

RUNER
SITE #55
MINFILE #105M016

Runer was the focus of a 1996 Phase II Environmental Assessment undertaken by Environmental Services, Public Works and Government Services Canada. The site was revisited in 1999, and no major changes at the site were noted. The text of this report is largely based on the PWGSC 1996 report.

1. LOCATION AND ACCESS

Runer is located on the southwestern toe of Keno Hill at an elevation of 3800ft (1160m), 3km east of Keno town site. It is accessible by 4-wheel drive or all-terrain vehicles along a gravel road branching off from the dirt road between the Signpost Road and Lightning Creek Road. The UTM co-ordinates for the site are 7 087 550m N and 488 150m E.

2. SITE PHYSIOGRAPHY

Runer is situated on a 35° south-facing slope. Exposed side hill excavations indicate the underlying soil to be peaty silts and sands to a depth of 20-40cm, underlain by well-mixed, compacted boulders, cobbles, sand and silt to depth varying between 3 and 8m. The toe of the bottom-most waste rock pile is situated approximately 600m north of Lightning Creek. Charity Gulch, a stream originating near Keno Summit and draining southward to Lightning Creek is located approximately 1.1km to the east of the mine site. Black spruce, willows and birch, with lesser amounts of shrubs and moss dominate the vegetation.

3. GEOLOGY AND MINERALIZATION

The commodities of interest at the Runer site are silver, lead and zinc. The Keno Hill-Galena Hill silver-lead ores occur in erratic shoots and lenses lying in vein-faults that cut fine-bedded to massive quartzite, intercalated greenstone sills and lenses, and various schistose rocks. These rocks are intruded by gabbro and diabase sills. Mineralization consists of pyrite, galena, sphalerite and tetrahedrite in quartzite and siderite gangue.

4. SITE HISTORY

An adit was apparently driven approximately 30m in the 1920's, following the discovery of the rich No. 9 Vein on Keno Hill. Two short shafts (7.6m and 12.1m) were sunk in 1946. Between 1952 and 1953, the 3900-level adit was driven 305m and the 3800-level adit was driven 91m. A 45.7m adit was driven above the 3900-level (upper) adit prior to 1959. 55.2 tonnes of ore were produced during this early period.

Between 1975 and 1979 bulldozer trenching exposed a new vein 15m to 30m east of the 3800-level adit. 41.2 tonnes of ore were shipped from this occurrence between 1979 and 1981. 19.1 tonnes of ore were obtained from a 6.7m shaft. Between 1979 and 1982 the upper adit was rehabilitated and bulldozer trenching was completed. In 1983 a new 35.4m adit was driven near the 3820 level. In 1986 a new exploration adit was collared, although its depth is unknown. 534 tonnes of ore was shipped during this period. In 1987, roughly 500m of lateral underground development and 25m of shaft sinking occurred.

The current claim holder has undertaken further mining of an open cut in the lowest part of Runer. At the time of the site visit, a bulldozer was scraping the bedrock to expose a silver-rich galena vein (photo 55-1). The ore was hand sorted into 2L pails.

5. MINE DEVELOPMENT (Photo 55-2)

5.1 Mine Openings and Excavations

The remains of an adit (possibly the 3800-level adit) were observed high in the wall of the lower trench; a timber retaining wall above the adit and the adit entrance have been crushed by slumping overburden and bedrock.

The adit is inaccessible because of the instability of the surrounding rock. Tracks and an ore car indicate the presence of a buried adit approximately 150m west of the lower trench. No accessible underground workings were encountered during the site assessment.

It appears that the extensive trenching program conducted in the vicinity of the 3800-level and 3900-level adits have buried, caved, or removed the historical workings. The trenching in the vicinity of these adits has disturbed an area approximately 70,000m². The trenches themselves are approximately 10 m wide, cover a strike length of 300 m, and are over 30 m deep in places. The remaining area of disturbance is created by the deposition of waste rock and overburden in piles that average 5 m in height.

Additional trenching has occurred in the vicinity of the buried adit 150 m west of the lower trench. The disturbed area is approximately 11,000 m². Two trenches, 10 m wide by 50 m long and approximately 5 m deep, exist at this location. Trenching has also taken place on the east side of the upper/lower trench area. The area disturbed is approximately 100 m by 150 m. The trenches in this area were generally less than 5 m deep. Undercuts and rotational slumps evident and at the top edge of the upper workings (Photo 18) are indicative of ongoing slope wasting.

Because both trenches have been cut into rock, the trench wall slopes range from 40° to near-vertical. Loose waste rock or overburden piles are "perched" atop the trench walls at the trench edges. The margins of both trenches are not fenced, and no warning signs have been posted to alert site visitors of danger areas.

5.2 Waste Rock Disposal Areas

The disturbed rock on site is predominately a result of the surface trenching programs. Records indicate a limited extent of waste rock would have been generated from underground development, in the order of 10,000 tonnes. The assumptions made to derive this estimate are:

- a specific gravity of 2.65;
- a total of 550m of development; and,
- mine openings 2.5m by 2.7m.

There are four areas disturbed by trenching and underground development at the Runer mine site, as shown in Drawing 2. Waste rock from the underground workings has been mixed with overlaying weathered bedrock and overburden at each of the disturbed areas. The slopes of the trench walls are steep and unstable. The slopes of the bulldozer-worked piles of overburden and rock appeared to be at the angle of repose and are considered relatively stable, with one critical exception. A near-vertical fracture in the weathered bedrock below the machine shop has caused the ground to cave within 10m of Buildings 55A and 55B. Extension cracks are present within 2m of the buildings.

In 1996, samples of the overburden/weathered bedrock material were collected at each of the disturbed areas (RUWR/P303, P304, P307, P308, and P310). Samples were also collected from chert-rich material in a waste rock pile beside the western adit (RUWR/P306) and beside the lower trench (RUWR/P301). Samples RUWR/P305 and RUWR/P309 were collected from chlorite-altered waste rock beside the lower trench. Sample RUWR/P302 was collected from a pile of sphalerite-rich, carbonized waste rock near the garage. Samples are described and ABA/ICP results are presented in Attachment A, Tables 1 and 2 respectively

5.3 Tailings Impoundments

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

5.4 Mine site Water Treatment

There is no mine site water treatment facility at the site.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

Building 55A: Garage

Dimensions (L x W x H): 11m x 4.3m x 4m

Location: On a level waste rock pad.

Construction: The building is of wood-frame construction with plywood interior cladding.

Paint: No paint was observed.

Asbestos: No asbestos was observed.

Foundation: There is a 25 x 25cm-beam foundation to a height of 1m.

Non-Hazardous Contents: galvanized sheeting, rubber hosing, various hand tools, 2 pneumatic rock drills and associated drill steel

Hazardous Contents: 15 empty 20L motor oil pails, 3 205L drums (one drum is one-third filled) containing salt, and 2 Caterpillar tractor batteries (one with a cracked casing)

Building 55B: Storage Shed

Dimensions (L x W x H): 4.9m x 2.4m x 3m

Location: On a level waste rock pad.

Construction: The building is of wood-frame construction with plywood interior cladding, wood plank flooring and anodized sheet metal exterior cladding and roof covering.

Paint: No paint was observed.

Asbestos: No asbestos was observed.

Foundation: There is a 25 x 25cm-beam foundation to a height of 1m.

Non-Hazardous Contents: Coil of aluminum spiral electrical cable, 3 empty 20L motor oil pails, steel rods, plastic tarps, fiberglass insulation, miscellaneous steel couplings and pipe fittings

Hazardous Contents: 3 full 20L motor oil pails

Building 55C: This log and beam structure was likely a water tower.

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

Location: The possible water tower is situated about 200m east of the garage.

Construction: A wood plank deck is attached to the top of the base support, the deck is surmounted by a 3m x 3m x 3m wood beam box with attached steel wire cabling.

Asbestos: No asbestos was observed.

Foundation: The structure is supported by log and beam cross bracing to a height of 5m.

Non-Hazardous Contents: none

Hazardous Contents: none

6.2 Fuel Storage

There are two 22,750 welded steel above-ground storage tanks (ASTs) located on an embankment behind the garage and storage shed buildings. A wooden support for a refueling line joins the easternmost tank with a wood beam loading dock, which at one time supported a smaller-volume refueling tank. A visual inspection of the tanks' interiors found the easternmost AST to be empty with a minimal sludge residue; the westernmost tank was tilted slightly downward at its western end, and approximately 1.5cm of oily water was measured at the lowest point. Also in the garage and storage shed area are eight 205L drums, one empty and three are filled with wood stakes.

Approximately 125m west of the garage are twenty empty 205L fuel drums. On top of the slope above these drums approximately 315 empty 205L drums are stacked in four contiguous rows. Another 6 empty 205L drums were observed at various locations in the immediate vicinity.

6.3 Rail and Trestle

Area 1

Location: The rails are located on an embankment 10m north of the material laydown area.

Fabrication: steel rails

Amount of materials: There are 16 6m rails.

Condition: The rail pile does not pose any safety risks.

Area 2

Location: The rails are located in the material storage area.

Fabrication: The rails and steel car are composed of steel.

Amount of materials: There is one steel ore car and 8 6m steel rails.

Condition: The rails and car do not pose any safety risks.

6.4 Milling and Processing Infrastructure

There is no milling and processing infrastructure located at this site.

6.5 Electrical Equipment

Electricity is not provided to the site and no electrical equipment was encountered.

7. SOLID WASTE DUMPS

Three areas of material storage were encountered:

Solid Waste Area #1: Material Laydown Area

Location: Immediately west of the storage shed.

Dimensions (L x W x H): 20m x 20m x 1.5m

Drainage: Lightening Creek

General composition: Various steel heavy equipment parts and Caterpillar tread placed on two wooden pallets, roughly 80 timber poles, 75-100mm diameter and averaging 8m in length, 2 pieces of 400mm diameter galvanized metal ducting, each 4m in length, approximately 40 pieces of "2x4" and "4x4" lumber, 1 empty 205L drum and 2 empty 20L pails, 1 wooden outhouse

Impacted vegetation: The vegetation does not appear to be impacted.

Solid Waste Area #2: Material Storage Area

Location: Approximately 125m west of the garage.

Dimensions (L x W x H): 20m x 20m x 2m

Drainage: Lightening Creek

General composition: Various steel heavy equipment parts, 20 empty 205L drums, 10 pieces of steel casing 150-200mm in diameter and varying in length between 2m and 6m, approximately 2m³ of stacked shoring timber

Impacted vegetation: The vegetation does not appear to be impacted.

Solid Waste Area #3: Materials Stored near Garage

Location: The material is stored near the garage and storage shed.

Dimensions (L x W x H): 10m x 10m x 1.5m

Drainage: Lightening Creek

General composition: wood frame plywood work bench, 2 wooden ladders, 4 empty 20L plastic pails, wood timber frame formerly supporting vehicle fuel dispensing tank, wood support fuel line, miscellaneous drill steel and steel piping.

Impacted vegetation: The vegetation does not appear to be impacted.

8. POTENTIAL CONTAMINANTS OF CONCERN

8.1 Out-of-Service Transformers

No out-of-service transformers were encountered.

8.2 Metals and Hydrocarbons in Soil

Almost all of the untimbered portion and about one-quarter of the timbered section of the garage floor exhibited moderate to heavy hydrocarbon staining. The waste rock/soil portion was most heavily stained, and appeared to have been used as a disposal area for waste motor and transmission oil.

Stained soil was also noted adjacent to the southwest corner of the timber frame refueling structure west of the garage and south of the two ASTs.

Soil staining was evident outside the doorway to the small storage shed located west of the garage. In 1996, the stained area was excavated to 30cm depth; stained wood fibre was found to 5cm depth beneath which was waste rock and sandy silt to 30 cm. No obvious signs of soil discoloration were noted below the layer of wood fibre.

A small area of staining was noted immediately south of the drum stack. Soil composition was sandy and exhibited a slight hydrocarbon odour.

8.3 Liquid Hazardous Materials

In 1996, four samples were obtained from 20L pails of motor oil located within the storage shed. None of the samples were found to contain PCBs.

8.4 Solid Hazardous Materials

Two locked 1.5 x 1m red painted steel magazines were found approximately 30m west of the material storage area, and another steel locked magazine (2 x 3 x 3m) was located approximately 80m southwest of the materials storage area. Contents of the three magazines are unknown. All magazines were at the side of a roadway leading to the garage and storage shed.

9. WATER QUALITY

No seepage from waste rock was observed at the toe of the piles, and no seepage was observed in the trenches.

In 1996, three surface water samples (RU-WQ-STR-001, -002, and -003) were obtained from Lightning Creek at points upstream and downstream from the Runer site. Results are presented Attachment A, Table 3.

10. RECLAMATION

No active reclamation measures are known to have been undertaken by present or past operators. Due to the recentness of the mining, very little vegetation was observed in the disturbed areas.

11. OTHER INFORMATION AND DATA

Detailed information and interpretation of results can be found in the *Phase II Environmental Assessment of the Runer Mine Site*, prepared by Environmental Services Public Works and Government Services Canada, March 1997.

12. REFERENCES

Public Works and Government Services Canada, Environmental Services. *Phase II Environmental Assessment of the Runer Mine Site*. March 1997



Photo 55-1: Bulldozer working at Runer site.



Photo 55-2: View of Runer site from Bunker Hill.

ATTACHMENT A

**RUNER
ACID ROCK DRAINAGE
ASSESSMENT REPORT**

(From PWGSC 1997
"Phase II Environmental Assessment of the Runer Mine Site")

RUNER ACID ROCK DRAINAGE ASSESSMENT REPORT

1.0 INTRODUCTION

This site specific report has been prepared in conjunction with a *Phase II Environmental Assessment of the Runer Abandoned Mine Site*, prepared by Environmental Services, Public Works and Government Services Canada (PWGSC). As part of the Phase H assessment prepared by PWGSC, Steffen Robertson and Kirsten (SRK) was requested to assess the potential for acid rock drainage associated with the site, which is the subject of this report. The reader is directed to the PWGSC report for a comprehensive environmental assessment of the Runer site.

This report assesses existing, and potential acid rock drainage (ARD) conditions at the Runer site and provides recommendations for remediation. This site specific report is part of the *Acid Rock Drainage Review Report, Yukon Abandoned Mine Site Assessments*, prepared by SRK, which includes similar assessments for a number of sites. The reader is directed to that report for detail regarding the scope of work, site assessment methodology, ARD remediation options, and the evaluation of potential remediation options.

The Runer exploration site is located on the southern slope of Keno Hill, three kilometres east of the village of Keno Hill, Yukon Territory. The site is accessible by vehicle. An operating mine, the Bellekeno Mine, is located one kilometre to the southwest, on Sourdough Hill. Lightning Creek flows between the two sites.

Mining related disturbances observed during the site assessment consist of four areas of trenching with remnants of older underground workings. The waste rock consists of mine rock, weathered bedrock and overburden and is the result of two periods of development: 1952 to 1959; and 1975 to 1985 (Yukon Minfile 105M 016). All ore was shipped off site for processing.

The site is located in a transition zone between western boreal forest and subalpine forest. Sparse vegetation, in the form of fireweed, grasses (foxtail barley) and sedges, is growing along the crests of rock piles. The slopes and tops of the piles are generally barren of vegetation, except for the eastern workings where shrubs and small trees are growing. The toe of the waste rock is approximately 250 metres north of Lightning Creek, a third-order stream.

2.0 GEOLOGY AND MINERALIZATION

The Keno Hill silver-lead ores occur in erratic shoots and lenses lying in vein-faults that cut fine-bedded to massive quartzite, intercalated greenstone sills and lenses, and various schistose rocks (GSC Paper 68-68, p.21). These rocks are intruded by gabbro and diabase sills. The vein-faults at the Runer site consist of brecciated quartzite, graphite schist, phyllite and some greenstone. The mineralization consists of oxidized forms of pyrite (FeS_2), galena (PbS), sphalerite ($(\text{Zn,Fe})\text{S}$) and tetrahedrite ($(\text{Cu,Fe})_{12}\text{Sb}_4\text{S}_{13}$) in quartzite and siderite (FeCO_3) gangue (GSC Bulletin I 11, p. 46-47).

3.0 WASTE ROCK DISPOSAL AREAS

3.1 Description

There are four areas of workings, each disturbed by trenching and underground development, at the Runer site as shown on the site maps (four sections). The trenches, which were excavated by a bulldozer mounted ripper (pers. comm. J.B. O'Neill), appear to have buried or caved the underground workings. The cut slopes of the trenches and roads are relatively steep. The faces of the push dumped rock piles are gentler, at 30° to 35°, and the underlying hillside generally slopes at 25°.

Portions of the rock piles, as shown on the site maps, are rich in quartzite and chert, phyllite altered to sericite, and chlorite schist. The piles at the lower workings are predominately overburden and consist of rounded cobbles and boulders. No ponding water or surface runoff was observed, nor were any seeps encountered below the rock piles.

Records indicate that only a limited amount of the waste rock in the piles was generated from underground development, in the order of 10,000 tonnes (Yukon Minfile 105M 016). The assumptions made to derive this estimate are:

- a specific gravity of 2.65;
- a total of 550 metres of development; and
- mine openings 2.5 metres by 2.7 metres.

An area approximately 70,000 m² was disturbed by trenching in the central area of the workings (upper and lower trench area). The trenches are approximately 10 metres wide, and cover a strike length of 330 metres, and are over 30 metres deep in places. The remaining area of disturbance at the upper and lower trench area was created by the pushing and end dumping waste rock and overburden in piles that average 5 metres in height. The upper trench area extends from the road at the north end of the site southward to a level area just above the timbers from the old underground workings. The west and north wall of the trench is cut into weathered bedrock. The excavated material has been piled on the east side of the trench. The lower trench area consists of one deep trench, that extends 130 metre south from the old underground workings. The west, north and east walls of the trench have been cut into overburden and weathered bedrock. The excavated material has been piled on the east side of the trench and push dumped to the south. Between this trench and the southern road piles of excavated material indicate the location of buried trenches.

Additional trenching occurred in the vicinity of a buried adit, 150 metres west of the lower trench. The disturbed area is approximately 11,000 m². Two trenches, 10 metres wide by 50 metres long and approximately 5 metres deep are located in the western half of the workings, below the bedrock face. Rail lines mark the location of the adit.

Trenching has also taken place on the east side of the upper trench area. The area disturbed is approximately 100 metres by 150 metres. The trenches in this area were generally less than 5 metres deep.

Steep and unstable slopes were encountered along the walls of the trenches in the central area. A near vertical fracture in the weathered bedrock below a garage, as shown on the site map of the central workings, has caused the ground to cave within 10 metres of the building. Extension cracks were observed within 2 metres of the garage. The slopes of the remaining cut faces and rock piles appeared to be at the angle of repose and relatively stable.

3.2 Sampling

Samples RUWR/P303, RUWR/P304, RUWR/P307, RUWR/P308 and RUWR/P310 were collected of the overburden/weathered bedrock material as shown on the site maps. Samples RUWR/P306 and RUWR/P301 were also collected from chert-rich quartzite material in a waste rock pile beside the western adit and beside the lower trench. Samples RUWR/P305 and RUWR/P309 were collected from chlorite altered waste rock beside the lower trench. Sample RUWR/P302 was collected from a stockpile which contained approximately 100 m³ of ore grade material. Descriptions of the samples are summarized in Table 1.

Three water samples were collected from Lightning Creek. Sample RUWQ/Str-001 was collected approximately 500 metres upstream of the site, below the confluence of Charity Gulch with Lightning Creek. Sample RUWQ/Str-002 was collected approximately 500 metres downstream of the site and 100 metres downstream of the Bellekeno discharge point. Sample RUWQ/Str-003 was collected approximately 350 metres below the Runer workings, 50 metres above the confluence of Thunder Gulch with Lightning Creek, and above the Bellekeno Mine site.

3.3 Analytical Results

Results of geochemical analyses of waste rock samples are provided in Table 2 and the analytical results for the water samples are provided in Table 3.

Paste Parameters

The laboratory paste pH values for the ten rock samples ranged from 7.2 to 8.2, indicating that the material is not currently generating acid. Conductivity values of the waste rock were measured at four locations in the field and ranged between 10 μ S/cm to 30 μ S/cm.

Acid Base Accounting

The rock samples had Neutralization Potential to Acid Potential (NP:AP) ratios of less than 1.5, suggesting that the material is potentially acid generating. Total sulphur concentrations ranged from 0.02% to 0.13%. Four of the samples had negative NP values and neutral to alkaline paste pH values, which indicating that this material has undergone acid generation in the past but that its acid generation potential has been nearly exhausted.

Metals Concentrations

The sample from the ore grade stockpile contains elevated concentrations of antimony, copper, lead, manganese and silver. Two samples of waste rock/overburden also contain elevated concentrations of lead and manganese. The metal concentrations of the remaining samples are comparatively low.

Water Quality

All the water samples had field pH values between 7.5 and 7.8 and laboratory conductivity readings between 155 $\mu\text{S}/\text{cm}$ and 170 $\mu\text{S}/\text{cm}$. The upstream and downstream samples obtained from Lightning Creek above the Bellekeno workings contained <0.0001 ppm silver, <0.03 ppm iron and 0.006 ppm zinc.

Zinc concentrations were elevated to 0.02 ppm and iron concentrations to 0.13 ppm below the Bellekeno workings. Concentrations of silver (0.0002 ppm) in the sample collected below the Bellekeno workings exceed CCTNE freshwater aquatic life criteria.

4.0 EXISTING OR POTENTIAL ACID ROCK DRAINAGE CONDITIONS

The rock piles at the Runer site are composed of predominately oxidized rock and overburden. The material has either undergone acid generation in the past or is potentially acid generating. Testing indicates that the material is not currently generating acid.

Comparison of the upstream and downstream water quality from Lightning Creek suggests that the downstream environment is unaffected by waste rock drainage. There is no evidence of surface run off and no seeps or relic staining was observed below the dumps at the time of the assessment.

5.0 REMEDIATION OPTIONS

Typical reclamation and control options for acid generating mine waste and mine openings include:

- source control which includes limiting further oxidation, for instance, by placing the waste under water thus preventing oxygen entry;
- migration control which limits the mobility of oxidation products, for example, by reducing infiltration to the waste by placing a low permeability cover; and,
- release control by collecting and treating contaminated flows prior to discharge.

Collection and treatment of the runoff from the Runer site was not considered a feasible control option due to the lack of contaminated surface water discharging from the site. Remediation requirements are generally limited to providing public safety and improving the aesthetic appearance of the site, since the receiving environment does not appear to be significantly impacted.

Relocation of part of the excavated rock to infill the deepest trenches and buttress the cut slopes will address physical stability concerns. It is unlikely that all of the waste rock at the site will fit back in the trenches because of bulking. Relocating the dump material to the trenches will also help control migration of oxidation products by reducing the catchment area for surface run-on and by compacting the pile to minimize the surface area available for infiltration.

Covering the rehandled dump material with a simple soil cover (such as silt-glacial till) and encouraging vegetation to grow will improve the physical stability and the aesthetic appearance of the site. Migration of oxidation products from the rock would also be reduced.

6.0 CONCLUSIONS AND RECOMMENDATIONS

While the site does have the potential to be acid generating and metal leaching the risk to the environment is low. Considering the near neutral paste pH of the material; the volume of weather bedrock and overburden mixed in with the mine rock; and the lack of surface runoff at the site it is unlikely that acidic drainage or metal leachate from the waste rock is or will significantly impact the downstream environment.

Based on the limited samples collected to date, no remediation action is required with respect to acid rock drainage at the Runer site. Remediation requirements are therefore limited to providing public safety and improving the aesthetic appearance of the site. The excavated material is suitable for backfilling the trenches.

7.0 REFERENCES

- Boyle, R.W., 1961. 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.
- Canadian Council of Ministers of the Environment, 1991. Interim Canadian Environmental Quality Criteria for Contaminated Sites. The National Contaminated Sites and Remediation Program.
- Findlay, D.C., 1968. The Mineral Industry of Yukon territory and Southwestern District of Mackenzie, 1967. Geological Survey of Canada Paper 68-68.
- DIAND Technical Services, 1994. Assessment Report 105M-14-3 Runer Abandoned Mines Assessment. Indian and Northern Affairs Canada.
- DIAND, Exploration and Geological Services Division, 1994. Yukon Minfile No. 105M 0 16, Runer.
- MMLE, 1977. Metal Mining Liquid Effluent Regulations. Canada Gazette Part II, Vol. III, No. 5. Regulations, codes and Protocols Report No. EPS I-W-77-1, Ministry of Supply and Services Canada.

TABLE 1 Runer Waste Rock Sample Descriptions

Sample ID	Sample Location and Description
RUWR/P301	Sample of chert/quartzite rich material collected on the east side of the lower trenches. The sample was collected over a thickness of 40 cm and consisted of carbonitized schist and 20% quartzite fragments up to 8 cm in diameter. Surface was a buff/orange colour.
RUWR/P302	Sample collected over a thickness of 20 cm from 100 M3 stockpile of mineralized rock behind the garage. The surface of the pile was weathered black by manganese oxides. Field paste pH was 7.4 and conductivity 20 μ S/cm.
RUWR/P303	Grab sample of typical weathered bedrock and overburden collected on the east side of the upper trenches. Fragments included quartzite, schist and greenstone.
RUWR/P304	Grab sample of a pile of typical weathered bedrock collected beside the eastern trenches. This material did not appear to be significantly reworked by a bulldozer and contained less overburden as compared to the piles beside the central trenches.
RUWR/P305	Sample collected from a pile of schist and quartzite vein material on the west side of the lower trenches. The sample was collected over a thickness of 30 cm. The upper 5 cm consisted of sand and silt sized chlorite schist and quartzite and organic material. Cobbles up to 25 cm in diameter of chlorite altered greenstone were dominate below the sand and silt layer.
RUWR/P306	Sample of chert/quartzite rich dump material collected beside the buried adit at the western trenches. Surfaces of the quartzite have oxidized to a red/brown colour. Sample collected over a thickness of 26 cm and contained >50% sand sized material with minor clay. The field paste pH was 7.5 and the paste conductivity was 10 μ S/cm.
RUWR/P307	Sample of overburden and weathered bedrock collected at the crest of the rock pile below the western trenches. Sample collected over a thickness of 22 cm from subrounded fragments of chloritized greenstone and quartzite. Field paste pH was 5.6.
RUWR/P308	Sample of overburden and weathered bedrock, similar to P307, collected below the western trenches at the crest of the rock pile. The sample was collected over a thickness of 20 cm and contained more silt sized material than P307. The field paste pH was 7.4.
RUWR/P309	Sample of chlorite waste rock piled on the western side of the lower trenching, collected over a thickness of 25 cm in quartzite and chlorite schist, with fragments up to 15 cm in diameter. The sand and silt fraction was moist to the touch. The field paste pH was 7.3 and the field conductivity was 30 μ S/cm.
RUWR/P310	Sample of typical waste rock material collected on the east side of the lower trenches, collected over a thickness of 30 cm in chlorite schist and minor quartzite fragments.

TABLE 2 Runer Waste Rock ABA and ICP Results

Parameter	Unit	Sample Number RUWR/									
		P301	P302	P303	P304	P305	P306	P307	P308	P309	P310
Lab Paste pH		7.50	7.25	7.61	7.50	7.43	7.71	7.49	7.98	7.54	8.23
Total Sulfur	%	0.13	0.17	0.06	0.09	0.05	0.03	0.02	0.03	0.06	0.10
AP		4.06	5.31	1.88	2.81	1.56	0.94	0.63	0.94	1.88	3.13
NP		2.63	3.44	2.63	2.88	2.13	-0.06	0.69	-0.50	-1.31	-22.19
Net NP		-1.44	-1.88	0.75	0.06	0.56	-1.00	0.06	-1.44	-3.19	-25.31
NP/AP		0.65	0.65	1.40	1.02	1.36	<0.1	1.10	<0.1	<0.1	<0.1
Aluminum	%	0.26	0.48	1.12	2.16	1.11	0.40	0.45	0.65	1.28	1.15
Antimony	ppm	94	999	32	21	10	4	3	3	18	35
Arsenic	ppm	1060	<1	<1	<1	28	37	40	24	<1	87
Barium	ppm	36	90	139	70	77	1	1.11	64	72	66
Beryllium	ppm	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	ppm	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calcium	%	0.12	0.13	0.17	0.31	0.14	0.11	0.09	0.18	0.2	0.92
Chromium	ppm	154	93	94	65	104	117	136	144	115	97
Cobalt	ppm	9	22	11	35	9	5	6	7	11	1
Copper	ppm	169	1262	81	146	47	29	17	22	60	108
Iron	%	3.65	12.52	4.01	7.57	3.10	1.63	1.67	1.75	3.98	4.00
Lead	ppm	3192	>10000	969	1173	206	100	10	2	382	1756
Lithium	ppm	2	4	12	27	16	4	6	8	17	15
Magnesium	%	0.07	0.23	0.53	1.31	0.51	0.15	0.12	0.28	0.56	0.67
Manganese	ppm	7419	>10000	965	9789	570	285	262	219	1059	2684
Molybdenum	ppm	13	35	13	23	11	6	7	7	13	13
Nickel	ppm	40	183	34	91	32	18	21	19	32	41
Potassium	%	0.04	0.05	0.06	0.10	0.06	0.06	0.04	0.04	0.04	0.05
Phosphate	ppm	460	530	700	860	540	350	400	350	610	520
Silver	ppm	114.0	>200	34.0	13.8	7.0	3.2	0.3	0.3	14.3	58.1
Sodium	%	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	ppm	24	30	23	41	20	13	23	14	19	14
Tin	ppm	3	11	2	6	2	<1	<1	<1	2	3
Titanium	%	<0.01	<0.01	0.04	0.03	<0.01	<0.01	<0.01	0.03	<0.01	0.02
Tungsten	ppm	21	4	3	<1	4	6	7	7	3	4
Uranium	ppm	<1	<1	<1	<1	1	<1	<1	<1	<1	<1
Vanadium	ppm	4.4	20.9	27.5	72.4	28.4	9.8	7.8	33.1	29.0	36.0
Zinc	ppm	441	1645	185	1006	170	99	83	54	217	865

AP = Acid Potential in tonnes; CaCO₃equivalent per 100 tonnes of material

NP = Neutralization Potential in tonnes CaCO₃ equivalent per 1000 tonnes of material

Net NP = Net Neutralization Potential = tonnes CaCO₃equivalent per 1000 tonnes of material

na = no assay analysis

< = lower detection limit

> = upper detection limit

TABLE 3 Runer Water Quality Results

Parameter	Units	Sample Number		
		RUWQ/STR-001	RUWQ/STR-002	RUWQ/STR-003
Field Conductivity		120	140	120
Field pH		7.5	7.8	7.6
Conductivity	µmhos/cm	155	169	159
Hardness (CaCO ₃)	mg/L	72.4	78.3	75.2
PH		7.66	7.81	7.7
Acidity (to pH 8.3) CaCO ₃	mg/L	2.7	3.3	2.5
Alkalinity-Total CaCO ₃	mg/L	30.3	37.1	31.8
Sulphate SO ₄	mg/L	45.3	42.7	45.5
Aluminum T-Al	mg/L	0.013	0.074	0.011
Arsenic T-As	mg/L	0.0023	0.0031	0.0022
Barium T-Ba	mg/L	0.06	0.06	0.06
Beryllium T-Be	mg/L	<0.005	<0.005	<0.005
Boron T-B	mg/L	<0.1	<0.1	<0.1
Cadmium T-Cd	mg/L	<0.0002	0.0004	<0.0002
Calcium T-Ca	mg/L	22.2	24.3	23.1
Chromium T-Cr	mg/L	<0.001	<0.001	<0.001
Cobalt T-Co	mg/L	<0.02	<0.02	<0.02
Copper T-Cu	mg/L	<0.001	0.001	<0.001
Iron T-Fe	mg/L	<0.03	0.13	<0.03
Lead T-Pb	mg/L	<0.001	0.012	<0.001
Lithium T-Li	mg/L	<0.02	<0.02	<0.02
Magnesium T-Mg	mg/L	4.14	4.27	4.26
Manganese T-Mn	mg/L	0.006	0.017	0.005
Mercury T-Hg	mg/L	<0.00005	<0.000051	<0.00005
Molybdenum T-Mo	mg/L	<0.03	<0.03	<0.03
Nickel T-Ni	mg/L	<0.02	<0.02	<0.02
Selenium T-Se	mg/L	0.0009	0.0009	0.0006
Silver T-Ag	mg/L	<0.0001	0.0002	0.0001
Sodium T-Na	mg/L	<2	<2	<2
Vanadium T-V	mg/L	<0.03	<0.03	<0.03
Zinc T-Zn	mg/L	0.006	0.02	0.006

< = lower detection limit