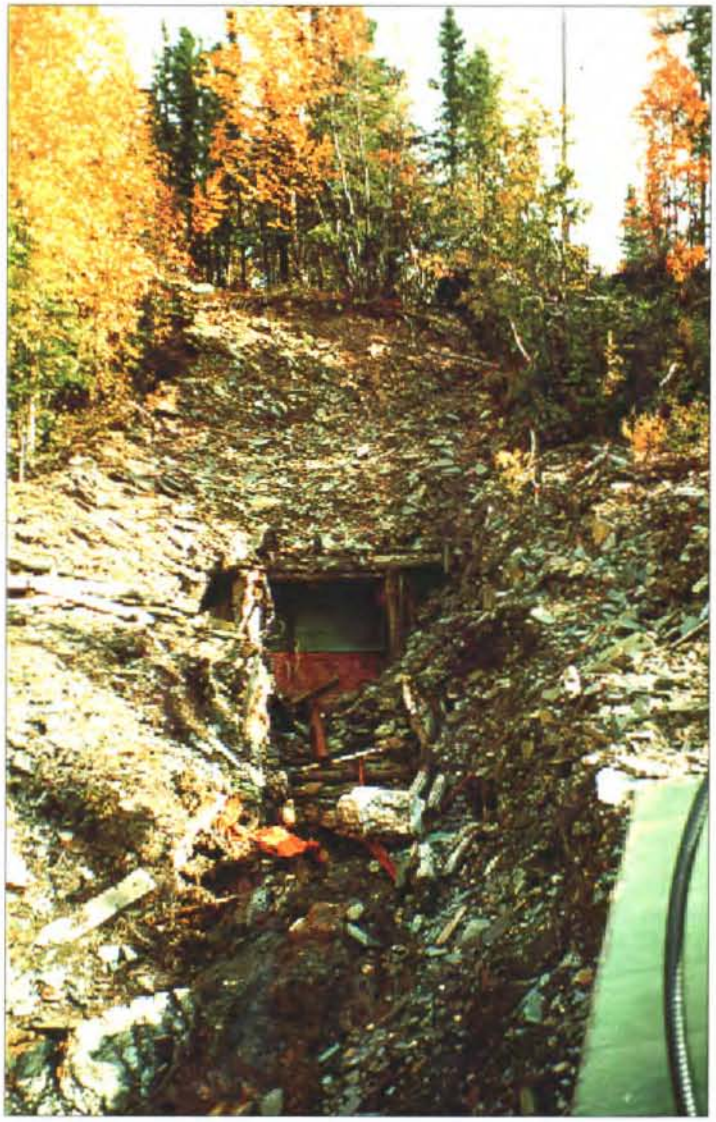


Photo 19-2: 400 level portal and runoff channel. Note debris at entrance.

Photo 19-3: Runoff channel below 200 level portal. Note adjacent waste rock.

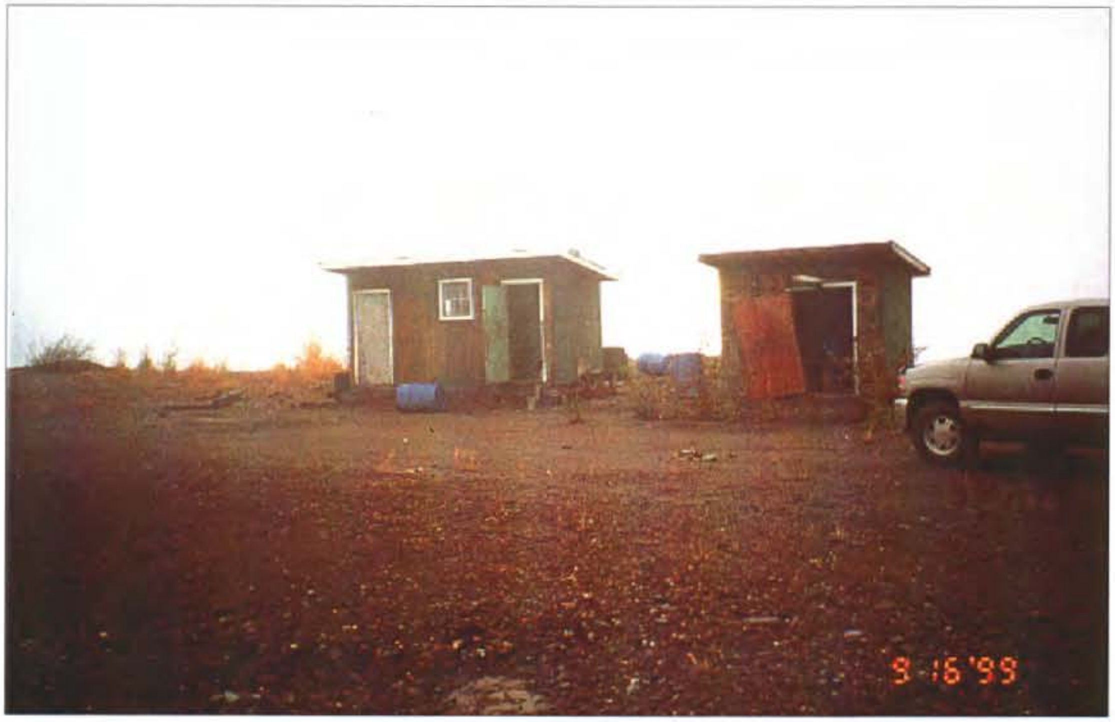


Photo 19-5: Buildings 19A & 19B at upper camp.

Photo 19-6: Buildings 19C & 19D at upper camp. Note oil staining in foreground.

Photo 19-7: Remains of building 19E at lower area. Note oil staining in foreground.

Photo 19-8: Equipment and staining in sumps at compressor building (19E).

Photo 19-9: Former storage area in building 19E where hazardous liquids stored.

Photo 19-10: Concrete foundation (building 19F) with much metal and debris.

Photo 19-11: Concrete foundation (building 19G) and much debris.

Photo 19-12: Construction waste debris remaining from demolition of building 19G.

Photo 19-13: Explosives shed above pit site.

Photo 19-14: Remains of building 19N at loading site below lower road.

Photo 19-15: Wood debris at loadout site.

Photo 19-16: Concrete foundation (building 19O) at loadout site.

Photo 19-17: Former trestle area at 400 level portal.

Photo 19-18: Solid waste dump at bottom of waste rock dump at upper camp.

Photo 19-19: Hydrocarbon containers and extensive staining inside building 19C.

Photo 19-20: Extensive staining in sumps at building 19G.

Klondyke Keno (# 20)

MINFILE# 105M 001v

1. LOCATION AND ACCESS

Klondyke Keno is located on the northwest slope of Keno Hill, approximately 1.5 km southwest of the Wernecke town site. Air Photo identification NW 95030-77. Approximate UTM coordinates are 7090700 m N 484700 m E. The elevation of the site is approximately 38500 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.

2. SITE PHYSIOGRAPHY

Klondyke Keno if 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.

3. GEOLOGY AND MINERALIZATION

The minfile indicates that the host rock for both veins at Klondyke Keno is greenstone. The east-west vein which produced the ore, is up to 1 m wide, and contains quartz, arsenopyrite, pyrite, galena, sphalerite, calcopyrite, and tetrahedrite in a siderite gangue.

4. SITE HISTORY

The date of the adit and shaft workings are unknown. Bulldozing, drilling, and shipping of ore occurred in the 1950's.

5. MINE DEVELOPMENT

There are two main workings at the Klondyke Keno site consist of two adits, three shafts, and bulldozer trenching. The Air photo indicates access roads leading to a third possible area of workings located due north, in line with the two identified adits. Three depressions located within ten meters of the upper adit are possibly the three shafts identified in the minfile. Site details can be found on the site map.

5.1 Mine Openings and Excavations

Lower Adit

There is a level, cleared area outside of the portal. Approximately 10 meters of the portal has collapsed behind the enterance. A steady flow of water is running out of the adit.

Location: The adit is located in the center of the Klondyke Keno main site.

Dimensions (W x H): The lower adit portal is 2.0m x 2.0m (roughly).

Supports: Timber was used to support the portal.

Condition: The portal entrance is standing, but has collapsed for approximately 10 meters behind the entrance

Accessibility: The adit is inaccessible.

Upper Adit

Adit has collapsed and filled with overburden. Identified by obvious trench leading in and 2 inch steel pipe leading out of collapsed entrance.

Location: Approximately 225m N (Az 16^0) from lower adit.

Dimensions (L x W x H): unknown

Condition collapsed

Accessibility: inaccessible.

5.2 Waste Rock Disposal Areas

Waste rock areas were located near the lower adit. The waste rock was located in three main areas, but appeared to be uniform in content. Small areas of minor iron staining were observed on the surface.

Waste rock pile #1

There was minor iron (Fe) staining on the surface of the waste rock pile; there is no evidence of oxidation below the surface. Observed lithological content included (1b)carbonaceous phyllite, (2b) thin banded, broken, quartzite with carbonaceous phyllite interbeds, and (4c) Quartz-siderite veins. Pyrite content was estimated at 0.5 %

Location: center of site, 50 south of lower adit.

Sampling: 30cm test pit was dug and sample #20-WR-01 was collected. Field paste pH and conductivity were 7.4 and 42 μS respectively.

Waste rock pile #2

There was minor iron (Fe) staining on the surface of the waste rock pile; there is no evidence of oxidation below the surface. Observed lithological content included (1b)carbonaceous phyllite, (4c)

Quartz-siderite veins, and amphibole-chlorite-plagioclase greenstone. Pyrite content was estimated at 0.5%

Location: 35 m southwest of lower adit.

Sampling: 30cm test pit was dug and sample #20-WR-02 was collected. Field paste pH and conductivity were 7.8 and 42 μS respectively. This sample was not sent for analysis.

5.3 Tailings Impoundments

No ore was processed at this site and no tailings were encountered.

5.4 Minesite Water Treatment

There was no water treatment observed on this site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There are several small collapsed buildings on this site (see map). Debris from four cabins including a bunkhouse, outhouse, and cooking area, is found in the southern portion of the site, approximately 110 meters south of lower adit. Debris from two buildings, including a core shack, is located in the northern area, near the lower adit.

Construction: wood frames, some roll asphalt shingle, and metal fittings.

Paint: none observed

Asbestos: none observed

Foundation: none

Non-Hazardous Contents: miscellaneous scrap metal, fabric.

Hazardous Contents: none observed

6.2 Fuel Storage

Three heating oil drums located on wood platform at the Southern area of the site. Approximately 150 meters of 2" steel pipes lead from drum platform to collapsed cabins and lower adit area. All lines and drums are empty.

6.3 Rail and Trestle

Rail remnants leading from lower adit.

Fabrication: steel rail and wooden ties

Amount of materials: volume of material approx. 0.25 m^3.

Condition: Rail in decent condition, no apparent safety concerns.

6.4 Milling and Processing Infrastructure

No ore was processed at this site and no tailings were encountered.
Collapsed core shack was located approximately 30 meters NNW from lower adit. Cores were scattered throughout the debris.

6.5 Electrical Equipment

No electrical equipment was encountered at this site.

7. SOLID WASTE DUMPS

No large solid waste dumps were encountered at this site. Some empty drums and debris were observed down slope of waste rock pile #2.

8. POTENTIAL CONTAMINANTS OF CONCERN

No hazardous materials were encountered on this site. The only contaminants of concern would be the possibility of dissolved metals seeping or washing from the waste rock, or the seep from the adit.

9. WATER QUALITY

There is a steady stream flowing from the lower adit, across the waste rock and continuing westward. A sample was taken at the point nearest the adit (20-WS-1, 20-WS-2; field pH 7.6, cond 0.21 ms). The stream had no suspended particulate and no precipitation of metals was observed.

10. RECLAMATION

Natural revegetation is occurring in the trenches and on the roads. The waste rock piles have very little vegetation growing on them.

11. OTHER SOURCES OF INFORMATION AND DATA

No other sources of information and data were identified.

12. REFERENCES

Minfile #105M001v

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. *United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI.* Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

ATTACHMENT A: Klondyke Keno (#20) WATER SAMPLES LABORATORY RESULTS				
Sample Number	**Detection Limit**	**Units**	**20-WS-01 18/9**	**20-WS-0218/9**
Site Desciption				**Duplicate**
pH (field)	N/A	pH	7.4	7.8
Conductivity (field)	N/A	µS/cm	420	130
pH (Lab)	0.01	pH	7.33	7.44
Conductivity (Lab)	0.01	µS/cm	600	600
Total Alkalinity	5	mg CaCO3/L	197	197
Chloride	0.25	mg/L	<0.25	<0.25
Hardness (CaCO3 equiv)	5	mg/L	351	358
Nitrate-N	0.05	mg/L	<0.05	<0.05
Nitrite-N	0.003	mg/L	<0.003	<0.003
Sulphate	1	mg/L	115	116
Total Dissolved Solids	5	mg/L	391	375
Analysis by ICP-USN				
Aluminum	0.0008	mg/L	0.0071	0.0093
Antimony	0.005	mg/L	<0.005	<0.005
Arsenic	0.01	mg/L	<0.01	<0.01
Barium	0.00004	mg/L	0.0156	0.0155
Beryllium	0.00001	mg/L	<0.00001	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004
Boron	0.002	mg/L	<0.002	<0.002
Cadmium	0.00006	mg/L	0.00014	0.00016
Calcium	0.002	mg/L	75.1	75.7
Chromium	0.00006	mg/L	0.00021	0.00017
Cobalt	0.00003	mg/L	<0.00003	<0.00003
Copper	0.00003	mg/L	0.0009	0.00079
Iron	0.00001	mg/L	0.021	0.022
Lead	0.0003	mg/L	<0.0003	0.0006
Lithium	0.001	mg/L	0.009	0.008
Magnesium	0.0005	mg/L	33.1	33.4
Manganese	0.00002	mg/L	0.00464	0.00538
Mercury	0.0001	mg/L	<0.0001	<0.0001
Molybdenum	0.00007	mg/L	0.00847	0.00836
Nickel	0.00001	mg/L	0.0015	0.0015
Phosphorus	0.03	mg/L	<0.03	<0.03
Potassium	0.4	mg/L	<0.4	<0.4
Selenium	0.004	mg/L	<0.004	<0.004
Silicon	0.004	mg/L	3.87	3.87
Silver	0.00005	mg/L	<0.00005	<0.00005
Sodium	0.004	mg/L	2.2	2.2
Strontium	0.00002	mg/L	0.396	0.392
Sulphur	0.008	mg/L	36.6	36.4
Thallium	0.001	mg/L	<0.001	<0.001
Titanium	0.00002	mg/L	<0.00002	0.0001
Vanadium	0.00003	mg/L	<0.00003	<0.00003
Zinc	0.0002	mg/L	0.0159	0.0145
Analysis by Hydride AA				
Arsenic	0.0002	mg/L	0.0007	0.0009
Selenium	0.0001	mg/L	0.0002	0.0002

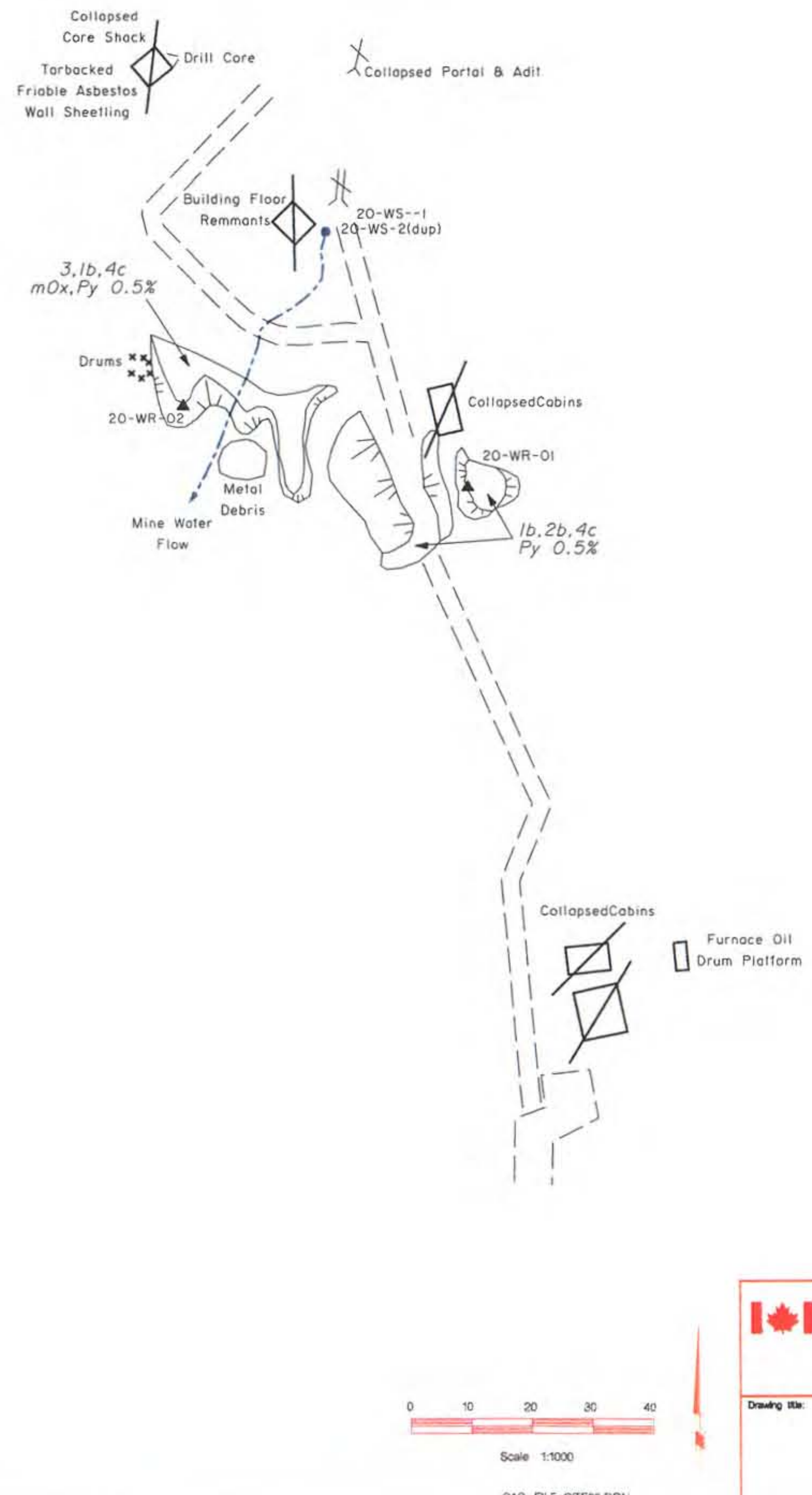
ATTACHMENT A: Klondyke Keno (#20) WASTE ROCK SAMPLES LABORATORY RESULTS			
Site Number	Detection Limit	Units	20-WR-01 - Klondike KENO - 5-20cm - 18/9/99 - Waste
Sample Desciption			
Paste pH (field)	N/A	pH	
Conductivity (field)	N/A	µS/cm	
pH in Saturated Paste			
pH	0.1	pH	7.2
pH in Soil (1:2 water)			
pH	0.01	pH	7.2
ICP Semi-Trace Scan			
Aluminum	5	µg/g	23600
Antimony	2	µg/g	4
Arsenic	2	µg/g	75
Barium	0.05	µg/g	173
Beryllium	0.1	µg/g	0.5
Bismuth	5	µg/g	<5
Cadmium	0.1	µg/g	67.7
Calcium	5	µg/g	15700
Chromium	0.5	µg/g	22.6
Cobalt	0.1	µg/g	16.7
Copper	0.5	µg/g	50.8
Iron	1	µg/g	43000
Lead	1	µg/g	239
Lithium	0.5	µg/g	13
Magnesium	1	µg/g	8910
Manganese	0.5	µg/g	2190
Mercury	0.01	µg/g	<0.01
Molybdenum	1	µg/g	13
Nickel	1	µg/g	50.1
Phosphorus	5	µg/g	1510
Potassium	20	µg/g	6100
Selenium	2	µg/g	<2
Silicon	5	µg/g	530
Silver	0.5	µg/g	17
Sodium	5	µg/g	384
Strontium	1	µg/g	38
Sulphur	10	µg/g	18500
Thorium	1	µg/g	<1
Tin	1	µg/g	2
Titanium	0.2	µg/g	53.1
Uranium	5	µg/g	<5
Vanadium	1	µg/g	30
Zinc	0.5	µg/g	5900
Zirconium	0.1	µg/g	42.9

ATTACHMENT A: 1999 Klondyke Keno (#20) WASTE ROCK LABORATORY RESULTS MODIFIED SOBEK METHOD ACID-BASE ACCOUNTING TEST								
SAMPLE	SITE DESCRIPTION	PASTE pH	S(T) %	S(SO4) %	AP	NP	NET NP	NP/AP
20-Wr-01 - Klondike KENO -5-20cm - 18/9/99 - Waste		7.9	1.09	0.06	32.2	62.8	30.6	1.9
20-Wr-01 - Klondike KENO -5-20cm - 18/9/99 - Waste RE		-	1.10	0.05	32.8	-	-	-

AP = ACID POTENTIAL IN TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.
NP = NEUTRALIZATION POTENTIAL IN TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.
NET NP = NET NEUTRALIZATION POTENTIAL = TONNES CaCO3 EQUIVALENT PER 1000 TONNES OF MATERIAL.
NOTE: WHEN S(T) AND/OR S(SO4) IS REPORTED AS <0.01, IT IS ASSUMED TO BE ZERO FOR THE AP CALCULATION.
N/D = NO DUPLICATE ASSAY. CALCULATIONS ARE BASED ON ASSAY RESULTS OF THE INITIAL SAMPLE.
RE = REPLICATE.

NOTE - A HIGH LEVEL OF SOLUBLE METALS (ESPECIALLY IRON) WERE OBSERVED IN MANY SAMPLES DURING THE ABA TI
SAMPLES WITH A NEGATIVE NET NP SHOULD BE TESTED FOR MOBILE METALS USING STANDARD SHAKE FLASK

- Building (22A: building site present reference*) 22A* Indicates Asbestos Material
- Collapsed Building
- Adit
- Collapsed Adit
- Shaft
- Collapsed/Backfilled Shaft
- Mine Rock Dump
- Bedrock Open Pit
- Trench
- Stripped Overburden Stockpile
- Stripped / Disturbed Area
- Outcrop Boundary
- Highway
- Road (gravel, 2 wheel drive)
- Road (gravel, 4X4 accessible)
- Road (inaccessible)
- Trail
- Culvert
- 24501-01 1999 Soil Sample (this study)
- Pre 1999 Soil Sample (other sources)
- 25WR04-01 1999 Waste Rock Sample (this study)
- Pre 1999 Waste Rock Sample (other sources)
- WO-12-06 1999 Water Sample
- Pre 1999 Water Sample
- Tension Cracks
- Mass Movement (note: for Forms: BelleKeno)
- Groundwater Seep
- Surface Water Flow (Stream, Creek, River)
- Lake
- Settling Pond / Water Treatment Pond
- Tailings Dam / Tailings Pond / Mill Tails
- Ponded Water / Trench
- Barrels
- Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
- Mine Rails / Trestle
- Collapsed Trestle
- Solid Waste Disposal Site
- Area of Soil Contamination
- (6) Transformer Loaction (number of transformer in brackets)
- Power Line
- Power Line Collapsed
- Aerial Transmission Towers
- Photo Site (arrow shows view direction)
- GPS Survey Location
- Former Building Site (Elsa)



Waste Rock Geological Legend

This legend intended for use as a key to the observed lithological content of the mine dumps and stockpiles of surficial materials investigated. It does not represent regional stratigraphy and no stratigraphic sequence is implied.

Pyrite content as percent: eg. Py 2%. Occurs as an alteration halo adjacent to vein fault structure.

Oxidation: Weak (wOx), moderate (mOx) and intense (iOx).

Quarternary: (5) Undifferentiated, unconsolidated colluvium, glacial till.

Veins:
- *(4a) Quartz veins;*
- *(4b) Quartz-pyrite veins;*
- *(4c) Quartz-siderite +trace galena-sphalerite veins;*
- *(4d) Siderite-quartz +trace galena-sphalerite veins;*
- *(4e) Suphide (galena-sphalerite) +quartz+siderite veins.*

Greenstone: (3) Amphibole-chlorite-plagioclase metadiorite or metagabbro.

Quartzite:
- *(2a) Thick beded, blocky gray quartzite;*
- *(2b) Thin banded, broken, quartzite with carbonaceous phyllite interbeds;*
- *(2c) Calcareous quartzite.*

Phyllite:
- *(1a) Broken sericite-chlorite phyllite;*
- *(1b) Carbonaceous phyllite.*

Public Works And Government Services Canada / Travaux publics et Services gouvernementaux Canada	designed by: / concu par:
Architectural & Engineering Services, Western Region	drawn by: / dessine par: C.S. — date: Nov./99
	approved by: / approuve par:
Drawing title: / Titre du dessin: Klondike-Keno Site #20, Site Assessment, Yukon Territory	revisions:
	project no. / no. du projet: 125-12.01 — dwg. no. / dessin no.: 1 of 1