

SADIE LADUE/WERNECKE CAMP

SITE #21

MINFILE 105001w,x

1. LOCATION AND ACCESS

The Sadie-Ladue mine site is located on the northwest slopes of Keno Hill at an elevation of 1,260m. The mine workings are spread across a number of claims and more than 700m northeast-southwest in what has become known as the Wernecke Camp. UTM coordinates for the centre of the Wernecke Camp are 7,092,000m north and 486,400m east. The Wernecke Camp site is located 5.7km along the two-wheel drive Wernecke Road from the Wernecke Road/Keno Mine Road junction in Keno City.

2. SITE PHYSIOGRAPHY

The area surrounding Wernecke slopes moderately at roughly 7° to the northwest. Soils are poorly developed, consisting of discontinuous deposits of decomposed weathered bedrock and glacial till. The area of the camp itself is highly disturbed, the result of many years of mining. Permafrost is discontinuous in areas of northerly aspect. A previous study (McTaggart, 1960; cited in UKHM, 1996) reported that permafrost was noted to a depth of 80m in the area.

Surface water on the site is limited to seeps and ponded, stagnant groundwater. All the mine water is drained from the workings out the Sadie-Ladue 600 level (site #77) located approximately 800m to the north at an elevation of 1100m. The water from the Sadie-Ladue 600 drains down a gully to a lake at the head of Ladue Creek in the valley bottom (elevation of 750m). The gully is dry above the Sadie-Ladue 600 all the way up to the Wernecke site. Roadcut seeps collect and run west along the Wernecke Road ditch line beginning at the Lucky Queen road turnoff. A single seep was observed draining from above the Sadie mine area and the Lucky Queen road. Seeps are common along road cuts in the area, specifically the Wernecke Road and the Lower Faro Gulch Trail. Stagnant groundwater has collected in bedrock pits at the west and east ends of the site. The Wernecke area is located more than 650m west of Gambler Gulch, the nearest significant drainage.

3. GEOLOGY AND MINERALIZATION

The Sadie-Ladue mine is situated along the contact of Devonian-Mississippian Earn Group carbonaceous phyllite and overlying meta-volcanic quartz-sericite-chlorite schists (Roots & Murphy, 1992). Silver and lead rich quartz-siderite veins occur along the contact between the phyllitic quartzites and a large concordant greenstone (gabbro) intrusive body. Mineralization consists of galena, sphalerite, freibergite and a range of other minor minerals.

The Wernecke camp is in an area of anomalously elevated metals values (Boyle, 1965; Gleeson & Boyle, 1980; both cited in UKHM, 1996). The host phyllites and schists have geochemical signatures that are anomalous in

PB, Zn, Cu, As, Sb, Mo and Ba. Significantly elevated levels of Ti, Ni, Co, Cu appear to be associated with the greenstones. High metal concentrations associated with the vein occurrences include silver, lead, zinc, copper, cadmium and antimony. Similar metal associations are reported for ore from the Lucky Queen mine (site #26) which was also processed on the site.

4. SITE HISTORY

The Sadie-Friendship and Ladue mines were begun as separate operations in 1921 by Keno Hill Limited (KHL) and the Treadwell Yukon Company, Ltd. (TYCL), respectively. In 1923 the Ladue mine was flooded by excess water, requiring development of the Ladue 600 level waste and drainage tunnel (Sadie-Ladue 600; site #77). In 1924, TYCL optioned the Sadie-Friendship mine and amalgamated the operation of the two mines. The Wernecke camp and mill site were built in that same year to service the what then became known as the Sadie-Ladue mine.

Mining continued on the Sadie-Ladue mine until 1929. All ore was hauled up shafts to surface, while most of the waste rock and all mine drainage was removed out the Sadie-Ladue 600 Level. The mill operated from 1925 to 1932, processing ore from the Sadie-Ladue and later the Lucky Queen (site #26) mines. Ore from the Lucky Queen located 2.5km to the south was brought by aerial tram to the Wernecke. Tailings from the mill were initially contained in a small pond structure below the mill. Later the tails were allowed to flow down the dry gully below the site to a lake at the head of Ladue Creek in the valley below. The Wernecke tailings (site #80) now fill roughly a quarter of the lake. Tails material was observed along the upper sections of the gully above the Sadie-Ladue 600. The Wernecke mill was dismantled and moved to the Elsa mine site (site #3) in 1935-36.

The Wernecke camp was a small town extending over an area of over 32ha with bunkhouses, various residences, cabins, a mess hall and kitchen and a recreation hall, complete with bowling alley. Mine buildings included warehouses, powerhouse, boiler house, assay office and the mill itself. Over 18 buildings remain on the site in various states of disrepair.

In the 1980s, Archer Cathro & Associates Ltd. optioned the site and began a program of mining the mine crown pillars from surface. The Sadie and Ladue mine areas were extensively stripped of overburden and a series of pits and trenches were established during this phase of work. All ore recovered was shipped off site.

United Keno Hill Mines Ltd. has been monitoring the Sadie-Ladue mine waters at the Saddle-Ladue 600 level adit since 1985 (UKHM, 1996). An initial environmental site investigation was conducted on the site by the Department of Indian and Northern Development (DIAND) Technical Services Branch in 1993. In 1996, a more detailed environmental assessment was conducted of the site by Norecol, Dames and Moore, Inc. (NDM, 1997)

for Public Works and Government Services Canada (PWGSC). The work reported in this 1999 study was conducted to update the environmental inventory and baseline data of the site.

The site is part of a local tourism network of trails and selected historic mine sites. Access to the site is actively promoted in pamphlets provided to the public.

5. MINE DEVELOPMENT

The Wernecke camp area can be divided into halves: the Ladue portion on the northeast end and the Sadie portion on the southwest end. The Sadie portion is located roughly 125m southeast and parallel to the Wernecke Road as it approaches the Ladue portion of the site. Mining operations in the Wernecke Camp site has progressed in three episodes. Most of the underground development was completed from 1925 to 1929. Two shafts at each of the Sadie and the Ladue mines provided access to extensive underground workings on six levels. A raise (probable manway) on the Ladue portion and reported open stopes are also present. Waste rock piles associated with the original mining is present at the east end of the site. Rehabilitation work conducted in the 1960s on the 600 level had little effect on the Wernecke Camp area. Surface trenching and open pit mining in the 1980s resulting in the most significant surface disturbances on the site. This work included the development of 4 small pits, over 10 trenches and five large dumps of striped overburden and waste rock. A collapsed stope is also present on the Ladue portion of the site.

5.1 Mine Openings and Excavations

Four shafts, a possible raise and 4 pits are described in this section. Due to there being more than ten, the trenches are described in general terms only. The Sadie-Ladue 600 level adit is not described here (see site #77).

No. 1 Shaft (Photo 21-1, 21-2 21-3)

Description: The shaft headframe structure has been completely removed, the shaft partially backfill and opening sealed with wood planks. The shaft is still partially open to roughly 5m depth. Recent (1980s) stripping work may have reduced the elevation of the shaft collar by over 1m.

Location: Located on the flat, excavated area at the base of the slope below the managers house, the old headframe structure and outhouse.

Dimensions: Dimensions of the shaft collar are 1.2m by 1.4m. The shaft is open to a depth of roughly 5m, although it is partially filled with rock.

Supports: There are no square set timber supports in the collar of the shaft. Two timbers protrude out the collar and the opening is decked over with planking.

Condition: The shaft poses some safety risks due to loose rock. The plank cover is reasonably sound.

Accessibility: The Shaft is not accessible, although the planking could be easily pried up. The shaft opening is partially blocked by loose rock.

Raise/Manway (Photo 21-2)

Description: A hole into bedrock is visible below the outhouse. It is largely filled with loose rock, but may have been a raise or manway.

Location: The possible raise is located just west of the manager's house and above the Shaft #2 on a rocky knob. The outhouse is situated over the opening.

Dimensions: The opening is roughly 1.2m square and 0.7m deep.

Supports: There are no supports present.

Condition: The opening poses no obvious safety risks.

Accessibility: The opening is filled with loose rock and is inaccessible.

Ladue Shaft #1, Sadie Shafts #1 and #2

Three other shafts existed on the site. These have all been back filled and the sites recontoured. They are discussed generally below.

Description: The Ladue #1, Sadie #1 and the Sadie #2 shafts have all backfilled and all related structures have been removed. The sites are not easily located now.

Location: Ladue #1: roughly 150m northwest of the Ladue #2 shaft adjacent to the steeper slope. Site marked by a small pile of waste rock and scattered mine timbers.

Sadie #1: Shaft was located just north of the road to the Lucky Queen. The site has been extensively disturbed by trenching and striping and is not identifiable now.

Sadie #2: The shaft was located roughly 135m southwest of the Sadie #2. The exact site is not now identifiable.

Dimensions: Not available.

Supports: Not available.

Condition: All sites backfilled.

Accessibility: All sites backfilled. All sites inaccessible.

Collapsed Slope (Photo 21-1, 21-4)

Description: Collapsed ground resulting from failure of the underground workings below.

Location: Located between Shaft #2 and Pit #1, approximately 15m north-east of Pit #1.

Dimensions: The opening is approximately 7m long x 4m wide. The cavity formed is approximately 2m high and extends up to 5m underground.

Condition: The site geology consists of near flat lying quartzites with phyllitic partings that have fallen off in slabs into the abandoned workings below, forming the cavity. Slabs of rock up to 50kg are

loose in the backs (roof) of the opening and pose a serious risk to persons entering. No signs have been posted identifying the hazard.

Accessibility: The site is easily accessible.

Open Pit #1 (Photo 21-1, 21-5)

Description: The largest pit on site oriented roughly azimuth 045°; developed in the 1980s to mine ore left behind by the original mining. Benched down in two levels. The southeast wall is the highest with a vertical lift of over 6m. The bottom of the pit is dry.

Location: Located on southwest end of the Ladue portion of site, approximately 80m southwest of the Ladue #2 shaft.

Dimensions: The pit has been developed in two bench levels. The upper bench is approximately 40m wide by 80m long and varies 3m to 4m deep. The lower bench varies between 10m and 20m wide by up to 50m long. The lower level is between 2 and 4m deep.

Condition: The pit is stable, although loose rock is common on most level surfaces.

Accessibility: The pit is easily accessible.

Open Pit #4 (Photo 21-6)

Description: Pit #4 may be a trench where no ore was removed, although it is excavated into bedrock. The east end of it is filled with water from groundwater seeps. There is no surface inflow of outflow.

Location: Pit #4 is located at the far northeast end of the site.

Dimensions: The pit is over 80m long and average 10m wide. It is between 1m and 3m deep.

Condition: Stable.

Accessibility: Easily accessible.

Open Pit #2, Open Pit #3, Open Pit # 5

The three remaining pits are small and described here together. They were all developed in the 1980s.

Description: Pits #2, #3 and #5 represent small excavations, possible sites where no ore was mined.

Location: Pit #2 and #3: located in the middle of the Ladue portion of the site, 15m apart and approximately 150m northeast of Pit #1. Pit #2 is west of Pit #3.

Pit #5: located in the Sadie portion of the site, roughly 75m southwest of the Lucky Queen road.

Dimensions: Pit #2: 10m long x 3m wide x 3m deep.

Pit #3: 15m long x 5m wide x 6m deep.

Pit #5: 20m long x 5m wide x 1m to 2m deep.

Condition: All sites are stable.

Accessibility: All sites are easily accessible.

Trenches

There are over 10 bulldozer trenches on the Sadie portion of the site. The trenches were not individually inventoried and are described below in general terms only.

Description: The trenches are all generally cut through the overburden to outcrop below and are oriented at a variety of azimuths.

Location: The trenches occur within an area of stripped overburden 75m wide and extending 200m out both sides of the Lucky Queen Road.

Dimensions: The trenches vary in length from 20m and 100m, but are all 4m wide and 1 to 2 metres deep.

Condition: All stable.

Accessibility: All easily accessible.

5.2 Waste Rock Disposal Areas

There are eight waste rock disposal areas, numbered WR-01 beginning at the northeast end in the Ladue area to WR-8 at the southwest end of the Sadie area. They are grouped below based on location, composition and source. No water was observed draining through or over any of the waste rock piles on the site.

Waste Rock Pile WR-01 and WR-02

Description: WR-01 and WR-02 are from the original development work of the Ladue mine, prior to construction of the Sadie-Ladue 600 level. They are composed of phyllite with minor quartzite interbeds and greenstone ranging in size from less than 0.5cm to 5cm. Pyrite and quartz vein material are present in minor amounts only. Oxidation is minor and there is minimal iron staining. No surface or subsurface water was noted draining from the waste rock piles. WR-01 has been naturally re-vegetated by alders; WR-02 has no vegetation.

Location: WR-01 is located at the extreme northeast end of the site along the start of the lower Faro Gulch Trail. WR-02 is located approximately 100m southwest of WR-01.

Dimensions: WR-01: (150m long) x (25m to 45m wide) x (2m to 5m high).

WR-02: (50m long) x (40m wide) x (3m to 5m high)

Sampling: No samples were collected in 1999.

1996 sampling (Norecol, 1997; see Attachments):

Pile WR-01 Sample: 1996WWR7

Pile WR-02 Sample: 1996WWR6

Waste Rock Pile WR-03

Description: WR-03 is comprised of phyllite and greenstone excavated from Pit #1. Material ranges in size from less than 0.5cm to over 25cm and contains minor amounts of pyrite and quartz vein.

Oxidation is minor and there is minimal iron staining. No surface or subsurface water was noted draining from the waste rock piles. Only minor willow vegetation is present.

Location: Located immediately southeast of Pit #1.

Dimensions: 100m long x 25m wide x (2m to 3m) high

Sampling: No samples were collected in 1999.

1996 sampling (Norecol, 1997; see Attachments):

Pile WR-03 Samples: 1996WWR2

1996WWR4

Waste Rock Piles WR-04, WR-05, WR-06, WR-07 and WR-08

Description: WR-04, -05, -06, -07 and -08 are mostly comprised of stripped overburden material (primarily residual soils and till) mixed with varying percentages of waste rock from mining. The northeast half of pile WR-04 is composed of up to 70% reworked mine waste rock, compared to only 30% on the southwest half. Piles WR-05 and WR-07 are primarily composed of stripped overburden. Piles WR-06 and -08 consist of between 20% and 30% reworked mine. No surface or subsurface water was noted draining from the waste rock piles. All of the piles are fairly recent (1980s) and have little vegetation cover.

Location: WR-04: Extends along main portion of site from Pit #1 northeast to the area of Pit #3
WR-05: Immediately southeast of WR-03 and Pit #1. Consists of material stripped from the Pit #1 area.

WR-06 to -08: Located around the perimeter of the Sadie portion of the site, moving from the northeast to the southwest. They are associated with the excavation of the trenches and Pit #5.

Dimensions: All dimensions approximate.

WR-04: (250m long) x (50m to 70m wide) x (0.5 to 3m high)

WR-05: (75m long) x (30m wide) x (2m high)

WR-06: (100m long) x (100m wide) x (1m to 2m high)

WR-07: (75m long) x (10m to 20m wide) x (2m high)

WR-08: (80m long) x (30m wide) x (1m to 3m high)

Sampling: No samples were collected on any of these waste rock piles in 1999, or as part of any previously reported investigation.

5.3 Tailings Impoundments

Tails from the Wernecke mill were allowed to flow down the slope below the site. The tails are now spread on the slope from the site all the way to a small lake situated at the headwater of Ladue Creek in the valley below. A delta comprised of tails fills up roughly 6ha of the lake (see Site #80 for a full description). Some attempt to contain the tails in a small impoundment structure, although most of the tails are spread down the slope below.

Tailings Impoundment Structure (Photo 26-7)

Description: Constructed out of sheet metal supported by wooden fence posts, the structure provided only limited physical confinement of the tails. The structure was not sealed against leakage or overflows. The structure is now largely collapsed. The tails material has a medium to coarse sand texture and is moderately to strongly oxidized.

Location: Located directly below waste rock pile WR-04, roughly 50m southwest of the road down to the Sadie-Ladue 600 adit site.

Dimensions: (60m long) x (20m wide) x (1m to 2.5m high)

Samples: No samples were taken in 1999 or any as part of any other study of the tails in the impoundment structure.

Tailings Deposits

Description: The slope west of the road between the Sadie-Ladue 600 and the Wernecke camp is covered with a fan of tails material up to 0.3m deep. The tails material is similar to that found in the impoundment structure above. The tails were deposited directly on the slope or were allowed to overflow the impoundment structure and are not immersed in water.

Location: Located directly below the tailings impoundment structure. The road down to the Sadie-Ladue 600 level forms the east boundary of the dispersion fan.

Area: The total area of tailings material is not accurately know. The area outlined is based on aerial photo interpretation and was not investigated.
(300m long) x (150m wide) x (0.1m to 0.3m thick)

Structures: There are no associated pumping facilities, piping ore decant structures associated with the tails material.

Samples: A paste pH field test was conducted on a sample of tails material in 1999:

Sample 21T01-01 pH: 6.4

Conductivity: 120 μ S/cm

A soil sample collected in 1996 was analyzed for metals (Norecol, 1997; see Attachments):

Sample 1996WS2

No acid-base accounting (ABA) analysis has been conducted on the tails material in either 1999 or previously.

5.4 Mine Site Water Treatment

No water treatment facilities are present at the Wernecke site.

6. MINE SITE INFRASTRUCTURE

Mine infrastructure includes the remains of over 18 buildings only. All other facilities, such as the mill, power plants, fuel storage sites have been removed.

6.1 Buildings

A total of 18 building structures were inventoried at the Wernecke site. These are summarized in Table 1 below.

No.	Description General Location	Photo No.	Size L (azimuth) x W	Age (approx.)	Condition
21-A	Mine Managers House Located south of Ladue Shaft #2 area.	21-9	20m (@140°) x 12m	1920's	Fair; foundation failing; roof intact; floors and walls warping; metal roofing intact. Modified in 1980s.
21-B	Sauna Located near Bldg. 21-A.	21-10	4.5m (@060°) x 3.5m	1980s	Good; shake roof; still operational
21-C	Office/bunkhouse (?) Located near Bldg. 21-A.	21-11	4 m (@0130°) x 4m	1920s	Poor; roof partially collapsed; no foundation; metal roof.
21-D	Tent frame Located near Bldg. 21-A.	21-12	4 m (@090°) x 3m	1980s	Good; sound; no foundation; frame for tent; no roof.
21-E	Shed	21-13	3 m x 3m	1920's	Poor; collapsed, no foundation; metal roof.
21-F	Mine building/house (?) Located near Bldg. 21-A.	21-14	12 m (@040°) x 10m	1920s	Poor; partially collapsed and striped; no roof; wood post foundations beginning to shift; some wood and plastic debris.
21-G	Mess and recreation hall Kitchen Located east of road down to Sadie-Ladue 600 level.	21-15	15 m (@000°) x 10m	1920s	Poor; hall partially collapsed; wood frame with wood truss roof; floor removed. Kitchen building attached; log construction; partially collapsed foundation and roof. Metal roof on both structures; partially removed.
21-H	Bunkhouse Located near Bldg. 21-G.	21-15	6m x 5m (approx.)	1920s	Poor; totally collapsed; wood frame; no roofing material.
21-I	Bunkhouse Located near Bldg. 21-G.	21-15	7m x 5m (approx.)	1920s	Poor; totally collapsed; wood frame; no roofing material.
21-G	Lookout (attached to kitchen) Located near Bldg. 21-G.	21-16	3 m (@160°) x 2.5m	1920s	Fair to poor; still standing; built on 4m stilts; flooring and foundation partially rotten; metal roof.
21-J	Unknown mine building Located west of road down to Sadie-Ladue 600.	21-17	16 m (@140°) x 10m	1920s	Poor; collapsed; wood frame; no roofing material.
21-K	Boiler house Located near Bldg. 21-J.	21-18	n/a	1920s	Poor; collapsed wooden shed adjacent to steel boiler.
21-L	Houses or bunkhouses. Located west of Pit #1 below access road.	21-19	n/a	1920s	Site of 4 buildings; all in poor condition; all partially collapsed; all wood frame with metal clad roofs.
21-M	Log shack On Lucky Queen road	None	n/a	1920s	Poor; log construction; collapsed metal clad roof.
21-N	Outhouse Located near Bldg. 21-A.	None	n/a	1980s	Fair; metal clad wood structure.

All the buildings on the site are wood frame with wood foundations. No asbestos containing materials (siding, tiles) or painted surfaces were observed. All the buildings were empty; no hazardous materials were found in any of the structures.

6.2 Fuel Storage

There was no fuel stored on the site at the time of this inspection. Previous investigations (Norecol, 1997) reported the past use of the site as a fuel cache (12 barrels of Jet B fuel) for a local helicopter operator. These have been removed.

Samples: One soil sample tested for BTEX, VPH, LEPH and HEPH (Norecol, 1997; see Attachments):

Sample: 1996WS1

6.3 Rail and Trestle

No rail or trestle structures exist on the site.

6.4 Milling and Processing Infrastructure

The Wernecke mill was completely removed from the site and all structures have been removed or destroyed. An assay lab existed on the site, but has also been removed. No evidence of any of these structures remains due to later stripping and mining activity on the site.

6.5 Electrical Equipment

No electrical equipment exists on the site. All generators, including a small camp generator used on the site in the 1980s, transformers and power lines have been completely removed. A power line did extend between the Sadie-Ladue 600 level, the Wernecke camp and then over the ridge south of the Lucky Queen mine site. The cable has been removed from the Wernecke camp and Sadie-Ladue 600 areas.

7.0 SOLID WASTE DUMPS

Two solid waste dumps are located on the Wernecke site. One site consists primarily of large metal waste, presumably from the mill and mine operations. The second dump consists of kitchen wastes.

Mine Waste Dump

Location: Located west of the Sadie Ladue 600 road just below the

Dimensions: (40m long) x (30m wide)

Drainage: Occurs at the upper limit of a dry gully. No significant drainage within 1km.

Composition: Wood and large metal debris including drums, rail, hoist wheels, strapping and beams. The latter is likely from the dismantled mill. The strapping appears to be from wooden treatment vats from the mill. At one location, the soil was reported by Norecol (1997) to appear

“darkened and stained”, possibly resulting from mill concentrate residue from mill equipment abandoned on the site.

Vegetation: The site is overgrown with willows.

% covered: The dump is not covered.

Samples: No samples were collected in 1999.

One soil sample collected in 1996 was analyzed for metals (Norecol, 1997; see Attachments):

Sample: 1996WS4

Camp Waste Dump (Photo 21-20)

Location: Located directly below the lookout and kitchen buildings (Bldg. 21-G) and the base of a small bluff.

Dimensions: (25m long) x (10m wide) x (1.0m deep)

Drainage: No significant drainage within 1km.

Composition: Approximately 65% metal (tin cans and lesser empty barrels, tubs), 20% wood, 10% glass, and 5% bone, cloth and rubber.

Vegetation: The site is surrounded by willows and small evergreen trees.

% covered: None of the dump is covered.

Sampling: No samples were collected in 1999, or as part of any previous investigation.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No transformers were observed on the site.

8.2 Metals and Hydrocarbons in Soil

Aside from expected elevated background levels for metals (silver, lead, zinc, copper, cadmium, antimony, iron) on the Wernecke site, three sites have been shown through preliminary sampling to be elevated in metals. These include the tails deposits (see Section 5.3), soils associated with the mine waste dump site (see Section 7.0) and approximately 0.6m³ of ash residue located at the base of the boiler. The boiler ash was elevated in cadmium, lead, zinc (Norecol 1997).

Sites where hydrocarbons were observed or suspected in soils are limited at the Wernecke site, due in part to the fact the site has been significantly altered since the 1920s. Three sites were identified. A fuel or oil stain was observed roughly 10m east of Pit #1. The stain was not reported in the report suggesting it has occurred since. It covered a total area of less than 5m² and penetrated to less than 5cm into the broken waste rock. It was not sampled. Soils at a site used for the temporary storage of Jet B helicopter fuel during a 1996 inspection was tested for BTEX, VPH, LEPH and HEPH (Norecol, 1997; see Section 6.2). Analysis of the boiler in 1996

identified elevated levels of benzo(b+k)fluoranthene and indeno(1,2,3-c,d)pyrene (Norecol, 1997; see Attachments).

Samples: No samples were collected in 1999.

Four soil samples were collected in areas of suspected contamination in 1996 (Norecol, 1997):

Helicopter pad:	1996WS1	Analyzed for BTEX, VPH, LEPH and HEPH.
Tails:	1996WS2	Analyzed for metals.
Boiler ash:	1996WS3	Analyzed for BTEX, VPH, LEPH and HEPH, metals.
Mine Dump:	1996WS4	Analyzed for metals.

8.3 Liquid Hazardous Materials

No hazardous liquid materials were observed on the site.

8.4 Solid Hazardous Materials

No hazardous solid materials were observed on the site.

9. WATER QUALITY

A single water sample representing upstream background water conditions was collected on the Wernecke site in 1999. Sample Sadie-WS-1 was collected from a seep originating from roughly 50m up slope above the Lucky Queen road and the Sadie mine area. It flows over the grassy and willow covered slope above the Lucky Queen road until it drains into the coarse rock in the stripped area below.

Mine waters and down stream samples include the Sadie-Ladue 600 adit water sample (site #77; sample 77WQ01-01/02) and the inflow stream sample for the Wernecke Tailings site (site #80; sample 99-100-WQ-04) respectively.

A single water sample was collected in 1996 by Norecol from the ponded water in Pit #4 (Norecol, 1997; see Attachments).

10. RECLAMATION (Photo 21-1)

Natural reclamation of the site has occurred with the spread of willows and small fir trees over most of the site. The areas stripped in the 1980s remain between 80% and 90% bare, however the waste rock dumps comprised on overburden material have greater vegetation cover. None of the waste rock piles, pits or trenches have been re-contoured. No reclamation has been completed on the tails, waste dump sites or buildings.

11. OTHER INFORMATION AND DATA

The Wernecke site has been the subject of at least 3 previous environmental studies. The Department of Indian and Northern Development (DIAND) Technical Services Branch conducted an initial environmental site

investigation in 1993, but collected no samples. Access Mining Consultants Ltd. conducted a limited compilation on the Wernecke camp, but have presented extensive monitoring results for the Sadie-Ladue 600 mine drainage waters dating back to 1985 (UKHM, 1996). Detailed monitoring of water chemistry, including pH, sulphate, conductivity, flows, cadmium, lead, zinc and copper is available for the period 1990 to 1996. These results are available as an appendix to this study. Norecol (1997) conducted an investigation of the site in 1996 collecting a total of 12 samples on the site including: 7 waste rock samples; 4 soil samples, and; 1 water sample. These samples are described in more detail in the appropriate sections of this report and the results are provided as an attachment.

12. REFERENCES

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ATTACHMENT 2: 1999 SADIE LADUE/WERNECKE WATER SAMPLES

LABORATORY RESULTS

Sample Number	Detection Limit	Units	Sadie-WS-1 18/9	99-100-WQ-04 - Wernecke Tailings - 17/09/99	77-WQ-01-02 - 17/09/99
Site Description			Upstream surface seep Sadie area	Downstream sample	Sadie Ladue 600 level mine drainage
pH (field)	N/A	pH	-	6.7	7.8
Conductivity (field)	N/A	µS/cm	-	549	150
pH (Lab)	0.01	pH	7.51	7.97	7.79
Conductivity (Lab)	0.01	µS/cm	220	710	690
Total Alkalinity	5	mg CaCO3/L	55	170	168
Chloride	0.25	mg/L	<0.25	<0.25	<0.25
Hardness (CaCO3 equiv)	5	mg/L	111	438	357
Nitrate-N	0.05	mg/L	<0.05	0.09	0.13
Nitrite-N	0.003	mg/L	<0.003	<0.003	<0.003
Sulphate	1	mg/L	48.8	204	196
Total Dissolved Solids	5	mg/L	144	487	483
Analysis by ICP-USN					
Aluminum	0.0008	mg/L	0.0197	0.0141	0.0423
Antimony	0.005	mg/L	<0.005	<0.005	0.006
Arsenic	0.01	mg/L	<0.01	<0.01	<0.01
Barium	0.00004	mg/L	0.027	0.0469	0.0158
Beryllium	0.00001	mg/L	<0.00001	<0.00001	<0.00001
Bismuth	0.0004	mg/L	0.0005	<0.0004	<0.0004
Boron	0.002	mg/L	<0.002	<0.002	<0.002
Cadmium	0.00006	mg/L	0.0001	0.00489	0.00519
Calcium	0.002	mg/L	32.1	108	93.8
Chromium	0.00006	mg/L	0.00021	<0.00006	0.00051
Cobalt	0.00003	mg/L	<0.00003	0.00014	0.00024
Copper	0.00003	mg/L	0.00202	0.00054	0.00304
Iron	0.00001	mg/L	0.01	0.148	0.16
Lead	0.0003	mg/L	0.0008	0.0009	0.002
Lithium	0.001	mg/L	0.003	0.005	0.004
Magnesium	0.0005	mg/L	5.49	25.6	32.8
Manganese	0.00002	mg/L	0.00229	0.119	0.0452
Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001
Molybdenum	0.00007	mg/L	0.00053	0.00087	0.00392
Nickel	0.00001	mg/L	0.0005	<0.0001	0.0175
Phosphorus	0.03	mg/L	<0.03	<0.03	<0.03
Potassium	0.4	mg/L	<0.4	0.4	0.6
Selenium	0.004	mg/L	<0.004	<0.004	<0.004
Silicon	0.004	mg/L	2.83	2.88	3.02
Silver	0.00005	mg/L	<0.00005	<0.00005	<0.00005
Sodium	0.004	mg/L	1	1.9	2.2
Strontium	0.00002	mg/L	0.084	0.29	0.424
Sulphur	0.008	mg/L	16.2	67.5	59.3
Thallium	0.001	mg/L	<0.001	<0.001	<0.001
Titanium	0.00002	mg/L	0.00031	0.00026	0.00104
Vanadium	0.00003	mg/L	<0.00003	<0.00003	na
Zinc	0.0002	mg/L	0.0091	0.555	0.746
Zirconium	0.00004	mg/L			<0.00004
Analysis by Hydride AA					
Arsenic	0.0002	mg/L	0.0004	<0.0002	0.0016
Selenium	0.0001	mg/L	0.0002	0.0004	0.0002

TABLE 1
WERNECKE SITE
SAMPLE PARAMETERS SUMMARY CHART
PUBLIC WORKS AND GOVERNMENT SERVICES
YUKON ABANDONED MINE SITES - WERNECKE
20749-013-310

Sample Identification	Sample Type	Parameters Analysed						
		PCB	Total Metals	ABA	BTEX/VPH	LEPH/HEPH	Conventional Parameters	PAH
WWR1	waste rock			X				
WWR2	waste rock			X				
WWR3	waste rock			X				
WWR4	waste rock			X				
WWR5	waste rock			X				
WWR6	waste rock			X				
WWR7	waste rock			X				
WS1	soil				X	X		
WS2	soil		X					
WS3	soil		X					X
WS4	soil		X		X	X		
WW1	surface water		X				X	

PCB - polychlorinated biphenyls

ABA - acid-base accounting

BTEX/VPH - benzene, toluene, ethylbenzene, xylenes, volatile petroleum hydrocarbons

LEPH/HEPH - light extractable petroleum hydrocarbons / heavy extractable petroleum hydrocarbons

Conventional Parameters - pH, sulphate, total suspended solids

PAH - polycyclic aromatic hydrocarbons

TABLE 2
MODIFIED SOBEK METHOD ACID-BASE ACCOUNTING
PUBLIC WORKS AND GOVERNMENT SERVICES
YUKON ABANDONED MINE SITES - WERNECKE
20749-013-310

Sample No.	Rock Type	Paste pH	S(T) %	S(SO4) %	AP	NP	NET NP	NP/AP
WWR1	Quartzite, grey; massive, <1% pyrite finely disseminated (5-10%)	7.45	0.51	0.18	10.3	90.0	79.7	8.7
WWR2	Quartzite, finely disseminated pyrite (1%); abundant fine calcium carbonate veining, partly oxidized	7.09	0.42	0.16	8.1	49.3	41.1	6.1
WWR3	Greenstone, dark green, <1% pyrite, 1% carbonate, massive	7.68	1.09	0.15	29.4	81.3	51.9	2.8
WWR4	Argillite, abundant quartz veining, iron staining associated with quartz veining, grey, slightly slate fabric	7.70	0.25	0.14	3.4	75.3	71.8	21.9
WWR5	Argillite to phyllite, abundant quartz veining, iron staining associated with quartz veining, grey, slightly slate fabric, slightly silky sheen	7.86	0.25	0.13	3.8	73.8	70.0	19.7
WWR6	Graphitic Schist, 20% carbonaceous material (graphite); medium to dark grey, silky sheen, platy texture, boudinage quartz veining, finely disseminated cubes of pyrite <1%	7.94	0.52	0.20	10.0	164.5	154.5	16.5
WWR7	Graphitic Schist, 20% carbonaceous material (graphite); medium to dark grey, silky sheen, platy texture, boudinage quartz veining, finely disseminated cubes of pyrite <1%	7.88	0.71	0.30	12.8	112.8	99.9	8.8

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.

TABLE 3
CONCENTRATION OF BTEX AND VOLATILE PETROLEUM HYDROCARBONS IN SOIL SAMPLES
PUBLIC WORKS AND GOVERNMENT SERVICES
YUKON ABANDONED MINE SITES - WERNECKE SITE
20749-013-310
ug/g (ppm)

			Benzene	Ethylbenzene	Toluene	Xylenes	Volatile Petroleum Hydrocarbons
CCME	Commercial/Industrial		5.	50.	30.	50 (a)	NC
CMCS PHC	Commercial/Industrial						200.
Sample No.	Location	Depth (m)					
WS1	Helicopter Pad	0 - 0.15	<0.5	<0.5	<0.5	<0.5	<10.
WS4	Scrap Metal/Garbage Dump	0 - 0.15	<0.5	<0.5	<0.5	<0.5	<10.
Method Detection Limit			0.5	0.5	0.5	0.5	10.

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CCME - Canadian Council of Ministers of the Environment Interim Canadian Environmental Quality Criteria for Contaminated Sites

CMCS PHC - Criteria for Managing Contaminated Sites, British Columbia, July, 1995 and New Petroleum Hydrocarbon Criteria, August, 1995

< - less than the detection limit indicated

NC - no criteria established

(a) - Criteria for total of m, p and o xylenes.

- Greater than CCME criteria for commercial/industrial land use

- Greater than CMCS PHC criteria for commercial/industrial land use

TABLE 4
CONCENTRATIONS OF LEPH & HEPH IN SOIL SAMPLES
PUBLIC WORKS AND GOVERNMENT SERVICES
YUKON ABANDONED MINE SITES - WERNECKE SITE
 20749-013-310
 ug/g (ppm)

			LEPH	HEPH
CMCS - PHC	Commercial/Industrial		2000.	5000.
Sample No.	Location	Depth (m)		
WS1	Helicopter Pad	0 - 0.15	<250.	<250.
WS4	Scrap Metal/Garbage Dump	0 - 0.15	<250.	<250.
Method Detection Limit			250.	250.

Page 1 of 1

CMCS PHC - Criteria for Managing Contaminated Sites, British Columbia, July, 1995
 and New Petroleum Hydrocarbon Criteria, August, 1995

< - less than the detection limit indicated

NC - no criterion established

- Greater than CMCS PHC criteria for commercial/industrial land use

TABLE 5
 CONCENTRATION OF METALS IN SOIL SAMPLES
 PUBLIC WORKS AND GOVERNMENT SERVICES
 YUKON ABANDONED MINE SITES - WERNECKE SITE
 20749-013-310
 ug/g (ppm)

			Silver	Arsenic	Boron	Barium	Beryllium	Cadmium	Cobalt	Chromium*	Copper	Mercury	Manganese	Molybdenum	Nickel	Lead	Antimony	Selenium	Tin	Vanadium	Zinc	
CCME	Commercial/Industrial		40.	50.	NC	2000.	8.	20.	300.	800.	500.	10.	NC	40.	500.	1000.	40.	10.	300.	NC	1500.	
Sample No.	Location	Depth (m)																				
WS2	Suspected Tailings	0 - 0.15	35.	0.2	55.	49.8	<1.	242.	2.	35.	79.	1.5	23400.	<4.	12.	2730.	37.	<0.5	<5.	21.	16700.	
WS3	Boiler Ash	0 - 0.15	33.	0.14	84.	123.	<1.	35.4	12.	18.	91.	0.08	2000.	<4.	33.	2350.	59.	<0.5	16.	24.	1910.	
WS4	Garbage Dump/Scrap Metal	0 - 0.15	51.	0.18	48.	63.2	<1.	222.	<1.	7.	61.	1.4	40400.	<4.	10.	2720.	110.	<0.5	<5.	12.	17200.	
Method Detection Limit			2.	0.05	0.5	0.1	1.	0.25	1.	2.	1.	0.001	0.2	4.	2.	1.	10.	0.5	5.	0.5	1.	

CCME - Canadian Council of Ministers of the Environment Interim Canadian Environmental Quality Criteria for Contaminated Sites
 < - less than the detection limit indicated
 NC - no criteria established
 ☐ - Greater than CCME criteria for commercial/industrial land use
 * - Total Chromium

TABLE 6
 CONCENTRATIONS OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) IN SOIL SAMPLES
 PUBLIC WORKS AND GOVERNMENT SERVICES
 YUKON ABANDONED MINE SITES - WERNECKE SITE
 20749-013-310
 ug/g (ppm)

CCME	Commercial/Industrial	Benz(a)anthracene	Dibenz(a,h)anthracene	Chrysene	Benzo(b+k)fluoranthene*	Benzo(ghi)perylene	Pyrene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Acenaphthene	Acenaphthylene	Anthracene	Fluoranthene	Fluorene	Naphthalene	Phenanthrene	Total PAHs (a)	Total Low MW PAHs	Total High MW PAHs
Sample No.	Location Depth (m)	10.	10.	NC	10.	NC	100.	10.	10.	NC	NC	NC	NC	NC	50.	50.	NC	NC	NC
WS3	Boiler Ash 0 - 0.15	4.2	1.6	8.3	17.	18.	6.	7.2	15.	<0.05	0.12	0.35	5.2	<0.05	0.07	1.8	84.8	2.34	82.5
Method Detection Limit		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05			

CCME - Canadian Council of Ministers of the Environment Interim Canadian Environmental Quality Criteria for Contaminated Sites

< - less than the detection limit indicated

NC - no criterion established

(a) Total PAH concentration calculated using value of one half the detection limit where reported as "less than".

* - Criterion for each of benzo (b) and (k) fluoranthene.

☐ - Greater than CCME criteria for commercial/industrial land use

TABLE 7
CONCENTRATIONS OF CONVENTIONAL PARAMETERS AND TOTAL METALS IN SURFACE WATER
PUBLIC WORKS AND GOVERNMENT SERVICES
YUKON ABANDONED MINE SITES - WERNECKE SITE
20749-013-310
ug/L (ppb)

CCME	Freshwater Aquatic Life	pH	Total Suspended Solids (mg/L)	Sulphate SO4 (mg/L)	Silver	Aluminum*	Arsenic	Boron	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Iron	Mercury	Manganese	Molybdenum	Nickel	Lead	Selenium	Tin	Vanadium	Zinc
Sample	Location	6.5-9.0	NC	NC	0.1	5 - 100	50	NC	NC	NC	0.2 - 1.8	NC	2 - 20	2 - 4	300	0.1	100	NC	25 - 150	1 - 7	1	NC	NC	30
WW1	Northernmost Trench - Pond	7.93	3.	433.	<0.1	<200.	<1.	<10.	8.	<3.	0.2	<1.	<1.	<1.	50.	<0.05	29.	3.	2.	<1.	<1.	<1.	<10.	47.
Method Detection Limit					0.1	200.	1.	10.	1.	3.	0.2	1.	1.	1.	30.	50.	3.	1.	1.	1.	1.	1.	10.	5.

CCME - Canadian Council of Ministers of the Environment Interim Canadian Environmental Quality Criteria for Contaminated Sites

< - less than the detection limit indicated

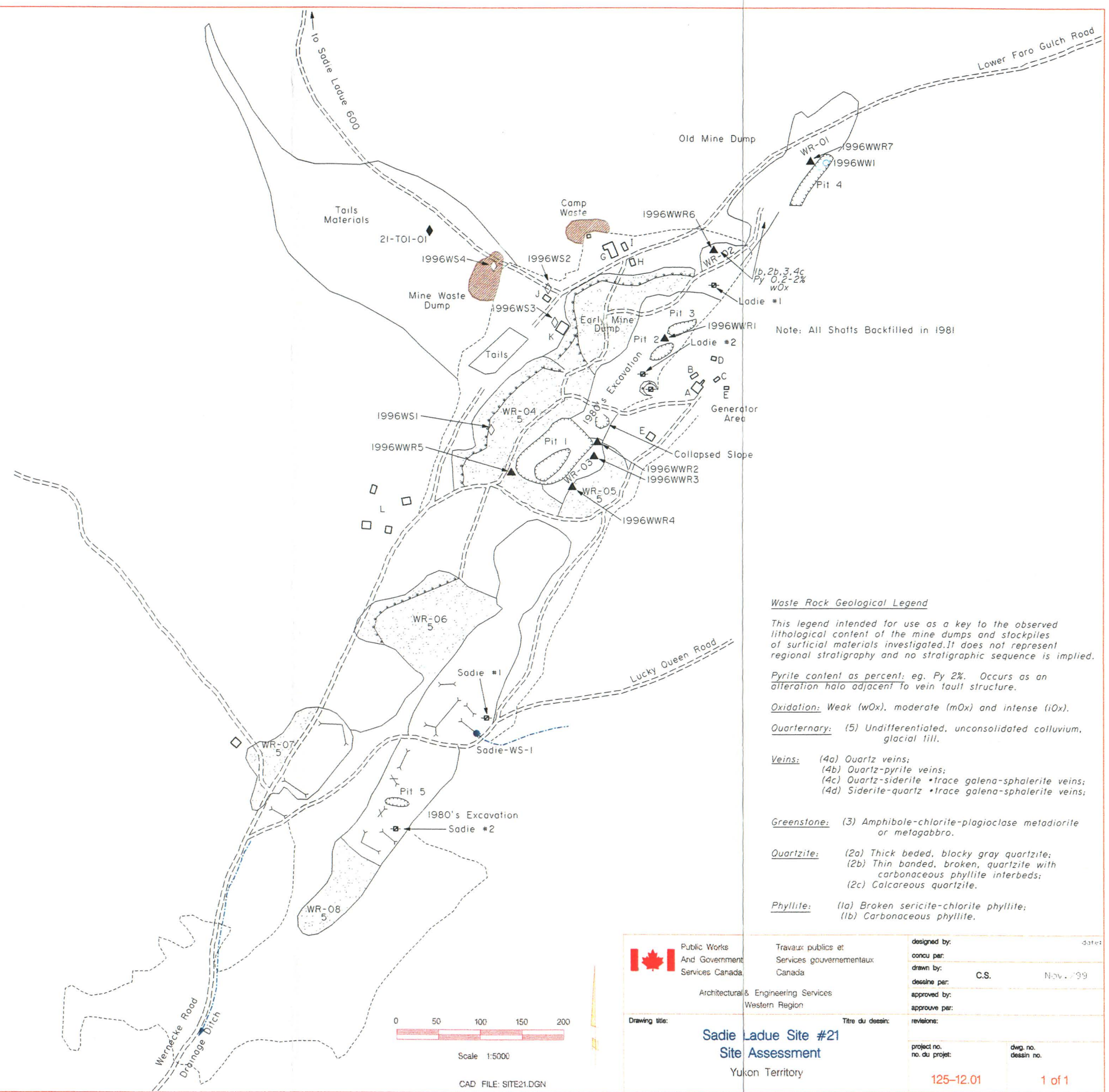
NC - no criteria established

☐ - Greater than CCME criteria for aquatic life (AW)

* - Criteria depend on pH or hardness of sample



- 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)
- W0-12-06 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 Location (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)



Note: All Shafts Backfilled in 1981

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).

Quaternary: (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 bedded, 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:	031111
		concu par:	
Architectural & Engineering Services Western Region		drawn by:	C.S.
		design per:	Nov. 1999
		approved by:	
Titre du dessin:	Titre du dessin:	revisions:	
Drawing title:	Sadie Ladue Site #21 Site Assessment Yukon Territory	project no. no. du projet:	dwg. no. dessin no.:
		125-12.01	1 of 1

Scale 1:5000
CAD FILE: SITE21.DGN



Photo 21-1: Panorama of main Werecke Camp and Sadie Ladue Mine area showing end dumped waste rock and overburden piles, Pitt#1 and decline hole to left, and partially collapsed shaft structures to far right.



Photo 21-2: Overview of Pit#1 developed in the late 1980's. (Azimuth 060°)



Photo 21-3: Open decline from recent (late 1980's) work. Note hazard from loose slabs in the roof resulting from horizontal foliation structures. (Azimuth 170°)



Photo 21-4: Sadie Ladue shaft area. Note dilapidated tressel, outhouse over callapsed manway and managers house in background. (Azimuth 080°)



Photo 21-5: Sealed haulage shaft. (Azimuth 000°)



Photo 21-6: Pit #4 with ponded water from groundwater seeps. (Azimuth 030°)



Photo 21-7: Mill tailings located below waste dumps. Note collapsed sheet metal impoundment structure and tailings delta in lake below at top-centre of photo. (Azimuth 335°)



Photo 21-8: Tailings material 250m down slope of Wernecke Camp area (el. 1220m).



Photo 21-9: Managers house (Bldg. 21-A). (Azimuth 180°)



Photo 21-10: Sauna built in 1986 (Bldg. 21-B). Note sound condition. (Azimuth 180°)



Photo 21-11: Partially collapsed building (Bldg. 21-C). (Azimuth 160°)



Photo 21-12: Tent frame structure (Bldg. 21-D). Note Bldgs. 21-A & C in background. (Azimuth 230°)



Photo 21-13: Collapsed shed (Bldg. 21-E) (Azimuth 000°)



Photo 21-14: Dilapidated mine building (Bldg. 21-F). (Azimuth 260°)



Photo 21-15: Mess hall, cookhouse and bunk houses (Bldgs. 21-G, H, I).
Note lookout roof visible behind mess hall. (Azimuth 340-010°)



Photo 21-16: Lookout (part of Bldg. 21-G). (Azimuth 020°)



Photo 21-17: Collapsed building (Bldg. 21-J). (Azimuth 320°)



Photo 21-18: Boiler (Bldg. 21-K). (Azimuth 000°)



Photo 21-19: Partially collapsed buildings (Bldgs. 21-L). (Azimuth 280-340°)



Photo 21-20: Dump site consisting primarily of cans and glass below cookhouse. (Azimuth 000°)