MN-009

PWGSC

Quality in Environmental Services

PHASE II ENVIRONMENTAL ASSESSMENT
OF THE
CANALASK
ABANDONED MINE SITE

prepared for:

Action on Waste Program
Indian and Northern Affairs Canada

prepared by:

Environmental Services
Public Works and Government Services Canada

February 1997

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada
Canada

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of the

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March 1997

Executive Summary

The Canalask mine site is located at latitude 61° 57' 25" N; longitude 140° 32' 02" W, approximately 3km south of the Alaska Highway from a turn off just south of the White River Lodge. Environmental Services, Public Works and Government Services Canada was retained to conduct an assessment of the Canalask abandoned mine site to a) identify specific environmental and human safety risks and aesthetic concerns; b) provide clean-up recommendations; and c) provide a Class "D" cost estimate for recommended remediation or mitigation measures. The Canalask mine site was inspected by PWGSC on 12 August, 1996.

Assessment components included mine openings and workings, buildings and infrastructure, waste disposal areas, waste rock disposal areas, and hazardous and non-hazardous materials on the site.

The assessment concluded that underground workings are highly dangerous areas to enter, and therefore may pose a hazard to human safety. A small shed and stairway are deteriorating and highly unstable and are also a concern from a health and safety point of view. Waste debris and deteriorating structures are a minor aesthetic concern. Two small waste rock piles are potentially acid producing, however, no seeps or evidence of seepage were observed from the piles, and since they are so small, the potential for significant environmental effects is unlikely.

Recommended actions include:

1. Assuming no further site development, the mine portal or adit opening should be sealed. Prior to closing the adit, the potential for the presence of hazardous materials should be evaluated only if the adit can be entered into safely.

2. Consolidation and removal of non-hazardous solid waste and burning of non-hazardous combustible wastes.

3. Should further development occur on the site, regulatory agencies should ensure that an acid drainage prevention plan is developed which includes detailed measures for handling and disposal/management of mineralized waste rock.

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1. INTRODUCTION AND BACKGROUND

In 1993, assessments of 49 abandoned Yukon mine exploration and development sites were completed under the Arctic Environmental Strategy - Action on Waste program by DIAND Technical Services. These assessments were intended to provide a general overview of historical activities, describe site infrastructure, workings and wastes, describe existing environmental or safety concerns on each site, and provide general recommendations for remediation or mitigation work, as appropriate.

At the eastern half of the Canalask property (hereafter referred to simply as Canalask), the overview assessment (DIAND, 1994) identified no obvious environmental or safety concerns (although the condition of the adit opening could not be confirmed) and no concerns with respect to site infrastructure and debris were identified. No rock, tailings, waste piles, soil or water samples were collected for this overview assessment.

Indian and Northern Affairs Canada determined that further investigation was warranted. Environmental Services, Public Works and Government Services Canada was retained to conduct a Phase 2 Environmental Assessment of the Canalask abandoned mine site to a) identify specific environmental and human safety risks and aesthetic concerns; b) provide clean-up recommendations; and c) provide a Class "D" cost estimate for recommended remediation or mitigation measures. The Canalask exploration site was inspected by PWGSC on August 12, 1996. Photo documentation of the site is provided in Appendix A.

1.1 Location

The Canalask mine site is located at latitude 61° 57' 25" N; longitude 140° 32' 02" W, approximately 3km south of the Alaska Highway from a turn off just south of the White River Lodge (Figures 1 and 2). The site is situated on the east bank of the White River and is accessed along a narrow all weather dirt road that is useable by 2 wheel drive vehicles (although use of a four wheel drive vehicle is recommended).

1.2 Overview of Site Development

The mine site was first staked by P. Eikland, W. Theriault, and F. Hickey in 1953. It was then optioned to Prospectors Airways Co. Ltd., on behalf of a syndicate including Noranda Mining Ltd. and Kerr Addison Gold Mines LTD., which drilled 14 holes (1653.2 metres) before dropping the option.

During 1953-54 the property was extensively fringe staked by Versluce and Associates as the Blue Ribbon claims, D. Taylor as the Polaris claims, and by General Enterprises as the Blair claims. In May, 1954 the mine site was optioned to Canalask Nickel Mining Ltd. Between 1954 and 1958 Canalask drilled 1025 metres from the surface, completed 518.2 metres of

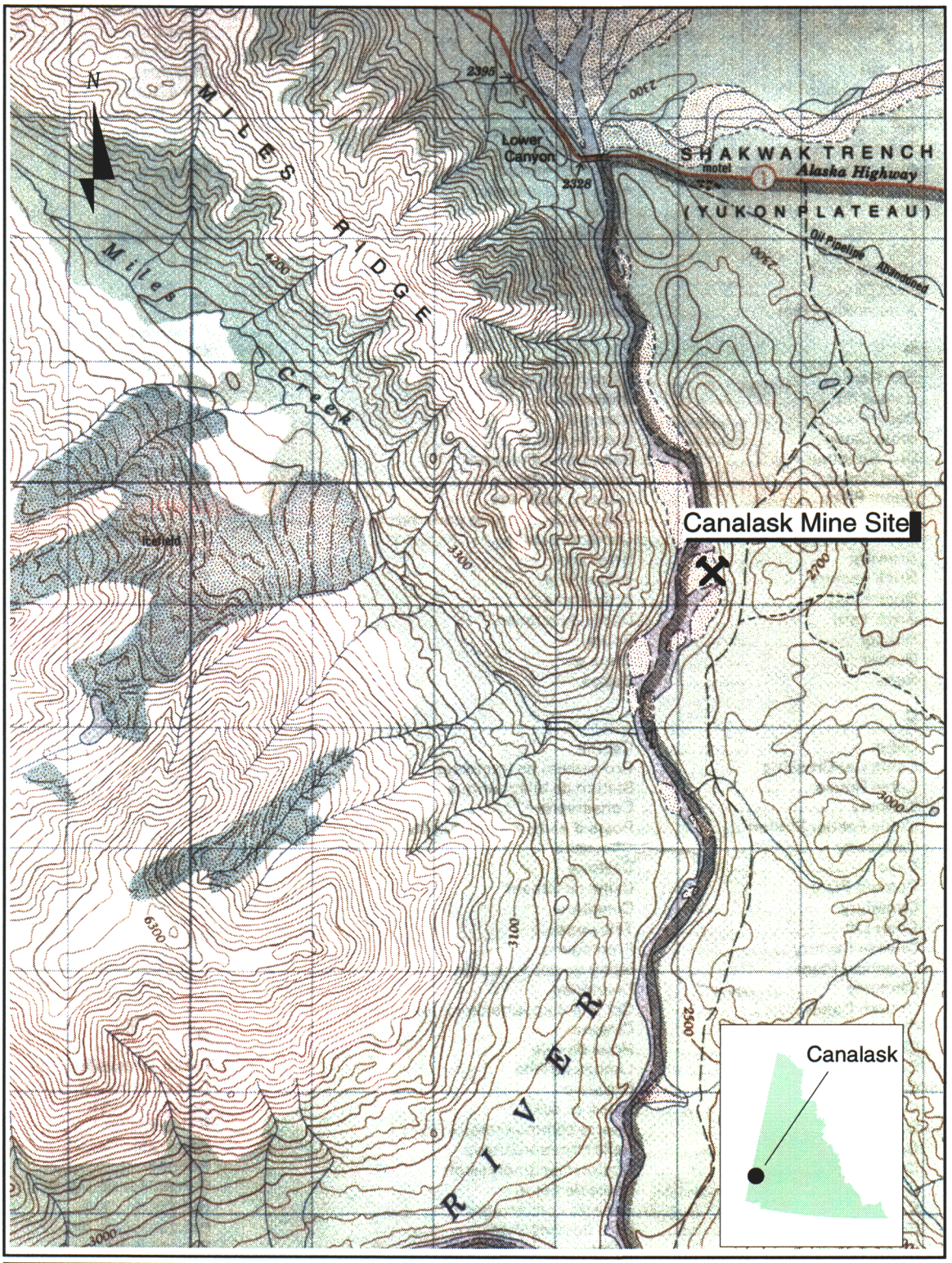
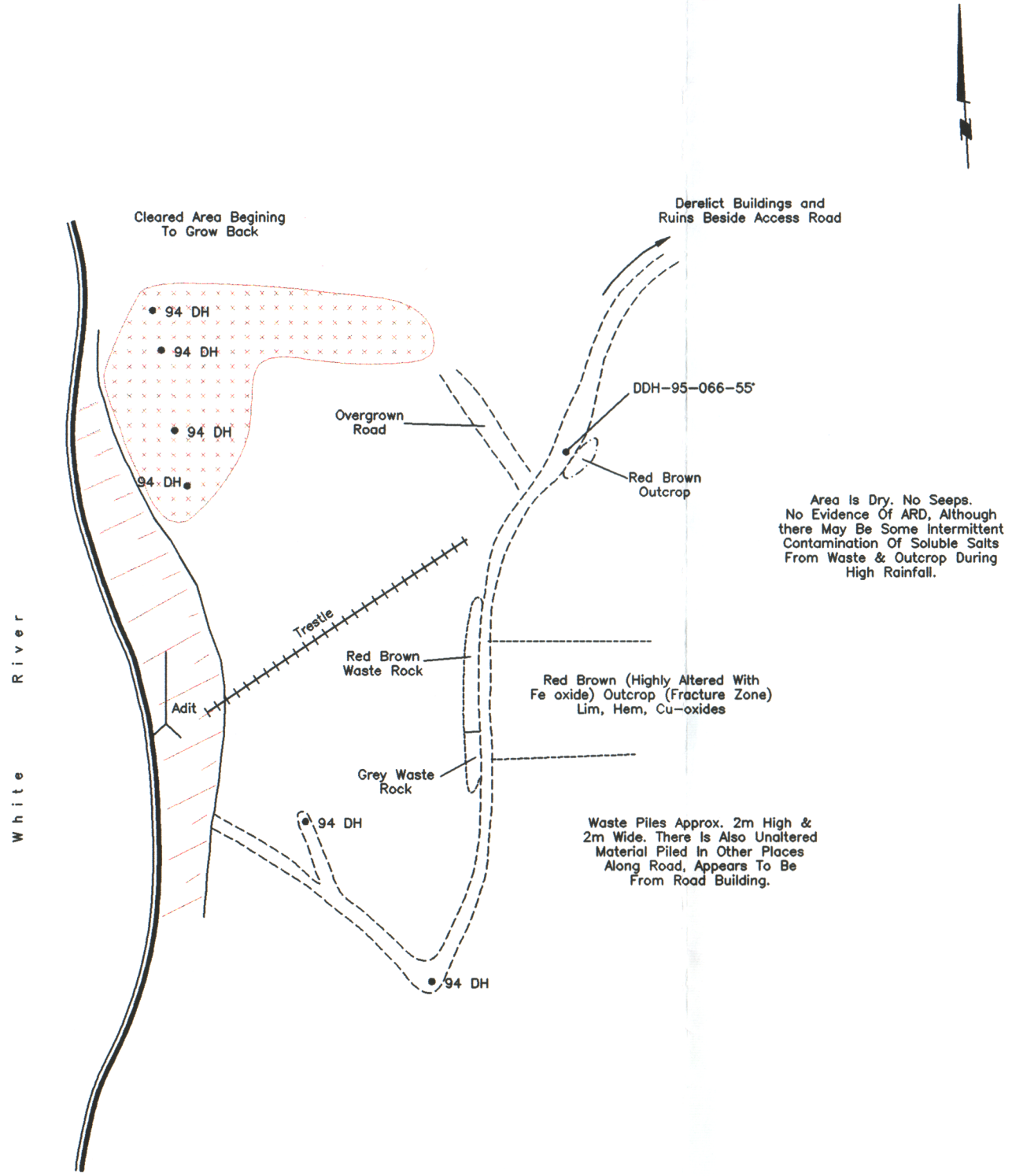


Figure 1: CANALASK SITE

N.T.S. 115/F15 Map Name: Canyon Mountan Map Scale: 1:50,000

Latitude: 61° 57' 25" N Longitude: 140° 32' 02" W



Legend

- Outcrop Boundry
- Adit
- Road
- Extent Of Waste Rock
- Trestle, with Track
- 94DH — Exploration Drill Holes From Work Carried Out In 1994
- Slope Down
- Buildings
- Extent of Debris, Timber, Cable, Pipe, etc.

Approx. Scale: 1:1000

PLOT: 1=1
CAD FILE: INVEN-96\CANALASK\CALASK-1

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:
approved by: / approuve par:
revisions:

Drawing title: / Titre du dessin:

Canalask Mine
Site Development & Geological Information
Yukon Territory

project no. / no. du projet: 626967

dwg. no. / dessin no.: 1 of 1

drilling on two levels through an adit and a 106.7 metre winze, and drilled 466.7 metres underground.

In 1963 the name of the mine was changed to Northwest Canalask Nickel Mines Ltd. just before the claims were allowed to lapse.

The mine site was restaked in 1964 as Micro claims by P. Versluce, H. Versluce, and C. Gibbons. Following trenching in 1965 and 1966 the property was optioned to Discovery Mines Ltd., Rayrock Mines Ltd., and Consolidated Can Faraday Ltd., which conducted magnetometer, electromagnetic, IP surveys, dozer trenching, and drilled 2 holes (399.6 metres). In 1968 Faraday's interest was transferred to Pacific Petroleum Ltd. and the underground workings were re-opened to permit 370.9 metres of underground drilling. In addition about 1005.9 metres of drilling was done from the surface.

The owners performed more trenching in 1970 before optioning the property to the Nickel Syndicate which explored by geological mapping, magnetic and electromagnetic surveys later in the year. In 1973, 640 metres in 5 holes were drilled and Mag claims were added before dropping the option in 1974. In 1978 the owners rehabilitated the portal.

Between 1978 to 1990 there has been minor work at the site with some exchange of options and minor exploration including mapping, magnetometer and VLF electromagnetic surveys, geochemical sampling, core relogging, and 603.2 metres of drilling from 5 holes in 1987. Some additional trenching occurred on the site in 1990.

In 1993 Expatriate Resources purchased a 100% interest in Micro, Weng, Cana, and Orion claim groups and in April of that year staked the White cl (YB38234) and River cl 1-8 (YB38243). Archer, Cathro and Associates Ltd., on behalf of Expatriate carried out a program of trenching and line cutting. In 1994 this program was extended to include drilling of 6 HQ diameter drill holes (940 metres) on the Micro 1-4 cl (86108).

Existing Micro claims and possibly the Weng 11 claim, in the area of the Canalask property on the east bank of the White river that comprise the mine exploration site for the purposes of this report, will expire on April 10, 1998.

Physical disturbance at the mine site is limited to the area around the adit and the wooden trestle located on the bank just above the adit; two small waste rock piles situated adjacent to the access road just to the east of the trestle and adit; and an area of building ruins to the north of the exploration area. The area of building ruins is not shown on the mapped area. The access road runs along the eastern side of the site in a north to south direction. Some minor trenching was evident along the access road. The access road slopes relatively steeply towards the White River.

1.3 Site Access

Canalask is accessible by a 3 km compacted dirt road branching from the Alaska Highway immediately south of the White River Lodge. Canalask attracts occasional hikers, locals and visitors travelling the Alaska Highway. The site is relatively easy to get to by four wheel drive and during dry periods can be accessed by two wheel drive vehicles All areas on the site are accessible by foot. The mouth of the adit, however, is situated on the face of the bank of the White River about 10 metres above the river bed and is only accessible by traversing along the cliff face.

2. PURPOSE AND SCOPE OF WORK

This assessment was carried out by PWGSC for Indian and Northern Affairs Canada to a) identify potential environmental and human safety risks associated with specific abandoned mine sites and b) to provide recommendations and preliminary cost estimates for remediation or mitigation of those risks. Accordingly, the following assessment activities were considered:

- Inspection of mine openings and workings, buildings and infrastructure, and waste disposal areas
- Photo documentation and mapping of relevant site features
- Sampling of waste rock disposal areas, stained soils, surface water (including waste rock seeps and receiving waters) and barrel contents as required
- Identification and inventory of hazardous and non-hazardous materials on the site
- Identification of potential or actual environmental pathways and receptors for site contaminants
- Assessment of human safety hazards and potential for accidental or deliberate access to hazardous areas
- Assessment of acid rock drainage potential in waste rock and mine development areas

Upon completion of relevant activities, preliminary cost estimates were generated to meet remediation/mitigation requirements:

- Physical stabilization of waste rock disposal areas
- Sealing of all mine openings
- Consolidation and landfill of all non-hazardous, non-combustible solid wastes
- Removal and disposal of hazardous solid wastes
- Onsite flaring or removal and off-site disposal of petroleum products and other liquid hazardous wastes as required
- Demolition of buildings and infrastructure to foundation level and burning of combustible non-hazardous materials in approved location

3. SITE ASSESSMENT METHODOLOGY

3.1 Assumptions

At the Canalask mine site, the assessment was limited to the area specifically developed or occupied for mine exploration or mining purposes and immediately-adjacent areas within applicable claim boundaries, as well as off-site environmental resources believed to be affected by mine exploration or development activities. The access roadway to the mine site was not included in this assessment.

3.2 Assessment Criteria

CCME Criteria

The Canadian Council of Ministers of the Environment (CCME) Interim Canadian Environmental Quality Criteria for Contaminated Sites are numerical limits for contaminants in soil and water intended to protect, maintain or improve environmental quality and human health at contaminated sites in general.

CCME criteria include two types of benchmarks for soil and water quality: assessment criteria and remediation criteria. Assessment criteria are approximate background concentrations or approximate analytical detection limits for contaminants in soil and water, and remediation criteria are for specified uses of soil and water. Remediation criteria are for generic use and do not address site-specific conditions. They are considered generally protective of human and environmental health for specified uses of soil and water at contaminated sites. The remediation criteria for soil are classified by three land uses:

1) Agricultural,
2) Residential/Parkland, and
3) Commercial/Industrial.

Remediation criteria for water are classified by four uses of water likely of concern at contaminated sites:

1) Freshwater aquatic life,
2) Irrigation,
3) Livestock watering, and
4) Drinking water.

For the Yukon mine assessments, in general, commercial/industrial criteria were used to assess soil contaminants and the Freshwater Aquatic Life criteria were used to assess surface water quality. For the Canalask mine site such criteria were not relevant since no soil or water samples were collected for analysis. There was no evidence of possible soil

contamination and there was no seepage of surface water at the site.

Acid Rock Drainage Assessment Criteria

Acid base accounting (ABA) analysis was completed on waste rock samples that were identified as potentially being acid producing. The ABA evaluates the net acid producing potential of a sample by evaluating the acid produced and the neutralization potential of a sample. When acid production exceeds neutralization capacity or rate of neutralization, acid rock drainage results. ABA is a static test that can only be used to indicate whether or not there is the potential to generate net acidity at some unknown time in the future. The test should only be used as an initial screening technique to assess the potential for acid rock drainage and not as a means to predict actual field geochemistry or waste rock drainage/groundwater quality.

The predictive ability of ABA is generally considered to be reliable when the net acid production potential is greater than 20 kg H_2SO_4 per tonne (acid producing) or less than -20 kg H_2SO_4 per tonne (non acid producing).

3.3 Methods

3.3.1 Background Information

Available background information was consolidated from the Yukon Chamber of Mines mine records, Whitehorse Public Library, Yukon Archives holdings, and records and reports from the Yukon Renewable Resources Library, Yukon Water Board, DIAND Lands Branch, DIAND Water Resources, and DIAND Library. INAC (1994) provided an overview assessment of the Canalask mine site to that date. Other published information sources were examined for site or regional information as applicable. On the basis of available information, knowledge gaps regarding existing or potential safety and environmental risks at the site were identified and a site assessment plan was developed.

3.3.2 Site Assessment Components

A site assessment was conducted to identify existing or potential safety and environmental risks on the site. The assessment included the following components:

Waste Rock disposal areas were inspected and sampled by a professional geologist to assess acid rock drainage potential by:

- Identifying waste rock mineralization with potential to release acidic and/or metal-contaminated drainage
- Mapping and logging waste rock, tailings, pit walls and rock faces
- Collecting and field testing representative samples of mine wastes

Mine Openings were inspected and documented to identify closure requirements.

Non-Hazardous Site Debris was inventoried.

Hazardous Materials were inventoried and sampled for analyses of contaminant constituents, as necessary.

Buildings and other Structures were inspected for hazardous materials and assessed for stability.

Borrow Sources were identified and assessed for accessibility and approximate quantity and type of granular material as applicable.

Scale site plans were prepared to identify the dimensions and locations of site structures, mine workings, adits, waste rock disposal areas, on-site sampling locations (as applicable), and any other pertinent information (Figure 2).

3.3.3 Sampling Methods and Quality Assurance

Test Pit Sampling

Test pits were excavated to a depth of approximately 0.3 to 1.0 m. Horizons in the test pit walls were logged, noting colour/weathering, rock composition, primary and secondary mineralization, particle size distribution, paste pH and paste conductivity, and moisture content. The test pit was photographed and its location was marked on the field map.

Approximately 1 kg of rock was collected at each sample site. For test pits showing a homogeneous wall face, a plastic sheet was placed at the bottom of the test pit and the pit wall was cut vertically down with a cleaned shovel. All rock larger than 75 m in size was discarded.

For test pit walls showing clearly-distinguishable horizons by colour, composition or grain size, the horizons were sampled individually.

Quality Assurance

Quality Assurance (QA) is a set of procedures for ensuring that the results of chemical analyses are, and can be shown to be, accurately representative of field conditions. A complete QA program includes both a field component and a laboratory component.

In addition to the standard sample collection methods outlined above, the field QA measures that were implemented for this assessment study include:

- chain of custody procedures and forms;
- a sample labelling and sample location identification scheme;
- laboratory preparation of all sampling containers;
- laboratory defined sample preservation and shipping procedures; and
- regular maintenance (including re-calibration) and cleaning of field equipment.

Laboratory QA measures included replicate analyses of selected soil and water samples. Replicate analytical results were submitted with each analytical report.

4. ENVIRONMENTAL SETTING

4.1 Geology and Mineralization

As described in Archer, Cathro and Associates Ltd.'s report on the Canalask property in December, 1993; "property geology consists of a bedded sequence of Pennsylvanian-Permian andesitic tuff, limestone and clastic volcanic rocks (Skolai Group) that are overlain by an Upper Triassic submarine and subaerial mafic volcanic assemblage (Nikolai Group). Skolai Group rocks are intruded by the Middle Triassic White River Mafic-Ultramafic Complex. The intrusion cuts bedding at a low angle and forms a steeply south-dipping sill that separates tuff, argillite and limestone in the footwall from greywacke, argillite and chert in the hanging wall. The sill is comprised primarily of massive dunite and peridotite with discontinuous marginal gabbro and olivine clinopyroxenite along the footwall contact."

"Both magmatic and epigenetic styles of nickel $\pm$ copper-platinum group element mineralization are present. Disseminated pyrrhotite-pentlandite and chalcopyrite occur in the marginal facies gabbro - prozenite in a fashion similar to the former Wellgreen mine located 90 km. to the southeast. Because of glacial overburden cover and its relatively recessive nature, little exploration has been carried out for this type of mineralization on the Canalask Property."

4.2 Surface Hydrology

Regional drainage is northwards towards the Yukon River via the Donjek and White Rivers. In the northern part of the Region drainage is northwest into Alaska.

The White River splits the Canalask property in half into an eastern portion which is accessible by road and the western portion which has no road access. Only the eastern portion of the site was visited.

There is no seepage coming from the adit, nor is there any surface streams or creeks running through the eastern portion of the property and draining into the White River. Any subsurface drainage from the site will discharge to the White River.

4.3 Climate

The mean annual temperature is approximately -7°C and weather data from Beaver Creek and Snag indicate a relatively harsh continental climate with January mean temperatures about -34°C and July mean temperatures of about 13°C. The coldest temperature recorded in the Yukon was at Snag where the temperature dipped to -63°C. Mean annual precipitation is about 412 mm, more than half falling during June to August. Prevalent storms from the west or southwest are deflected by the St. Elias Mountains and precipitation increases toward the northwest near the Dawson Range. Temperature inversions during winter are common.

4.4 Vegetation

The Canalask property is located within the Interior White/Black Spruce Forest Zone. The characteristic vegetation cover types in this zone include white and black spruce forest, trembling aspen and balsam poplar forests, shrub communities dominated by greyleaf willow or glandular birch, and wetlands dominated by either sedge or glandular birch (Sentar, 1994).

The property, itself, is well vegetated. Linear areas that heave been recently disturbed either as a result of trenching or bull-dozing access trails within the boundary of the property have been seeded with grass and are exhibiting rigorous growth. Alder, poplar and aspen are the predominant trees at the site. The area of building debris is heavily covered with will, alder and a variety of shrubs.

4.5 Fish and Wildlife Resources

The White River borders the west side of the east Canalask property. No tributaries or creeks were identified on the property. Information regarding fisheries resources have been provided by Yukon Renewable Resources. The White River is glacial-fed and therefore discharge rates of this river vary considerably. The White River is characterized by extensively braided channels in a wide floodplain. The floodplain fills in the early summer and the water quality is characterized by high concentration of suspended solids.

Fish species observed during an investigation in the vicinity of the pipeline crossing (Beak, 1976-77) include, arctic grayling, lake whitefish, round whitefish, burbot, longnose sucker and slimy sculpin. No Chinook or chum salmon were collected or observed at, above, or immediately below the proposed pipeline crossing during their investigations. Chum salmon, however, are reported to spawn upstream at the mouth of Miles Creek.

Habitat utilization of the White River in the vicinity of Canalask property is sparse and it is unlikely that salmon spawning occurs in mainstream portions of the White River because high levels of suspended solids and the changeable nature of river channels provided unsuitable habitat. This region may be used by salmon and Arctic grayling as a spawning migration route to clear headwater streams in the spring. The backwaters and side channels are used sparingly by Arctic grayling as nursery and rearing areas. Whitefish may spawn in this area of the river, however, information reviewed could not confirm this observation.

Wildlife in the area include bear, moose, caribou, canids (fox, coyote and wolf), raptorial birds and waterfowl (Sentar, 1994). The Canalask property is located in close proximity to a large mammal travel corridor, winter range for caribou and major migratory flyway route for a number of waterfowl including ducks and geese.

4.6 Site Topography and Soils

The region in which the Canalask property is located was glaciated during early or pre-Wisconsin time, and a somewhat lesser portion by the late Wisconsin advance. Glacier ice moved into the area from the Coast and Cassiar mountains and some ice moving eastward out of Alaska. The earlier advance covered elevations to approximately 880 m, and the recent advance to about 730 m. Glacial ice lobes extended into channels of the White River.

Moraines occur near the northern limits of the glacial advances. The Wellesley Lake basin area is covered with deep deposits of medium-textured till, large areas of coarse-textured glaciofluvial material and some fine-textured glaciolacustrine deposits.

The eastern portion of the Canalask property in the area of the adit, trellis and small waste piles slopes relatively steeply towards the White River. That part of the property where the building debris is located exhibits a much more moderate sloping terrain.

5. SITE DESCRIPTION AND FINDINGS

5.1 Buildings, Infrastructure, and Equipment

All building structures with the exception of one small wooden shed have been demolished. Two debris piles, from the demolition of these structures, have been left in a wooded area adjacent to an open area beside the access road. This area where the mine site buildings were located is higher up off the bank of the White river and above the adit or working area of the mine. The shed has been significantly damaged and is in very poor structural condition.

There is also a wooden staircase on the bank leading to the mouth of the adit. The staircase is in extremely poor condition with several of the stairs, as well as portions of the railing, missing. The remnants of a wooden trellis is located on the bank above the adit opening. Like the stairs, this structure is in extremely poor condition and has been overgrown with

vegetation.

Details of construction features and interior contents are summarized in Table 5.1.

Table 5.1 Canalask Building and Infrastructure Construction Features and Interior

Structure	Construction Features	Interior Contents	Photo No.
Shed	- 4 x 3 m in plan, 3 m height - wooden block foundation - one open room - 2" x 4" wood frame - plywood interior and exterior cladding - duroid roof covering - single front door and side window	- no contents	
Staircase	- 2" x 4" and 2" x 6" wood construction - wooden railing - staircase is broken and hazardous	- not applicable	
Trellis	- wooden trellis, 6" x 6" wood construction - overgrown with vegetation and partially dismantled	- not applicable	

5.2 Non-Hazardous Waste Materials

Two non-hazardous material storage/disposal areas were identified on the Canalask property. Locations and inventoried materials are summarized in Table 5.2.

Table 5.2 Canalask Non-Hazardous Waste Materials

Area	Location	Inventoried Material	Photo No.
Building Debris 1	- in wooded area adjacent to open flat area above exploration site.	- pile of wood debris from demolished building, including some pieces of tar roofing.	
Building Debris 2	- in wooded area adjacent to open flat area above exploration site.	- collapsed wooden material.	
Metal Debris	- in wooded area in vicinity of wood debris piles.	- has appearance of metal shack.	

5.3 Hazardous Waste Materials

No hazardous waste materials were identified at the Canalask mine site. Mr. Neil Whartley, Resource Management Officer, DIAND, indicated that equipment (elevator, tramway) associated with the workings exists in the adit and that there is potential for the presence of fuels and oils in the adit. At the time of the investigation, the safety of the investigators could not be assured, therefore, the adit was not entered to investigate its' contents.

5.4 Surface Water Quality

There were no surface water bodies near or on the mine site, with the exception of the White River. There was no seepage from the adit. A water sample was not collected from the White River because the river was not accessible from the mine site by foot. Furthermore the river has a significant flow and taking a sample, would be of no benefit to define water quality with respect to contributions form the mine site.

5.5 Waste Rock Disposal Areas

There are two very small waste rock piles that have been left at the Canalask site as a result of trenching and rock cuts along the access road. Combined the piles cover an area of about 20 metres by 5 metres or approximately 250 sq. metres. The piles are approximately 1 to 2 metres high.

One pit was dug in each of the waste rock piles and samples collected for Acid Base Accounting (ABA) and metals analysis using Inductively Coupled Plasma - Atomic Emission Spectrophotometry (ICP-AES). The sample locations are shown on the site map (Figure 2) and test pit logs are attached. ABA test results are summarized in Table 5.3.

Table 5.3 Acid-Base Accounting Test Results - Canalask Waste Rock Samples

Sample #	Paste pH	Total Sulphur (%)	Sulphur as SO_4 (%)	AP	NP	Net NP	NP/AP
G4225 - 5 (CA-WR P1-1)	5.4	1.17	No assay	36.6	3.2 to 3.7	-32.9	.10
G4225 -10 (CA-WR P2-1)	5.6	2.22	No assay	69.4	19.5	-49.9	2.8

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 equals tonnes $CaCO_3$ equivalent per 1000 tonnes of material

Samples collected from the ore concentrate waste piles have moderate to high acid producing potential. Mineralized limestone has high neutralizing capability, and overburden and the development rock have generally equal acid and neutralizing capability. In general the waste rock is anomalously high in copper, nickel, and zinc. Laboratory reports showing the results of the ABA and metal analysis are provided in Appendix B.

5.6 Mine Opening

The portal opening or mine adit measures 2 m high by 1.5 m wide and is located on the face of the eastern bank of the White River. The adit is constructed of wood beams and 2 inch by 4 inch lumber. Some of the beams that had provided a roof over the adit entrance have fallen away, possibly due to rock slides, and others are missing. A wire mesh screen was installed over the entrance of the adit to restrict access, but the screen has been cut. A sign reading "danger keep out" has also been installed at the entrance. the bank above and beside the adit entrance appears to be unstable, consisting of loose shale and rock outcropping. The adit entrance is only accessible by traversing the cliff face. The stairs that provided access in the past are no longer safe.

6. CONCLUSIONS

Existing or potential health and safety hazards, environmental and/or aesthetic concerns associated with the eastern portion of the Canalask property are summarized in Table 6.1, and are examined more fully in following subsections.

Table 6.1 Summary of Hazards or Concerns at Canalask Mine Site

Site Assessment Component	Hazard or Concern
Buildings, Infrastructure, and Equipment	Minor hazard of people exploring through rubble and stepping on nails, etc. Attempting to use unstable stairs could result in a 7 m fall to a side channel of the White River. Small unstable building could collapse with someone inside.
Non-Hazardous Waste Materials	Minor hazard of people exploring through rubble of old demolished building could result in stepping on nails and other sharp objects. Piles of rubble are a minor aesthetic concern.
Waste Rock Disposal Areas	Waste rock is potentially acid-generating
Mine Openings	The entrance to the mine adit is extremely hazardous to approach and timber cribbing is unstable. Adit opening presents a significant safety concern.

6.1 Health and Safety

Access to the underground workings is still possible but highly dangerous, and therefore may pose a hazard to human safety. The small shed that has not collapsed is highly unstable and therefore is of concern from a health and safety point of view.

6.2 Environmental Risks

Results of ABA tests suggest that the waste rock at the Canalask property is potentially acid-producing and contains high concentrations of soluble oxidation products. However, no seeps or evidence of seepage were observed from the piles, and since they are so small, the potential for significant environmental effects is unlikely.

6.3 Aesthetic Concerns

The aesthetic concerns arise from the presence of waste debris and deteriorating structures.

7. RECOMMENDATIONS

Recommended remediation and management actions are compliant with applicable federal or territorial regulations and criteria, rely upon available technology, and are intended to be appropriate for local conditions and sensitivities.

Recommendation 1. Assuming no further site development, the mine portal or adit opening should be sealed by blasting. Charges can be placed by drilling from above. Experienced blasters should be retained to minimize potentially land slides entering the White River and endangering workers above the adit.

Prior to closing the adit, the potential for the presence of hazardous materials should be evaluated only if the adit can be entered into safely.

Recommendation 2. Piles of wood debris should be sorted and all hazardous objects such as nails and sharp objects should be removed and properly disposed of off site. All combustible material including the wooden staircase leading to the entrance to the adit and the wood frame building should be dismantled and/or demolished, stockpiled and burnt under controlled conditions.

Recommendation 3. Should further development occur on the site, regulatory agencies should ensure that an acid drainage prevention plan is developed which includes detailed measures for handling and disposal/management of mineralized waste rock.

8. COST ESTIMATES TO IMPLEMENT RECOMMENDATIONS

An estimated breakdown of expected remediation/mitigation costs to an accuracy of 25% is provided under separate cover to this report. The cost estimate includes contractor and project management costs and contingency.

References

Sentar. 1994. Shakwak Project Environmental Assessment Km 1780 to Km 1907, Alaska Highway No. 1, Component Volume 3, 4, 5, & 6. Prepared for Yukon Community and Transportation Services.

Beak. 1976-77. A Summary of Fisheries Investigations in Waterbodies Within the Influence of the Proposed Alaska Highway Pipeline in Yukon Territory, 1976-77. Prepared for Foothills Pipe Lines (Yukon) Ltd.

Indian and Northern Affairs Canada. "Yukon Abandoned Mines Assessment Report 115F-15-1 Canalask". Prepared by DIAND Technical Services, March, 1994.

Appendix A

Site Photographs

Photo 1. Overgrown trail entering the mine site area.

Photo 2. Acess road running through the lower part of the mine site area.

Photo 3. Lower part of claim area adjacent to the White River shown in the background. Adit is on the bank behind the trees in the left portion of the photo.

Photo 4. Adit opening located on the bank of the White River. Staircase leading to the adit is visible behind shrubs to the left of the adit.

Photo 5. Bank area above adit opening. Note loose shale material on bank.

Photo 6. Adit entrance has been screened off and sign posted warning of danger, keep out. Note screen has been cut to allow access.

Photo 7. Timbers supporting the adit are in poor condition.

Photo 8. The staircase leading to the adit is in disrepair and is very unsafe.

Photo 9. Wooden trestle running up bank above the adit.

Photo 10. Demolished building in the wooden area on bank above the adit area.

Photo 11. Damaged building at finge of open area along side access road. In same general area as building debris shown in photo 10.

Photo 12. Waste Rock pile along side mine access road.

Photo 13. Sampling waste rock pile.

Appendix B

Analytical Results

Sample Index Report for WO# G4225

for Public Works & Gov't Services

ASL ID	Customer ID	Date	Time
G4225 - 1	CN-WR- P1-1	96 08 13	
G4225 - 2	CN-WR- P2-1	96 08 13	
G4225 - 3	CL-WR- P1-1	96 08 13	
G4225 - 4	SC-WR- P1-1	96 08 14	
✓G4225 - 5 ← CANALASK →	✓CA-WR- P1-1	96 08 11	
G4225 - 6	SD-WR- P4-1	96 08 15	
G4225 - 7	SD-WR- P3-1	96 08 15	
G4225 - 8	SD-WR- P2-1	96 08 15	
G4225 - 9	SD-WR- P1-1	96 08 15	
✓G4225 - 10 ← CANALASK →	CA-WR- P2-1	96 08 11	
G4225 - 11	CL-WQ- STR-1	96 08 13	
G4225 - 12	SD-WQ- STR1-1	96 08 15	
G4225 - 13	CL-WQ- STR-2	96 08 13	
G4225 - 14	SD-WQ- STR1-2	96 08 15	

End of list.

Canalask - Potential NEW producer.

September 9, 1996
File: 2-21-900

Mr. Fred Chen
ASL Ltd.
1988 Triumph St.
Vancouver, B.C.
V6C 2V6

Dear Fred:

Subject: ***Results of Acid Base Accounting of Soil Samples.***

Below are the results of acid base accounting of 10 soil samples received August 21, 1996. Samples G4225-1, G4225-5, G4225-6, G4225-7, G4225-8 and G4225-10 are potential net acid producers. All remaining samples are net acid consumers.

Results of Acid Base Accounting:

Sample ID	Paste pH	Total Sulphur (Wt. %)	Maximum Potential Acidity (kg $CaCO_3$/tonne)	Neutralization Potential (kg $CaCO_3$/tonne)	Net Neutralization Potential (kg $CaCO_3$/tonne)	
~~G4225-1~~	~~5.7~~	~~0.52~~	~~16.3~~	~~2.0~~	~~-14.3~~	
~~G4225-2~~	~~5.4~~	~~0.14~~	~~4.4~~	~~5.0~~	~~0.6~~	
~~G4225-3~~	~~9.0~~	~~0.02~~	~~0.6~~	~~422.8~~	~~422.2~~	
~~G4225-4~~	~~8.1~~	~~0.17~~	~~5.3~~	~~71.4~~	~~66.1~~	
G4225-5	5.4	1.17	36.6	3.7 / 3.2*	-32.9	✓ CA
~~G4225-6~~	~~3.2~~	~~0.74~~	~~23.1~~	~~-20.8~~	~~-43.9~~	
~~G4225-7~~	~~4.8~~	~~0.30/0.30*~~	~~9.4~~	~~3.4~~	~~-12.8~~	
~~G4225-8~~	~~4.1~~	~~0.62~~	~~19.4~~	~~16.9~~	~~-36.3~~	
~~G4225-9~~	~~7.7~~	~~0.11~~	~~3.4~~	~~37.2~~	~~33.8~~	
G4225-10	5.6	2.22	69.4	19.5	-49.9	✓ CA

*Duplicate analysis.

The analysis were carried out according to Sobek A. et al., EPA-600/2-78-054, March, 1978. Total cost for this work is $700.00, based on our price of $70 per sample. Please find enclosed our invoice for $700.00 plus GST. Thank you for using BCRI.

Sincerely,
BCRI

Tim O'Hearn, P.Eng.
Mine Waste & Drainage
Environmental Services and Technology

BC Research Inc.
3650 Wesbrook Mall
Vancouver, BC
Canada V6S 2L2
Canada
Tel: (604) 224-4331
Fax: (604) 224-0540
USA
Tel: 360 734-0158

RESULTS OF ANALYSIS - Sediment/Soil[1]

File No. G4225

		SD-WR-P4-1	SD-WR-P3-1	SD-WR-P2-1	SD-WR-P1-1	CA-WR-P2-1
		96 08 15	96 08 15	96 08 15	96 08 15	96 08 11
Physical Tests						
Moisture	%	17.7	21.4	22.6	13.7	7.4
Total Metals						
Antimony	T-Sb	<20	<20	<20	<20	<40
Arsenic	T-As	7.14	8.28	6.95	21.9	17.7
Barium	T-Ba	27	25	38	111	17
Beryllium	T-Be	1.5	4.2	1.5	1.0	<1
Cadmium	T-Cd	<2	<2	<2	<2	<4
Chromium	T-Cr	2	6	3	52	19
Cobalt	T-Co	<2	3	3	21	158
Copper	T-Cu	9	14	11	43	2590
Lead	T-Pb	<50	<50	<50	<50	<100
Mercury	T-Hg	0.150	0.077	0.234	1.26	0.052
Molybdenum	T-Mo	<4	<4	<4	<4	<8
Nickel	T-Ni	18	19	16	90	6510
Selenium	T-Se	<20	<20	<20	<20	<20
Silver	T-Ag	<2	<2	<2	<2	<4
Tin	T-Sn	<30	<30	<30	<30	<60
Vanadium	T-V	15	17	14	52	32
Zinc	T-Zn	15	22	40	135	342

CANALASK

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Results are expressed as milligrams per dry kilogram except where noted.

RESULTS OF ANALYSIS - Sediment/Soil[1] File No. G4225

		CN-WR-P1-1	CN-WR-P2-1	CL-WR-P1-1	SC-WR-P1-1	CA-WR-P1-1
		96 08 13	96 08 13	96 08 13	96 08 14	96 08 11
Physical Tests						
Moisture	%	9.5	8.7	7.6	7.4	4.1
Total Metals						
Antimony	T-Sb	48	61	<20	<20	<20
Arsenic	T-As	871	2050	52.1	63.9	44.5
Barium	T-Ba	50	161	22	127	14
Beryllium	T-Be	0.6	0.8	<0.5	<0.5	<0.5
Cadmium	T-Cd	4	2	<2	<2	<2
Chromium	T-Cr	3	6	229	22	20
Cobalt	T-Co	5	7	89	12	110
Copper	T-Cu	588	407	3	94	737
Lead	T-Pb	5270	3870	<50	<50	<50
Mercury	T-Hg	0.099	0.054	0.640	0.225	0.025
Molybdenum	T-Mo	127	101	<4	14	<4
Nickel	T-Ni	<2	3	1930	56	2140
Selenium	T-Se	<20	<20	<20	<20	<20
Silver	T-Ag	5	21	<2	2	<2
Tin	T-Sn	<30	<30	<30	<30	<30
Vanadium	T-V	18	32	<2	34	34
Zinc	T-Zn	491	254	5	222	90

CANALAK

Remarks regarding the analyses appear at the beginning of this report.
< = Less than the detection limit indicated.
[1]Results are expressed as milligrams per dry kilogram except where noted.