DA 145 / MN-033

SITE ASSESSMENT REPORT

HART RIVER MINERAL EXPLORATION PROPERTY

DA 145

for

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT
ARCTIC ENVIRONMENTAL STRATEGY - ACTION ON WASTE

by

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EXECUTIVE SUMMARY

This report contains the results of a preliminary site assessment of the Hart River Mineral Exploration property, known locally as the Hart River Mine. The overall objective of the site assessment was to evaluate the current environmental risks at the site and make recommendations as to actions required to minimize that risk. A detailed field investigation was carried out in August, 1997, which included documentation and mapping of site materials and features, cataloguing solid and hazardous waste, and sampling of surface soils and other media to determine the extent and migration of any contamination. The main findings of the assessment are summarized below:

The contaminants of concern are almost exclusively petroleum hydrocarbons.
There is a total of 94,690 litres of petroleum product on site. Of this total, 77,370 litres is diesel fuel stored in above ground storage tanks and drum caches; 2,200 litres is engine oil stored in drum caches; 14,900 litres is spoiled gasoline in above ground storage tanks; and 220 litres is fuel / water mix in drums.
All of the above ground storage tanks are at least thirty years old, and although still structurally sound, all are resting on the ground on rotten wood sleepers. All have freely opening delivery valves. Some of the tanks are developing water content.

There is a large inventory of non hazardous waste on site consisting of buildings, equipment, infrastructure, and wood and metal waste.

There was evidence of past spills contaminating subsurface soils. The concentrations of hydrocarbon related parameters were well below remediation criteria for the "commercial / industrial" categories of criteria under the CCREM Interim Guidelines, and the Environment Act Contaminated Sites Regulations.

The risk of a significant large volume spill from one or several sources is high if not inevitable.

The aquatic environment of Marc Creek and its Eastern tributary is heavily affected by metals which appear to originate from surface water draining the outcrop of the sulphide ore body. Based on limited spatial sampling, affects appear to be entirely natural, and not a result of development activity.

The recommendations resulting from this study are:

Due to high cost, difficult access, and other environmental considerations conventional clean up of non hazardous waste at the site is not recommended.

On site flaring using a waste oil flaring device is recommended for the next open water season to remove the risk of soil and water contamination by petroleum hydrocarbons.

Research into the origin, migration, and fate of metals in the aquatic environment at the site is suggested due to the high levels of some metals encountered in the water column and in sediment samples.

1.0 INTRODUCTION AND BACKGROUND

The Hart River Mineral Exploration Property, known locally as the "Hart River Mine", has been an area of interest to environmental managers for some time because of the large inventory of materials and fuel that have remained on site for thirty years. Laberge Environmental Services (L.E.S.) provided a letter / report to the Arctic Environmental Strategy (A.E.S.) Action on Waste Program in October, 1996 outlining the results of office research and recommended study plans. Subsequent to the completion of this office exercise, Action on Waste decided that additional investigation was warranted. L.E.S. then performed a preliminary site assessment in the summer of 1997 to identify and quantify environmental and human safety risks associated with the site and provide recommendations for remediation or clean up if required.

1.1 Location and Access

116 A 10

See figure One - Site Location, from NTS Map sheets 116 A, B/C. The Hart River deposit is located in the Wernecke Mountains at 64°38' 06" North Latitude by 136°49'22" West Longitude. The developments are situated 20Km south of the Hart River on the east side of a north draining tributary of the Hart known as Marc Creek. The site is 120Km north west of Mayo and 140Km Northeast of Dawson City.

During the winter of 1968 - 1969 a 103 Km winter road was constructed to the property from the Dempster highway. A 2 Km airstrip was built at the site, which now is limted to about 500 m due to vegetation growth and erosion by Marc creek. The site is currently only accessible by rotary and small fixed wing aircraft, and on horseback.

1.2 Scope of Work

Laberge Environmental Services submitted a proposal for this site assessment in July, 1997. The following is a summary of the objectives of this study:

- Collect and review all existing site information. Interview people with knowledge of the site. Plan a detailed site investigation based on this information.
- Inspect mine openings, buildings and infrastructure, waste disposal areas and petroleum product storage.
- Photo document and map relevant site features.
- Catalogue all solid waste (non hazardous waste).
- Catalogue all hazardous waste, particularly petroleum products. Determine the condition of above ground storage tanks and small containers with product.
- Assess the presence and lateral extent of hydrocarbon contamination resulting from past or current product releases by field screening and sampling of various media.
- Assess the potential or presence of metals transport on the aquatic ecosystem.
- Assess wildlife habitat impacts and degree of revegetation.
- Assess human safety hazards and potential for accidental or deliberate access to hazardous areas or hazardous materials.
- Make recommendations on the remediation or clean up as required.

2.0 HISTORICAL OVERVIEW

Frank Rae, an early resident and trapper discovered copper mineralization in the area in the 1930s, but no staking occurred until 1955. Interest in the property increased in the 1960s when the conspicuous orange red gossan, the outcrop of the main sulphide zone on the mountain overlooking the site, was staked and intensively explored. The Marc claims were explored by Hart River ML from 1967 through to 1971. After the construction of the winter road in 1968, extensive underground diamond drilling and surface drilling was carried out. In total, 530 metres of underground development plus 1645 metres of underground drilling and over 2000 metres of surface drilling was accomplished before this phase of exploration stopped in 1971. Through the 1980's and as recently as 1994, exploration has continued in the form of geophysical surveys and diamond drilling.

Hart River ML changed its name first to North Hart Resources Limited, and then to Calypso Developments Limited. The latter company holds the Mark and Core claims, which cover the camp and original exploration targets. INCO Exploration and Development holds the Arm claims which cover the general area and airstrip. Most of the claims are valid to at least 2002.

2.1 Previous Clean up Activities

The Resource Management Office of the Field Operations Branch of D.I.A.N.D., Dawson District, completed a partial clean up of the site in August, 1991. This work consisted of moving full fuel drums from steep slopes using a 206/B rotary aircraft. 58 empty 45 gallon drums, 66 empty 10 gallon kegs, 43 full 45 gallon drums of diesel fuel, and 1 full 10 gallon keg of diesel fuel were slung from the mountainside drill pads. The drums were cached at the airstrip. In addition, a significant amount of wooden refuse was collected and burned.

3.0 METHODS

Based on a review of site information and discussions with people who had visited the site as private individuals or as government inspectors, it was clear that the contaminants of concern were petroleum products. There appeared to be a very low probability that exploration activities could have resulted in metals contamination above naturally occurring concentrations. There also appeared to be a very low probability of contamination by persistent chemicals. The sampling program was therefor focused on investigating the presence and migration of hydrocarbons, with lesser emphasis on examining the possibility of metals impacts on aquatic environments. The field program was carried out on August 3rd to August 6th, 1997. Access to the site was by helicopter. An ATV was used to transport field crew and equipment on site.

3.1 Review of Historical Site Information

All available information from D.I.A.N.D. files was reviewed. Several people were consulted about the site including present and past D.I.A.N.D. staff, helicopter pilots, outfitters, and other people who had visited or worked at the site. Attempts to obtain permission to review assessment reports for the property from the claim holders were unsuccessful.

Assumptions and Assessment Criteria

The Canadian Council of Ministers of the Environment (CCME) produced interim environmental quality criteria for contaminated sites in 1991. Since then the criteria have been routinely adopted for federal lands, and because there are no comparable criteria specific to mineral exploration properties in the Yukon, the soil sampling results have been assessed according to CCME criteria. Also, the Yukon Environment Act, Contaminated Sites Regulations provide guidance in regard to hydrocarbon contamination, and these were also used in data evaluation. In both cases, the "commercial/industrial" category of acceptable levels was chosen because there is no "mining" category. Aquatic environmental data was evaluated according to the guidelines for freshwater aquatic life, also published and updated from time to time by CCME. The Ontario Environment Ministry Sediment Guidelines were also referenced.

3.2 Sampling and Analytical Program

A judgmental approach was used, where samples were collected in areas most likely to be contaminated, outward from the source along potential migration pathways. Samples were intended to show the current status of the site, the nature and distribution of the suspected contaminants, and to indicate presence of any contamination migration within the ecosystem. Water, sediment, and benthic macro invertebrate samples were also collected in order to establish receiving water environmental conditions and indicate any impacts that the site activities may be having on the aquatic ecosystem due to metals transport.

The following is a summary of the samples collected on August 4 and 5, 1997:

AREA	Oil/Fuel	Soil	Water	Sediment	Benthics	Plants
Background			2	2	2	
Shop	2	20				5
3680 Adit	3	2	1			2
Camp	5	10	1	1		2
Airstrip	2	10	2	2		2
TOTALS	**12**	**42**	**6**	**5**	**2**	**11**

A field sampling kit was prepared that included sample containers for all of the potential contaminants of concern. Field sceening allowed us to reduce the number of lab analyses. Three semi quantitative field screening techniques were used; organic vapour analyser, hydrocarbon extraction kit, and PCB immunoassay field kit. There was no indication of serious on going hydrocarbon product releases, so volatile hydrocarbon related parameters were not examined in water samples.

Analyses were targeted to evaluate primarily hydrocarbon related parameters, with a lesser emphasis on typical aquatic environmental indicators associated with mineralized areas. The following table is a summary of the analyses conducted by sample for the main areas of interest at the site:

Sample Type and Quantity

	VPH LEPH/ HEPH, BTEX	P A H	Test Kit (ppm TEH)	Organic Vapour	Cursory Examination	Metals	Routine Parameters	PCB
OIL/FUEL					11			1
SOIL	12	10	11	40				1
WATER			1			6	6	
SEDIMENT						5		
PLANTS					10			

VPH - Volatile Petroleum Hydrocarbons
LEPH - Light Extractable Petroleum Hydrocarbons
HEPH - Heavy Extractable Petroleum Hydrocarbons
Test Kit - Petro Flag soil test kit, semi quantitative result in Total Extractable Hydrocarbons (TEH)
Organic Vapour - 1314 Gastec Hydrocarbon Surveyor, results in ppm organic vapour
Cursory Examination - Physical examination in the field, sample not retained
Metals - Low detection limit ICP metals scan
Routine Parameters - Major ions, sulphate, pH, specific conductance, temperature
PCB - Poly chlorinated biphenals, immunoassay field test kit

Lab Analysis Sample Identification and Location

Soil Samples

Sample I.D.	Location
SC -1	stained soil around Airstrip drum cache at 15 cm depth
SC - 2	3 m East of SC - 1
SS -1	Tarry stain at shop, 5 cm depth
S - 1	Shop grid, South east corner, 15 cm depth
S - 3	Shop grid, 5 m East of shop wall, 15 cm depth
S - 8	Shop grid, 20 m North east of shop, 15 cm depth
S - 12	Shop grid, 30 m North east of shop, 15 cm depth
ST - 4	5 m downgrade of AST ST - 4, 15 cm depth
TC - 10	stained soil at drum cache below AST TC - 10, 5 cm depth
TC 10A	5 m downgrade of AST' TC 8,9 and 10 at camp, 10 cm depth
8 - D	stained soil below engine oil cache near camp, 5 cm depth

Water, Sediment, Benthics (Ws, Ss, Bs)

H - 1	Seepage 40 m North of 3680 adit (Ws)
H - 2	East Tributary upstream of shop / adit area (Ws, Ss, Bs)
H - 3	Marc Creek 1 Km downstream of camp (Ws, Ss)
H - 4	Marc Creek downstream of airstrip (Ws, Ss, Bs)
H - 5	Marc Creek 2 km upstream of camp (Ws, Ss)
H - 6	West Tributary upstream of Marc Creek (Ws, Ss)

3.3 Waste Inventory

All solid waste was catalogued and photographed, and its location noted. Fuel tanks and other containers were examined using drum thieves and "colli wassa" sampling tubes to accurately measure the type and amount of petroleum products stored. Where the type of product was not obvious, a sample was collected and archived for later analysis for fuel type identification by gas chromatography if required.

3.4 Soils Investigations

A large part of the field program consisted of delineating the presence and lateral extent of hydrocarbon contamination in soils by sampling in shallow hand dug test pits. These pits were dug in obviously contaminated areas such as soil stains near tanks or drums. The lateral extent of contamination was determined by collecting additional samples at succedingly more distant locations along the most likely migration pathway until no hydrocarbons were detected. Samples of soil were usually screened for the presence of volatile organic hydrocarbons using a portable organic vapour analyser. A "petro flag" soil test kit was used to obtain a semi quantitative value of the total amount of hydrocarbon present, and to establish the relationship of the field instrument to actual concentrations. Samples for lab analysis were selected on the basis of soil vapour readings, test kit readings, or obvious contamination. A 3 metre sampling grid was used at one location adjacent to the main shop to better define the source and lateral profile of soil contamination. Otherwise, samples were collected selectively. A PCB immunoassay soil test kit was used to confirm the assumption that none were used or released at the site.
Where circumstances warranted, samples of soil were collected for detailed analysis by Norwest Labs.

3.5 Surface Waters, Sediment, and Benthic Macro Invertebrates

Water samples were collected in either new 1 litre plastic bottles or acid washed polyethylene bottles for metals analysis. One sample of seepage and five surface water samples were collected upstream and downstream of the developments using standard sampling technique. Analyses included in situ measurements of pH, conductivity, temperature, and dissolved oxygen. Lab analyses included ICP low detection limit metals scan, sulphates, and major ions. A composite of three sediment samples was collected using a Teflon scoop at each water sampling site, and analysed for metals.

Samples of benthic macroinvertebrates were collected at two of the water sampling sites, from undisturbed fast flowing gravel strewn riffle habitat. Collections were made with a surber sampler (area = 0.0929 m^2), preserved in the field and analysed by Charles J. Low, PhD, invertebrate biologist, in Victoria B.C.

4.0 ECOLOGICAL SITE DESCRIPTION

4.1 Geology

The Hart River deposit is a massive sulphide type consisting of two lens shaped ore bodies. Total proven reserves have been reported at 523,849 tonnes with various grades of zinc, copper, lead, silver, and gold. The sulphide minerals are mainly pyrite and pyrrhotite with lesser amounts of spahlerite, galena, and chalcopyrite.

4.2 Site Topography and Soils

The site is in steep rugged topography with narrow flat valley bottoms. Scree slopes and bare rock are prevalent above 1,100 m ASL. The last glaciation has left glaciofluvial coarse grained soils in the lower elevations, which are capped by more recent fluvial and fan deposits. The mine openings are well above tree line at elevations where colluvium and scree slopes are common. The site developments are located in the flood plain of Marc creek and on nearby steep mountain slopes. The original bright red gossan which triggered the exploration in the first place is on a North facing slope at about 3.700 ft ASL. The underground developments were at 3,600 to 3,900 ft ASL. Valley soils were granular to flakey. The camp is situated on an alluvial fan with gravelly soils prevalent.

Permafrost is common to most of the site except for the well drained south facing slope of the "East Tributary" of Marc Creek, and the main stem of Marc creek.

4.3 Surface Hydrology

The exploration camp and all associated activities at the site occurred in the watershed of Marc Creek and a west flowing tributary. Marc creek is a north flowing tributary of the Hart River. It has a drainage area of about 220 Km^2, and ranges from 2.5% slope in the upper reaches, to 1.5% slope near its confluence with the Hart River. The stream itself is characterized by large gravelly substrate, moderate sinuosity, and widespread areas of braided channels. Marc creek upstream and adjacent to the airstrip is routinely subject to aufice formation and consequent flooding. Discharge measurements were made at surface water sampling sites, with the results as follows:

East Tributary upstream of developments	H 2 - 0.169 m^3/sec
West Tributary	H 6 - 0.2 m^3/sec
Marc Creek upstream of Camp	H 5 - 1.142 m^3/sec
Marc Creek downstream of airstrip	H 4 - 1.812 m^3/sec

4.4 Climate

The site is fairly dry with annual precipitation expected to be about 450 mm. Mean annual temperature at the site would be about - 7 to - 9° C.

4.5 Vegetation

Please refer to APPENDIX THREE, FIGURE 6 - VEGETATION, and APPENDIX TWO - HART RIVER MINE VEGETATION. The Hart River mineral exploration site falls within the Mackenzie Mountains ecoregion (Ecological Stratification Working Group, 1995). This ecoregion represents the transition from the boreal forest in the south to the sub-arctic forest in the north. Much of the region is at high elevation and characterized by unvegetated rock and scree, or alpine tundra and dwarf birch-willow shrub land. Valleys below 1200 m are usually covered by black or white spruce forests. Permafrost may inhibit tree growth on valley bottoms. The site has developed significant natural revegetation, with almost all disturbed areas now covered with robust growth.

The exploration site, including the two adits, workshop and camp, are situated in the upper Marc Creek valley just above tree line. The riparian vegetation along Marc Creek, and the tributary draining the mine site to the east, is dominated by a dense cover of tall willow shrubs. The upland vegetation is dominated primarily by low shrubs including dwarf birch (*Betula glandulosa*), Labrador tea (*Ledum decumbens*), willow (*Salix* spp.) and arctic white heather (*Cassiope tetragona*). Natural revegetation of disturbed areas around the exploration site includes such common successional species as fireweed (*Epilobium angustifolium*), willow (*Salix* spp.), Drummond's mountain avens (*Dryas drummondii*) and common horsetail (*Equisetum arvense*). **(A list of plant species noted at the exploration site and surrounding area is shown in Appendix TWO).**

The airstrip, two kilometers downstream from the camp, is located within a narrow strip of riparian white spruce forest. This area, including the airstrip, is frequently disturbed by flooding. In addition to stunted white spruce (*Picea* glauca), the vegetation in this area is characterized by such riparian plant species as broad-leaved willow herb (*Epilobium latifolium*), sweet coltsfoot (*Petasites* sp.), common horsetail (*Equisetum arvense*) and willow (*Salix* spp). Natural revegetation of the airstrip includes fireweed (*Epilobium angustifolium*), broad-leaved willow herb (*Epilobium latifolium*), willow (*Salix* spp.) and graminoids such as *Agrostis scabra*, *Heirochloe alpina* and *Elymus* sp. (plant species noted on the airstrip and surrounding area are listed in Appendix A).

4.6 Wildlife and Fish

This region provides habitat for thinhorn sheep. A small band of nursery Dall's sheep (two ewes and two lambs) were observed near the adits during the site inspection in August, 1997. Sheep have apparently been observed frequently near both mine openings, and inside the 3880 adit. They may be attracted to the mineralized soil and rock.

Caribou were not observed in the area during the site inspection. The Hart River exploration area includes the southern extreme of the Porcupine barren ground caribou herd's winter range, as well as the winter range of the Hart River herd of woodland caribou. Caribou were observed in the mountains to the west during the flight to the exploration site.

Other wildlife observed near the exploration site included arctic ground squirrels and willow ptarmigan. Wolves were heard howling nearby at night.

Grizzly bear tracks were observed near the airstrip and wolverine scats were accumulated in and around the workshop.

The Hart River and its tributaries support a number of fish species including arctic grayling, round whitefish, pygmy whitefish, dolly varden, arctic charr, lake trout, slimy sculpin and longnose sucker. No obstructions to fish passage were observed between the Hart river and the project site. Adequate fish habitat features were present in Marc Creek and in the East Tributary, except for a apparently low population of benthic organisms.

5.0 SITE DESCRIPTION AND RESULTS OF FIELD SURVEYS

The following sections describe the site conditions as of August 4 and 5, 1997. A summary of all catalogued waste, buildings, and infrastructure is provided. Please refer to the maps and photographs in APPENDIX THREE and APPENDIX FOUR. The results of soil, water, sediment, and other matrix sampling is discussed below. Analytical results are presented in APPENDIX ONE.

5.1 Waste Inventory - Buildings, Equipment, and Infrastructure

There are two main concentrations of buildings and equipment on the site - the camp area and the shop/adit area. The camp area contains the remains of a fully serviced exploration camp, with four standing buildings, several caches of petroleum products in drums and small containers, five 5,000 gallon above ground storage tanks containing a total of 14,900 litres of product, three vehicle hulks, and quantities of metal waste, garbage, wood waste, propane tanks and miscellaneous items. The camp is situated at the confluence of a rust stained west flowing tributary known in this report as "East Tributary", and Marc Creek. The camp is 2 Km from the airstrip, connected by a road overgrown with willow and alder.

The shop area is located 2 Km east of the camp just below the 3880 adit. A road connects the camp, shop, and 3680 adit. The shop itself is a 6 x 20 m bolted steel building, the only one standing in the shop / adit area. Several large pieces of equipment, spare parts, steel fittings, and pipe are located at the shop area. Inside the shop are: two Atlas Copco type PR 620 GD diesel air compressors (good condition), two 29 Kv diesel generators, two Mecol Jenbach underground locomotives, one Emco 12B underground loader, and numerous pieces of pipe, fittings, hose, and wire.

The 3880 adit is accessed from the shop by a wooden stair and steel cable / railway. The adit is open. The 3680 adit is located 500 metres south of the shop. This opening is blocked by ice. A total of seven 5,000 gallon above ground storage tanks containing a total of 71,330 litres of petroleum products are located around the shop and 3680 adit.

The airstrip area has two concentrations of cached drums, containing a total of 6,030 litres of petroleum products. All of the cached drums are within the flood plain of Marc creek and have been subjected to repeated flooding by aufice and freshet flows.

The following table is a summary of solid waste catalogued, estimated amount or measured volume, and general location:

Camp area:

Description	Amount
empty drums and kegs	80
empty 1000 lb. propane tanks	3
vehicle hulks	1 1949 Ford water truck

	1 Adams grader
buildings	2 bunkhouse trailers 3 x 16 m
	1 burned trailer 3 x 16 m
	1 wood construction 3 x 6 m
	1 trailer 3 x 18 m
metal waste	90 pieces 1 ½" x 10' drill rod
	500' cable
	numerous pieces channel iron, small metal waste items, wrecked appliances, etc.
domestic garbage	small amounts scattered, some recent

Airstrip

empty drums and kegs	70 drums, 50 kegs
	numerous empty drums scattered along the airstrip and lower reaches of Marc creek
metal and wood waste	small quantities

Shop Area

empty drums and kegs	40 drums, 20 kegs
empty 5,000 gallon fuel tanks	3
buildings	shop, 10 x 20 x 6 m near collapse
metal waste	steel pipe fittings, approx. 3 tons
	30 pieces 1 ½" drill rod
	50 lengths 4" pipe
	100 pieces steel track
	10 ore hoppers,
	2 rolls unused steel cable
	150 1" steel drill rod
	3 large steel compressed air tanks
	11 compressed air bottles
equipment	2 diesel generators
	6 rock drills
	2 underground locomotives
	1 underground loader
	2 air compressors
miscellaneous	200 m rubber fuel hose
	1 rack collapsing drill core

5.2 Hazardous Waste Inventory

Hazardous waste encountered at the site consisted of a small quantity of propane and acetylene gas and large quantities of left over petroleum products, mostly Arctic Diesel. These products are stored in 45 gallon drums, 10 gallon kegs, 5,000 gallon above ground storage tanks (AST's), propane tanks, and small cylinders. There are 12 AST's on site, 6 of which contain product. There

are 200 drums or smaller containers on site, 60 of which contain product. The following is a summary of the location, type and volume of these wastes at the site (note that all above grade tanks AST's have freely opening 2 inch diameter valves, opening filler caps, and vent pipes. All AST's are name - plated, welded style construction) Please refer to Figures Three, Four, and Five for locations.

Camp Area: (see FIGURE 4 - CAMP AREA)

- AST numbers TC 8, TC 9, and TC 10 - structurally sound, on rotten log sleepers, perpendicular to slope, on top of excavated bank. TC 9 and TC 10 contain 14,900 litres of spoiled gasoline. Small amount of contaminated soil, extends for 20 metres. See photograph #16.
- AST numbers TC 11 and TC 12 - rusted. empty. TC 12 located parallel to stream on bank. TC 11 located near camp buildings. No soil contamination detected.
- Drum cache across East Tributary, 200 metres from camp. Eight drums full of engine oil, total of 1,600 litres. Slow leaks. Some contain water. Localized soil contamination. See photograph #18.
- Drum cache 10 metres North of TC 10: mostly empty. 120 litres of fuel / water mix. No soil contamination detected.
- Drum cache 5 metres East of TC 8: mostly empty. 100 litres fuel / water mix. Localized soil stains.
- Propane tanks: near camp buildings. Two of five 1000 pound capacity tanks contain 5% and 20% capacity propane. Tanks in good condition.

Airstrip Area: (see FIGURE 3 - AIRSTRIP AREA)

- Two separate drum caches, total of 100 drums. 32 contain product, mainly diesel fuel. Total volume of 6,000 litres. Cache containing product has been flooded. Slow leaks. Localized soil contamination. See photographs #20, 21.
- Numerous drums are scattered around the strip and many have been washed downstream.

Shop Area: (see FIGURE 5 - SHOP and ADIT AREA)

- AST number ST 1: located 10 metres North of shop. Parallel to slope on rotten wood sleepers. Structurally sound. Contains 5,200 litres diesel fuel. No detectable hydrocarbons in soil around this tank. (see photographs #9, 10)
- AST numbers ST 2 and ST 3: located 50 metres East and uphill from shop. Perpendicular to slope, on rotten wood sleepers, structurally sound. Empty. Contained 7,000 gallons of fuel in 1989. No detectable hydrocarbons in soil around these tanks.
- AST number ST 4: rolled downhill from shop area in 1980's. Soil below and downgrade contains hydrocarbons. Weathered diesel fuel. No hydrocarbons detected in soil 30 metres downgrade of tank. (see photograph #12)
- AST numbers ST 5, ST 6, and ST 7: located 15 metres north and upgrade from Adit 3680. All full of diesel fuel. Middle tank contains 5 cm water and is rusting. Others are in good condition. Total volume in three tanks is 66, 170 litres. No detectable hydrocarbons in soil around these tanks.(see photographs #5, 6)

- Drums around shop: Three drums engine oil, 600 litres. Not leaking.

Summary: There is 94,690 litres of petroleum products on site.

5.3 Surface Soil Surveys

As described above, soil sampling was done judging by soil staining and vegetation patterns, with the objective of collecting samples along the evident migration pathway until no more hydrocarbons were found. Invariably, there was visual cues as to spilled petroleum products in the immediate vicinity of the storage containers. In most cases, a shallow pit was dug from 10 to 30 cm, and a sample collected in a zip loc bag for head space development. These were allowed to stand for a few minutes and checked for hydrocarbon vapour. If a significant reading was noted, or if the soil was obviously contaminated based on colour or odour, a second sample was retained . the second sample was then checked with the field test kit to determine the approximate total concentration of petroleum hydrocarbons present. If the sample appeared to be near clean up criteria it was retained for lab analysis.
This procedure resulted in the gross lateral delineation of soils contaminated due to past releases of product. However, without sampling soil at depth, it is not possible to estimate the volume of contaminated soil present or to make observations on the subsurface migration pathway.
Significant weathering of hydrocarbon products was observed to have taken place, indicative of spills that are several years old.
A total of 40 soil samples were screened for volatile hydrocarbon vapour, 10 samples were screened using the soil test kit, and 12 samples were collected for detailed analysis in the lab for a range of hydrocarbon related parameters.

General Discussion:
The soil sampling program revealed the expected localized contamination of soils around fuel storage and handling areas, as well as evidence of significant past releases and general weathering of Hydrocarbons in soils. The results for BTEX (benzene, toluene, ethylbenzene and xylene) were all well below the soil remediation criteria for the Commercial/ industrial categories of both the CCME Interim Quality Criteria and the Contaminated Sites Regulations. This was also the case for PAH (polycyclic aromatic hydrocarbons). There are no CCME criteria available for VPH (volatile petroleum hydrocarbons), LEPH (light extractable petroleum hydrocarbons), and HEPH (heavy extractable petroleum hydrocarbons). Therefor these parameters were compared to the Yukon Environment Act Contaminated Sites Regulations (CSR). Most samples were below the remediation criteria for commercial/ industrial sites, with the exception of two near surface samples collected immediately adjacent to slow leaking containers. The standards for VPH, LEPH, and HEPH for the appropriate category of land use (commercial / industrial) are 200 ppm, 2,000 ppm, and 5,000 ppm respectively. The main findings of the soil sampling program are summarized below. Results of lab analysis on soils are contained in Appendix One - Analytical Results, and are summarized in Table One.

TABLE ONE Petroleum Hydrocarbons in Soil - Hart River Mineral Exploration Property

Parameter	28355-1 SC-1 SC-1 Drum Cache Strip Depth 15cm	SC - 2 3m from SC -1 15 cm	28355-2 SS-1 SS-1 Shop tain Depth 05cm	28355-3 S-1 S-1 Above op Depth 15c	28355-4 S-3 S-3 Shop Area oil Depth 15cm	28355-8 S-8 S-8 Shop Area il Depth 15cr	S - 12 Shop grid 15 cm	28355-5 ST - 4 T-4 Below Tan T4 Depth 15cr	28355-6 TC - 10 10 Drum Cache C-10 Depth 5cm	28355-7 TC 10A C-10A Soil Belo anks Depth 10cm	28355-9 D - 8 8-D 8 Drum che Depth 5cm	Shedule 1 C.S.R ppm	Detection limit
BTEX													
Benzene	<0.02	<0.02	<0.02	**0.02**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	**0.04**		0.02 ppm
Toluene	<0.02	<0.02	<0.02	**0.09**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.02 ppm
Ethylbenzene	**0.10**	**0.05**	**0.04**	**0.12**	**0.08**	**0.07**	**0.09**	<0.02	<0.02	<0.02	**0.11**		0.02 ppm
m- & p- Xylene	**0.09**	**0.19**	**0.14**	**0.57**	**0.39**	**0.14**	**0.48**	**0.28**	**0.13**	**0.10**	**0.57**		0.05 ppm
o- Xylene	**0.51**	<0.03	<0.03	**0.05**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		0.03 ppm
VPH (C5-C10)	**190**	**3.4**	**9.6**	<1.0	**15**	**50**	<1.0	<1.0	<1.0	<1.0	**4.4**	**200**	1.0 ppm
EPH (C10-C18)	**26000**	**68**	**15**	**22**	**360**	**1200**	**140**	**220**	**17**	**350**	**630**	**2,000**	10 ppm
EPH (C19-C32)	**770**	**21**	**270**	**180**	**1600**	**180**	**3800**	**1300**	**98**	**210**	**42000**	**5,000**	10 ppm
OVA (ppm organic vapour)	**>500**		**<5**	**20**	**150**	**150**	**160**	**200**	**10**				
ST KIT (ppm Total Hydrocarbon)					**2,470**	**1600**							
Percent Moisture	15	8	10	29	15	15	57	63	37	12	57		

CSR = Yukon Environment Act Contaminted Sites Regulations remediation criteria for "commercial / industrial" category of land use

Shop Area:
(see photographs #9, 11, 13) There was a notable patch of tarry stained soil and delineated vegetation die - off at the North west corner of the shop. Numerous soil vapour readings seemed to indicate a zone of subsurface contamination, so a 3 meter grid was established and shallow pits dug within the grid to delineate the lateral extent and shape of the contaminated plume. It was quickly apparent that the tarry stain near the shop was confined to a small area and was likely used engine oils. A more extensive spill apparently originated somewhere near the east wall of the shop and was likely diesel fuel. Soil under and down grade of the shop are contaminated with weathered hydrocarbon products, probably diesel fuel and used oils. No hydrocarbons could be detected 40 meters down slope from the shop using field screening methods.
Soil down grade and below an errant AST, tank ST - 4, are contaminated with weathered petroleum products, likely diesel fuel. No hydrocarbons could be detected 30 metres down grade from this tank. Apparently, the tank rolled down the hill some time during the 1980's, and came to rest with the air vent down, causing all fuel to escape at that time.

Camp Area:
Drum caches at the camp have released product over the years. Soil contamination is now limited to the immediate area of the caches. Also, a small area of contaminated soil was detected below AST's TC 8, 9, and 10. No hydrocarbons could be detected 20 metres downgrade from the tanks.

Airstrip:
Drums cached at the airstrip are currently leaking small amounts of diesel fuel. Soil contamination is limited to a few metres around the cache. 43 full drums of diesel (about 8,800 litres) were moved to this location from high elevation drill pads in August, 1991. Currently, there are 32 drums on the strip containing a total of 6,000 litres of product. It was impossible to determine whether the 2,800 litres of fuel had leaked, been washed downstream, or had been consumed by people using the area since that time.

5.4 Water Quality

A total of six water samples were collected, one of which was a seepage sample from the 3680 adit area (H - 1). Water sample results are presented in Appendix One - Analytical Results. The results are fairly typical of high energy streams draining porous mineralized soils. The metal ions are of interest, especially zinc. The furthest upstream sample, collected in the East Tributary upstream of the 3880 adit (H 2), was high in total and dissolved zinc, with values of 1.64 mg/L and 0.682 mg/L respectively. The CCREM recommended guideline for freshwater aquatic life is 0.03 mg/L total zinc. This creek drains the sulphide deposit outcrop zone just East of the water sample station. The exposed creek bed in the East Tributary was highly stained with an orange coloured precipitate (see photograph #3). These conditions appeared to be entirely natural, with no indication that metals were leaching as a result of the exploration work. The seepage sample (H - 1) discharge collected near the 3680 adit was almost negligible, and there was no seepage reporting to the surface at the 3880 adit.

5.5 Sediments

The sediment samples showed similar patterns as the water samples, with significant concentrations of metals in the East Tributary, very low concentrations upstream of the camp in Marc Creek, and subsequent high but diminishing concentrations downstream of the confluence of East Creek and Mark Creek mainstem. Sediment results are contained in Appendix One - Analytical Results. The concentrations of zinc in the East Tributary and the mainstem of Marc creek below this tributary exceeded the severe effects level (SEL) established by the Ontario Minstry of Environment at 820 ug/g. East tributary (H - 2) had 2430 ug/g zinc, and Marc Creek downstream of the airstrip (H - 4) had 1,450 ug/g zinc. Copper also exceeded recommended guidelines established at 110 ug/g SEL, with H - 2 having 2,100 ug/g and H - 4 having 606 ug/g copper. Arsenic, cadmium and lead were also high relative to recommended guidelines.

5.6 Benthic Invertebrates

Remarkably few invertebrates were captured in the two surber samples. The analysis results are contained in Appendix One - Analytical Results. A total of 39 invertebrates were collected in East Creek (H - 2) representing 8 taxonomic groups. Although the population was low, the community was diverse. Only 6 invertebrates were collected in Marc Creek (H - 4) suggesting poor sampling and sample handling technique. The low population of invertebrates may also be due to high concentrations of metals in the water column and in the sediment.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Health and Safety

This site is an active mineral exploration property - not a mine. As a result, the health and safety issues arising from mining hazards are evaluated with the current and most likely future uses in mind as opposed to considerations for an abandoned mine. For example, it would be normal recommended practise to seal all mine openings of an abandoned mine. In this case sealing of the remaining opening at 3880 feet ASL would unduly hinder further exploration underground. As the site is used regularly by resident hunters and by Outfitters and their clients, appropriate warning signs should be set up.

6.2 Environmental Risks

The environmental risks at this site have always been and continue to be dominated by the potential release of significant quantities of waste petroleum hydrocarbons into the soil and surface waters of the Mark Creek drainage. In the past thirty years there have been spills of these products, but these have not appeared to have had any significant long term environmental effects. The greatest risk to humans and other receptors from the more toxic components of hydrocarbon contamination are associated with inhalation pathways. These are not present in harmful concentrations at the site. Most of the soil contamination detected at the site was weathered to leave mainly the heavier and less harmful components.

It is only a matter of time, however, until a release can be expected either by flooding, accident, land movement, or an act of vandalism. There is enough product on site to cause significant harm to the environment if released in a worst case scenario by tank rupture or vandalism.

The fuel stored on the airstrip and at the camp represents a significant risk because it is stored within the wetted perimeter of very active streams prone to aufice and flooding.

The fuel at the 3680 adit, contained in three full 5,000 gallon tanks, represents a significant risk because it is subject to land sliding. At the time of the field investigation these tanks were partially buried by a recent landslide. Also, these tanks are beginning to show water content at the bottom, which will in turn lead to corrosion and tank failure. Release of this product would flow onto the waste rock pile and course granular material down slope and depending on the season, may seriously impact the Marc Creek watershed.

6.3 Aesthetic Concerns

The sheer quantity of drums, metal cans, litter, and left over buildings and equipment present an aesthetic concern. Aesthetic concerns are somewhat offset by the fact that as time passes much of the materials on site will take on some heritage value as historical artefacts, representative of the 1950's and 1960's era exploration methods. It would be prudent to consolidate or group the scattered drums and other solid waste around the camp and shop areas.

6.4 Clean up Options

Because the soil sampling program did not reveal any substantial areas of soil above remediation criteria, no soil remediation is likely to be required. Existing soil staining and contamination will continue to weather and degrade through natural processes. Removal of the hydrocarbon products that could cause new and significant spills is therefor the priority.

There are essentially two options for clean up at this site - conventional clean up with mobilization of waste off - site; and partial clean up by waste management on - site. Conventional clean up would mean mobilizing a crew to the site during open water season to group and prepare various components for removal, followed by a late winter trip to the site using the winter road access and heavy equipment. This option is *not* recommended for the following reasons:

- Extreme costs. Such a project would involve excessive costs in comparison to the environmental benefit.
- Permitting and other environmental considerations. A land use permit for a winter road into this area may prove to be a lengthy and somewhat controversial undertaking, given current concerns of First Nations and the general public. Also, there will be a perceived improved access to the area which may cause potentially harmful impacts on the environment such as hunting pressure and use of the corridor by off road vehicles.
- Low probability of substantial salvage value. It has been suggested in the past that the cost of demobilizing the equipment and fuel off site could be offset by salvage value. Recent regulations concerning fuel transport and storage would preclude moving the fuel in its current containers, and would also likely render those containers of no value for re use, making cost recovery on the fuel negligible. Also, the equipment left on site has deteriorated over the years so as to become far less valuable as salvage if it can be used at all.
- Ownership. Because of the status of the property as quartz claims in good standing, and because the equipment and infrastructure have never changed hands, the claim holders still own it and may have entirely differing views as to its disposal.

The second, and recommended option is to eliminate the environmental risks posed by the hazardous waste at the site. The recommended procedure for such a project is summarized as follows:

- Obtain an approved waste oil burner or flaring device and transport to site by rotary aircraft. (Open burning is not recommended because of air emissions)
- Organize and mobilize a work crew supervised by Environment Canada, Environmental Protection, or Waste Management staff conversant with waste fuel flaring.
- Burn waste fuel in the following order of priority; Airstrip cache, camp AST's and caches, shop AST and caches, and finally 3680 adit AST's. It may be feasible to decant some of the diesel at the 3680 adit into an alternate approved storage containment for future use in exploration activities.

7.0 REFERENCES

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Yukon Environment Act; Contaminated Sites Regulations, Storage Tank Regulations.

APPENDIX ONE

ANALYTICAL RESULTS:

- WATER SAMPLE RESULTS
- SEDIMENT SAMPLE RESULTS
- SOIL SAMPLE RESULTS
- BENTHIC INVERTEBRATE RESULTS

NORWEST LABS

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Winnipeg PH.(204) 982-8630 FAX (204) 275-6019

WO (Lang.) : 28356
PO # :
Date Rec'd. : 08/12/97
Date Comp. : 08/29/97

Client		Received From	
Name	: LABERGE ENVIRONMENTAL	Name	:
Address	: Box 5111, Whitehorse, Yukon Y1A 4S3	Address	:
Phone	: (403) 668-6838	Phone	:
Fax	: (403) 667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

RESULTS OF ANALYSIS

Lab #:	28356-1	28356-2	28356-3
Sample ID:	H-1 Adit Seepage	H-2 East Trib	H-3 Marc D/S Camp
Parameter: mg/L			
Sulphate	205	157	128
Nitrate-N	0.17	0.07	0.10
Cloride	0.13	0.12	0.12
Flouride	0.14	0.07	0.07
Nitrite-N	<0.05	<0.05	<0.05

Approved: _____
Randy Neumann, B.Sc.
Laboratory Manager

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Address	: Box 5111, Whitehorse, Yukon Y1A 4S3	Address	:
Phone	: (403) 668-6838	Phone	:
Fax	: (403) 667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

RESULTS OF ANALYSIS

Lab #:	28356-4	28356-5	28356-6
Sample ID:	H-4 Marc D/S Strip	H-5 Marc U/S Camp	H-6 West Trib
Parameter:	mg/L		
Sulphate	132	139	170
Nitrate-N	0.10	0.10	0.10
Cloride	<0.1	<0.1	<0.1
Flouride	0.06	0.05	0.05
Nitrite-N	<0.05	<0.05	<0.05

Approved:
Randy Neumann, B.Sc.
Laboratory Manager

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WO (Lang.) : 28356
PO # :
Date Rec'd. : 08/12/97
Date Comp. : 08/29/97

Client		Received From	
Name	: LABERGE ENVIRONMENTAL	Name	:
Address	: Box 5111, Whitehorse, Yukon Y1A 4S3	Address	:
Phone	: (403) 668-6838	Phone	:
Fax	: (403) 667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

RESULTS OF ANALYSIS

Lab #:	28356-7	28356-8	28356-9
Sample ID:	H-2 Sediment	H-3 Sediment	H-4 Sediment
Parameter: %			
Organic Matter	2.21	6.21	2.44

By loss of ignition

Approved: _____
Randy Neumann, B.Sc.
Laboratory Manager

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WO (Lang.) : 28356
PO # :
Date Rec'd. : 08/12/97
Date Comp. : 08/29/97

Client		Received From	
Name	: LABERGE ENVIRONMENTAL	Name	:
Address	: Box 5111, Whitehorse, Yukon Y1A 4S3	Address	:
Phone	: (403) 668-6838	Phone	:
Fax	: (403) 667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

RESULTS OF ANALYSIS

Lab #:	28356-10	28356-11
Sample ID:	H-2 Sediment	H-3 Sediment
Parameter: %		
Organic Matter	5.12	5.02

By loss of ignition

Approved: _____
Randy Neumann, B.Sc.
Laboratory Manager

To: LABERGE ENVIRONMENTAL
Box 5111
Whitehorse, Yukon
Y1A 4S3

Workorder: 28356
Received : 12-Aug-97
Completed: 27-Aug-97

Attn: Ken Nordin

Re: Water And Sediment Samples

ANALYSIS

OF

ENVIRONMENTAL SAMPLES

METHODOLOGY - WATER

Dissolved metals were determined in a filtered (0.45 um) & acidified sample aliquot by UNICP-AES (EPA Method 200.15).
Total metals were determined in a sample aliquot which was acid digested in a closed teflon vessel in a microwave oven (EPA Method 3015). The digest was analyzed by UNICP-AES (EPA Method 200.15).
Mercury was determined by cold vapour - UV (EPA Method 245.1).
Thallium and selenium were determined by GF-AAS (EPA Method 7000A).

METHODOLOGY - SEDIMENTS

DIGESTION
A portion (0.5 grams) of the -100 mesh fraction was acid digested in a closed teflon vessel in a microwave oven (modified EPA Method 3051).

ANALYSIS
Metals were determined on the resulting solution by UNICP-AES (EPA Method 200.15).

ACCREDITATION

Norwest Labs is accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL), by the Standards Council of Canada (SCC), and by Washington State Department of Ecology for specific tests. Norwest Labs is also registered in the B.C. Ministry of Environment Laboratory Registration Program.

To: LABERGE ENVIRONMENTAL W/O: 28356 Page 1

Sample type	surface wtr	surface wtr	surface wtr	surface wtr	surface wtr
Identification	H-1 Adit Seepage	H-2 East Trib	H-2 East Trib	H-3 Marc D/S Camp	H-3 Marc D/S Camp
Lab Reference #	28356-001	28356-002	28356-002	28356-003	28356-003
ICP - ULTRASONIC NEBULIZATION					
Method used	filt. 0.45u DISSOLVED	filt. 0.45u DISSOLVED	uwave HNO3 TOTAL	filt. 0.45u DISSOLVED	uwave HNO3 TOTAL
WATER NUMERICAL CRITERIA-AW					
aluminum .05-.5	< 0.01	0.02	0.75	0.04	0.08
antimony 0.3	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
arsenic 0.5	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
barium 10	0.0163	0.0098	0.0098	0.0679	0.0733
beryllium 0.053	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
bismuth	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
cadmium.002-.018	0.0012	0.0061	0.011	0.0010	0.0011
calcium	44.4	29.0	29.0	41.2	47.2
chromium 0.02	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
cobalt 0.5	< 0.001	0.014	0.015	< 0.001	< 0.001
copper 0.02-0.09	0.004	0.013	0.448	0.008	0.032
iron 3	0.015	< 0.003	4.	0.013	0.361
lead 0.04-0.16	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
lithium	< 0.002	< 0.002	< 0.002	< 0.002	0.003
magnesium	7.89	7.19	7.20	20.5	23.8
manganese 1	0.0054	0.227	0.228	0.0218	0.0287
mercury 0.001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
molybdenum 10	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
nickel 0.25-1.5	< 0.002	0.003	0.004	< 0.002	< 0.002
phosphorus	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
potassium	< 0.2	< 0.2	< 0.2	< 0.2	0.3
selenium 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
silicon	2.06	1.21	1.63	1.53	1.75
silver 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
sodium	1.64	0.86	0.86	0.42	0.52
strontium	0.030	0.039	0.042	0.044	0.053
sulfur	33.9	19.5	19.5	17.9	20.8
thallium 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
thorium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
tin	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
titanium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
uranium 3	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
vanadium	0.002	< 0.002	0.003	0.003	0.005
zinc 0.3	0.149	0.682	1.64	0.065	0.131
zirconium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Results in	mg/L	mg/L	mg/L	mg/L	mg/L

/2...

To: LABERGE ENVIRONMENTAL W/O: 28356 Page 2

Sample type	surface wtr	surface wtr	surface wtr	surface wtr	surface wtr
Identification	H-4 Marc D/S Strip	H-4 Marc D/S Strip	H-4 Marc D/S Strip duplicate	H-4 Marc D/S Strip duplicate	H-5 Marc U/S Camp
Fraction					
Lab Reference #	28356-004A	28356-004A	28356-004B	28356-004B	28356-005
ICP - ULTRASONIC NEBULIZATION					
Method used	filt. 0.45u DISSOLVED	uwave HNO3 TOTAL	filt. 0.45u DISSOLVED	uwave HNO3 TOTAL	filt. 0.45u DISSOLVED
WATER NUMERICAL CRITERIA-AW					
aluminum .05-.5	0.04	0.05	0.03	0.05	< 0.01
antimony 0.3	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
arsenic 0.5	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
barium 10	0.0567	0.0572	0.0570	0.0570	0.0639
beryllium 0.053	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
bismuth	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
cadmium.002-.018	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
calcium	40.6	41.2	39.6	40.9	38.4
chromium 0.02	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
cobalt 0.5	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
copper 0.02-0.09	0.008	0.013	0.007	0.016	< 0.002
iron 3	0.010	0.105	0.013	0.107	0.019
lead 0.04-0.16	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
lithium	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
magnesium	19.9	20.2	19.2	20.0	19.8
manganese 1	0.0115	0.0130	0.0110	0.0135	0.0052
mercury 0.001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
molybdenum 10	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
nickel 0.25-1.5	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
phosphorus	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
potassium	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
selenium 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
silicon	1.46	1.49	1.42	1.49	1.37
silver 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
sodium	0.43	0.56	0.44	0.63	0.28
strontium	0.042	0.044	0.043	0.046	0.039
sulfur	18.2	18.6	17.7	18.5	16.2
thallium 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
thorium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
tin	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
titanium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
uranium 3	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
vanadium	0.003	0.004	0.003	0.003	< 0.002
zinc 0.3	0.049	0.060	0.049	0.067	0.004
zirconium	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Results in	mg/L	mg/L	mg/L	mg/L	mg/L

/3...

Sample type	surface wtr	surface wtr	surface wtr
Identification	H-5 Marc U/S Camp	H-6 West Trib	H-6 West Trib
Lab Reference #	28356-005	28356-006	28356-006
ICP - ULTRASONIC NEBULIZATION--			
Method used	uwave HNO3 TOTAL	filt. 0.45u DISSOLVED	uwave HNO3 TOTAL
WATER NUMERICAL CRITERIA-AW----			
aluminum .05-.5	< 0.01	0.09	0.09
antimony 0.3	< 0.02	< 0.02	< 0.02
arsenic 0.5	< 0.02	< 0.02	< 0.02
barium 10	0.0653	0.0388	0.0419
beryllium 0.053	< 0.0002	< 0.0002	< 0.0002
bismuth	< 0.02	< 0.02	< 0.02
cadmium.002-.018	< 0.0005	< 0.0005	< 0.0005
calcium	38.5	45.1	46.1
chromium 0.02	< 0.001	< 0.001	< 0.001
cobalt 0.5	< 0.001	< 0.001	< 0.001
copper 0.02-0.09	< 0.002	< 0.002	0.002
iron 3	0.019	0.009	0.017
lead 0.04-0.16	< 0.005	< 0.005	< 0.005
lithium	< 0.002	< 0.002	< 0.002
magnesium	19.9	20.9	21.3
manganese 1	0.0064	0.0048	0.0050
mercury 0.001	< 0.0001	< 0.0001	< 0.0001
molybdenum 10	< 0.005	< 0.005	< 0.005
nickel 0.25-1.5	< 0.002	< 0.002	< 0.002
phosphorus	< 0.06	< 0.06	< 0.06
potassium	< 0.2	< 0.2	0.3
selenium 0.01	< 0.01	< 0.01	< 0.01
silicon	1.37	1.48	1.52
silver 0.001	< 0.001	< 0.001	< 0.001
sodium	0.37	0.43	0.57
strontium	0.039	0.046	0.047
sulfur	16.4	24.7	25.1
thallium 0.003	< 0.003	< 0.003	< 0.003
thorium	< 0.005	< 0.005	< 0.005
tin	< 0.005	< 0.005	< 0.005
titanium	< 0.001	< 0.001	< 0.001
uranium 3	< 0.06	< 0.06	< 0.06
vanadium	< 0.002	0.002	0.003
zinc 0.3	0.006	0.004	0.004
zirconium	< 0.001	< 0.001	< 0.001
Results in	mg/L	mg/L	mg/L

/4...

Sample type	sediment	sediment	sediment	sediment	sediment
Identification	H-2	H-3	H-3 duplicate	H-4	H-5
Fraction					
Lab Reference #	28356-007	28356-008A	28356-008B	28356-009	28356-010
ICP - ULTRASONIC NEBULIZATION					
Method used	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble	uwave HNO3/H2O2 soluble
Amount analysed	0.512 g	0.506 g	0.505 g	0.505 g	0.501 g
aluminum	32600	30900	26800	24000	18100
antimony	< 2.	< 2.	< 2.	< 2.	< 2.
arsenic	104.	30.	37.	24.	8.
barium	51.3	330.	291.	217.	292.
beryllium	< 0.1	0.8	0.7	0.6	0.8
bismuth	< 5.	< 5.	< 5.	< 5.	< 5.
cadmium	8.9	5.8	6.0	4.2	1.1
calcium	2650	35900	34700	22800	49000
chromium	49.7	37.5	35.3	34.9	20.4
cobalt	51.7	30.2	31.3	26.1	12.5
copper	2100	1070	1100	606.	52.7
iron	92000	52000	52000	46000	33000
lead	125.	60.	65.	51.	48.
lithium	32.9	25.1	24.4	23.9	19.3
magnesium	28900	31200	30500	26600	31000
manganese	2030	1580	1610	1340	1350
molybdenum	1.	2.	3.	2.	2.
nickel	40.1	27.1	28.3	28.6	26.4
phosphorus	381.	514.	503.	434.	542.
potassium	1580	8500	6200	4800	4980
selenium	< 2.	< 2.	< 2.	< 2.	< 2.
silicon	328.	517.	514.	375.	535.
silver	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
sodium	134.	388.	362.	340.	415.
strontium	4.	25.	24.	16.	28.
sulfur	720	510	530	280	410
thorium	< 1.	< 1.	< 1.	< 1.	< 1.
tin	< 1.	< 1.	< 1.	< 1.	< 1.
titanium	656.	418.	388.	415.	207.
uranium	< 5.	< 5.	< 5.	< 5.	< 5.
vanadium	75.	74.	70.	66.	71.
zinc	2430	1580	1610	1450	209.
zirconium	9.0	16.0	16.3	16.3	18.0
Results in	ug/dry g	ug/dry g	ug/dry g	ug/dry g	ug/dry g

/5...

To: LABERGE ENVIRONMENTAL W/O: 28356 Page 5

Sample type Identification Lab Reference #	sediment H-6 28356-011	lake sed CCGMR LKSD-3 28356-012	blank procedural 28356-013	lake sed CCGMR LKSD-3 28356-013A	lake sed CCGMR LKSD-3 28356-013B
ICP - ULTRASONIC NEBULIZATION					
Method used Amount analysed	uwave HNO3/H2O2 soluble 0.515 g	uwave HNO3/H2O2 soluble 0.511 g	uwave HNO3/H2O2 soluble -	total CCGMR MEAN	conc. aqua regia soluble CCGMR MEAN
aluminum	27300	31500	< 0.05	66100	-
antimony	< 2.	< 2.	< 0.02	1.3	1.4
arsenic	14.	31.	< 0.02	27.	23.
barium	223.	272.	< 0.0005	680.	-
beryllium	1.3	0.9	< 0.001	1.9	-
bismuth	< 5.	< 5.	< 0.05	-	-
cadmium	0.5	0.6	< 0.001	-	0.6
calcium	32600	10900	0.06	16000	-
chromium	26.0	50.2	< 0.005	87.	51.
cobalt	27.5	25.6	< 0.001	30.	30.
copper	44.6	36.1	< 0.005	35.	34.
iron	38000	35000	0.03	40000	35000
lead	34.	24.	< 0.01	29.	26.
lithium	26.7	23.4	< 0.005	25.	-
magnesium	27500	10900	< 0.01	12000	-
manganese	1390	1250	< 0.005	1440	1220
molybdenum	1.	2.	< 0.01	-	2.
nickel	36.4	39.9	< 0.002	47.	44.
phosphorus	454.	974.	< 0.05	1090	-
potassium	6400	7100	< 0.2	18400	-
selenium	< 2.	< 2.	< 0.02	-	-
silicon	362.	355.	0.42	39700	-
silver	< 0.5	2.4	< 0.005	2.7	-
sodium	470.	4460	< 0.05	17200	-
strontium	31.	68.	< 0.01	240.	-
sulfur	490	1520	< 0.1	1400	-
thorium	< 1.	4.	< 0.01	11.4	-
tin	< 1.	< 1.	< 0.01	3.	-
titanium	286.	1550	< 0.002	3330	-
uranium	< 5.	< 5.	< 0.05	4.6	-
vanadium	41.	55.	< 0.01	82.	55.
zinc	101.	133.	< 0.005	152.	139.
zirconium	18.6	41.3	< 0.001	178.	-
Results in	ug/dry g	ug/dry g	mg/L	ug/dry g	ug/dry g

/6...

Sample type	lake sed
Identification	CCGMR LKSD-3
Lab Reference #	28356-013C
ICP - ULTRASONIC NEBULIZATION	
Method used	dilute aqua-regia soluble
Amount analysed	CCGMR MEAN
aluminum	-
antimony	-
arsenic	-
barium	-
beryllium	-
bismuth	-
cadmium	0.4
calcium	-
chromium	-
cobalt	30.
copper	34.
iron	36000
lead	21.
lithium	-
magnesium	-
manganese	1300
molybdenum	-
nickel	46.
phosphorus	-
potassium	-
selenium	-
silicon	-
silver	-
sodium	-
strontium	-
sulfur	-
thorium	-
tin	-
titanium	-
uranium	-
vanadium	-
zinc	155.
zirconium	-
Results in	ug/dry g

Approved:

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Lethbridge PH.(403) 329-9266 FAX(403) 327-8527
Winnipeg PH.(204) 982-8630 FAX(204) 275-6019

WO (Lang.) : 28355
WO (Other) :
PO # :
Date Samp. : 5-Aug-97
Date Rec'd. : 12-Aug-97
Date Comp. : 22-Aug-97

Client		Received From	
Name	: Laberge Environmental	Name	:
Address	: Box 5111 Whitehorse, Yukon Y1A 4S3	Address	:
Phone	: 403-668-6838	Phone	:
Fax	: 403-667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

Petroleum Hydrocarbons in Soil

Parameter	28355-1 SC-1 Drum Cache @ Strip Depth 15cm	28355-2 SS-1 Shop Stain Depth 05cm	28355-3 S-1 Above Shop Depth 15cm	Detection Limit
BTEX				
Benzene	<0.02	<0.02	**0.02**	0.02 ppm
Toluene	<0.02	<0.02	**0.09**	0.02 ppm
Ethylbenzene	**0.10**	**0.04**	**0.12**	0.02 ppm
m- & p- Xylene	**0.09**	**0.14**	**0.57**	0.05 ppm
o- Xylene	**0.51**	<0.03	**0.05**	0.03 ppm
VPH (C5-C10)	**190**	**9.6**	<1.0	1.0 ppm
EPH (C10-C18)	**26000**	**15**	**22**	10 ppm
EPH (C19-C32)	**770**	**270**	**180**	10 ppm
Percent Moisture	15	10	29	

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.

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WO (Lang.) : 28355
WO (Other) :
PO # :
Date Samp. : 5-Aug-97
Date Rec'd.: 12-Aug-97
Date Comp. : 22-Aug-97

Petroleum Hydrocarbons in Soil cont'd

Parameter	28355-4 S-3 Shop Area Soil Depth 15cm	28355-5 ST-4 Below Tank ST4 Depth 15cm	28355-6 TC-10 Drum Cache @ TC-10 Depth 5cm	Detection Limit
BTEX				
Benzene	<0.02	<0.02	<0.02	0.02 ppm
Toluene	<0.02	<0.02	<0.02	0.02 ppm
Ethylbenzene	**0.08**	<0.02	<0.02	0.02 ppm
m- & p- Xylene	**0.39**	**0.28**	**0.13**	0.05 ppm
o- Xylene	<0.03	<0.03	<0.03	0.03 ppm
VPH (C5-C10)	**15**	<1.0	<1.0	1.0 ppm
EPH (C10-C18)	**360**	**220**	**17**	10 ppm
EPH (C19-C32)	**1600**	**1300**	**98**	10 ppm
Percent Moisture	15	63	37	

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.

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WO (Lang.) : 28355
WO (Other) :
PO # :
Date Samp. : 5-Aug-97
Date Rec'd. : 12-Aug-97
Date Comp. : 22-Aug-97

Petroleum Hydrocarbons in Soil cont'd

Parameter	28355-7 TC-10A Soil Below Tanks Depth 10cm	28355-8 S-8 Shop Area Soil Depth 15cm	28355-9 8-D 8 Drum Cache Depth 5cm	Detection Limit
BTEX				
Benzene	<0.02	<0.02	**0.04**	0.02 ppm
Toluene	<0.02	<0.02	<0.02	0.02 ppm
Ethylbenzene	<0.02	**0.07**	**0.11**	0.02 ppm
m- & p- Xylene	**0.10**	**0.14**	**0.57**	0.05 ppm
o- Xylene	<0.03	<0.03	<0.03	0.03 ppm
VPH (C5-C10)	<1.0	**50**	**4.4**	1.0 ppm
EPH (C10-C18)	**350**	**1200**	**630**	10 ppm
EPH (C19-C32)	**210**	**180**	**42000**	10 ppm
Percent Moisture	12	15	57	

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.

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WO (Lang.) : 28355
WO (Other) :
PO # :
Date Samp. : 5-Aug-97
Date Rec'd.: 12-Aug-97
Date Comp. : 22-Aug-97

Petroleum Hydrocarbons in Soil cont'd

Parameter	28355-10 S-12 Below Shop Depth 15cm	28355-11 SC-2 3M Below Strip C Depth 15cm	Detection Limit
BTEX			
Benzene	<0.02	<0.02	0.02 ppm
Toluene	<0.02	<0.02	0.02 ppm
Ethylbenzene	**0.09**	**0.05**	0.02 ppm
m- & p- Xylene	**0.48**	**0.19**	0.05 ppm
o- Xylene	<0.03	<0.03	0.03 ppm
VPH (C5-C10)	<1.0	**3.4**	1.0 ppm
EPH (C10-C18)	**140**	**68**	10 ppm
EPH (C19-C32)	**3800**	**21**	10 ppm
Percent Moisture	57	8.0	

Results are expressed in ppm (mg/kg), dry weight, without correction for recovery data.

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WO (Lang.) : 28355
WO (Other) :
PO # :
Date Samp. : 5-Aug-97
Date Rec'd.: 12-Aug-97
Date Comp. : 22-Aug-97

Petroleum Hydrocarbons in Soil (cont.)

Definitions / Methods

BTEX Analysis: US EPA 8020 which involves purge & trap extraction of the volatile components followed by analysis by capillary gas chromatography using a photo ionization detector.

VPH: VPH (Volatile Petroleum Hydrocarbons)
Summation of the C5 to C10 carbon range determined using a calibrated standard. This method involves purge & trap extraction of the volatile petroleum compounds followed by analysis by capillary gas chromatography using a flame ionization detector.

EPHs: EPH (Extractable Petroleum Hydrocarbons)
Summation of the C10 - C18 or C19 - C32 carbon range respectively, determined using a calibrated standard. B.C. Contaminated Sites Draft Method, 1996, which involves extraction of the sample with dichloromethane followed by analysis with capillary gas chromatography using a flame ionization detector. Correction for specified PAHs not done.

Comments

Quality Control Results

QA/QC		Analyst		
Compound	% Recovery	Analysis	Date	Analyst
BTEX	100	BTEX,VPH	21-Aug-97	Cathy C.
diesel fuel	92	EPHs	19-Aug-97	David D.

Supervisor

Note: All samples will be disposed of after 30 days following analysis unless other arrangements are made.

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Lethbridge PH.(403) 329-9266 FAX(403) 327-8527
Winnipeg PH.(204) 982-8630 FAX(204) 275-6019

WO (Lang.) : 28355
WO (Other) :
PO # :
Date Samp. : 5-Aug-97
Date Rec'd. : 12-Aug-97
Date Comp. : 26-Aug-97

Client		Received From	
Name	: Laberge Environmental	Name	:
Address	: Box 5111 Whitehorse, Yukon Y1A 4S3	Address	:
Phone	: 403-668-6838	Phone	:
Fax	: 403-667-6956	Fax	:
Attn.	: Ken Nordin	Attn.	:
Project	:		

Polynuclear Aromatic Hydrocarbons in Soil

Parameter	28355-1 SC-1 Drum Cache Strip Depth 15cm	28355-2 SS-1 Shop Stain Depth 05c	28355-8 S-8 Shop Area Soil Depth 15cm	28355-9 8-D 8 Drum Cache Depth 5cm	Detection Limit
Naphthalene	1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Acenaphthene	1	<0.1	<0.1	<0.1	0.1 ppm
Fluorene	0.3	<0.1	<0.1	<0.1	0.1 ppm
Phenanthrene	0.1	0.1	<0.1	<0.1	0.1 ppm
Anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Fluoranthene	0.1	<0.1	<0.1	<0.1	0.1 ppm
Pyrene	0.2	0.1	<0.1	<0.1	0.1 ppm
Benzo(a)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Chrysene	0.1	0.1	<0.1	<0.1	0.1 ppm
Benzo-fluoranthenes (b&k)	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(a)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Indeno(1,2,3-cd)pyrene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Dibenzo(a,h)anthracene	<0.1	<0.1	<0.1	<0.1	0.1 ppm
Benzo(g,h,i)perylene	<0.1	<0.1	<0.1	<0.1	0.1 ppm

Surrogate	% Recovery			Recovery Range
Nitrobenzene-d5	na	84	88	23-120
2-Fluorobiphenyl	116	84	83	30-115
4-Terphenyl-d14	97	112	101	18-137

Results are expressed in ppm (ug/g) dry weight, without correction for recovery data.
na = not available due to high hydrocarbon contamination.

NORWEST LABS

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Winnipeg	PH.(204) 982-8630	FAX(204) 275-6019

WO (Lang.) : 28355
WO (Other) :
PO # :
Date Samp. : 5-Aug-97
Date Rec'd. : 12-Aug-97
Date Comp. : 26-Aug-97

Polynuclear Aromatic Hydrocarbons in Soil (cont.)

Definitions / Methods

Polynuclear Aromatic Hydrocarbons: This analysis is carried out in accordance with U. S. Environmental Protection Agency Method 3540/8270 (#SW 846, 3rd Edition, Washington DC) which involves extraction of the components with an organic solvent followed by analysis by capillary gas chromatography using a mass selective detector.

Percent Moisture: Percentage of the total wet weight of the sample as received. This analysis is carried out gravimetrically by drying the sample to constant weight at 105 C.

Comments

Quality Control Results

QA/QC		Analyst		
Compound	% Recovery	Analysis	Date	Analyst
fluoranthene	113	PAHs	25-Aug-97	R. Corbet
benzo(a)pyrene	98			

Supervisor

Note: All samples will be disposed of after 30 days following analysis unless other arrangements are made.

APPENDIX TWO - HART RIVER MINE VEGETATION

Upland vegetation species at Hart River mine area:

Aconitum delphinifolium
Anemone richardsonii
Arnica sp.
Arctostaphylos rubra
Aster sibiricus
Cassiope tetragona
Dryas drummondii
Dryopteris fragrans
Empetrum nigrum
Equisetum scirpoides
Gentiana prostrata
Hedysarum alpinum
Juniperus communis
Ledum decumbens
Lupinus arcticus
Picea glauca
Pleurozium scheberi
Polygonum bistorta
Rubus chamaemorous
Salix spp.
Senecio sp.
Shepherdia canadensis
Solidago sp.
Sphagnum sp.
Vaccinium uliginosum
Vaccinium vitus-idaea
Valerian capitata

Revegetation species on disturbed area around shop and mine adits:

Anemone sp.
Antennaria sp.
Arctagrostis latifolia
Arctostaphylos rubra
Arctostaphylos uva-ursi
Betula glandulosa
Campanula sp.
Carex sp.
Dryas drummondii
Dryopteris fragrans

Empetrum nigrum
Epilobium angustifolium
Epilobium latifolium
Equisetum arvense
Eriophorum sp.
Hordeum jubatum
Juncus sp.
Ledum decumbens
Oxyria dignya
Polygonum alaskanum
Potentilla fruticosa
Salix arctica
Salix reticulata
Salix spp. (at least 2 species)
Saxifraga tricuspidata
Vaccinium uliginosum

Riparian vegetation species along Marc Creek near airstrip:

Epilobium angustifolium
Epilobium latifolium
Equisetum arvense
Gentiana algida
Papaver sp.
Parnassia sp.
Petasites sp.
Picea glauca
Pyrola asarifolia
Rosa acicularis
Salix spp.
Saxifraga sp.
Silene involucrata

Revegetation species on airstrip:
Agrostis scabra
Aster sibiricus
Elymus sp.
Epilobium angustifolium
Epilobium latifolium
Equisetum arvense
Heirochloe alpina
Salix spp.

APPENDIX THREE - FIGURES:

FIGURE 1 - SITE LOCATION

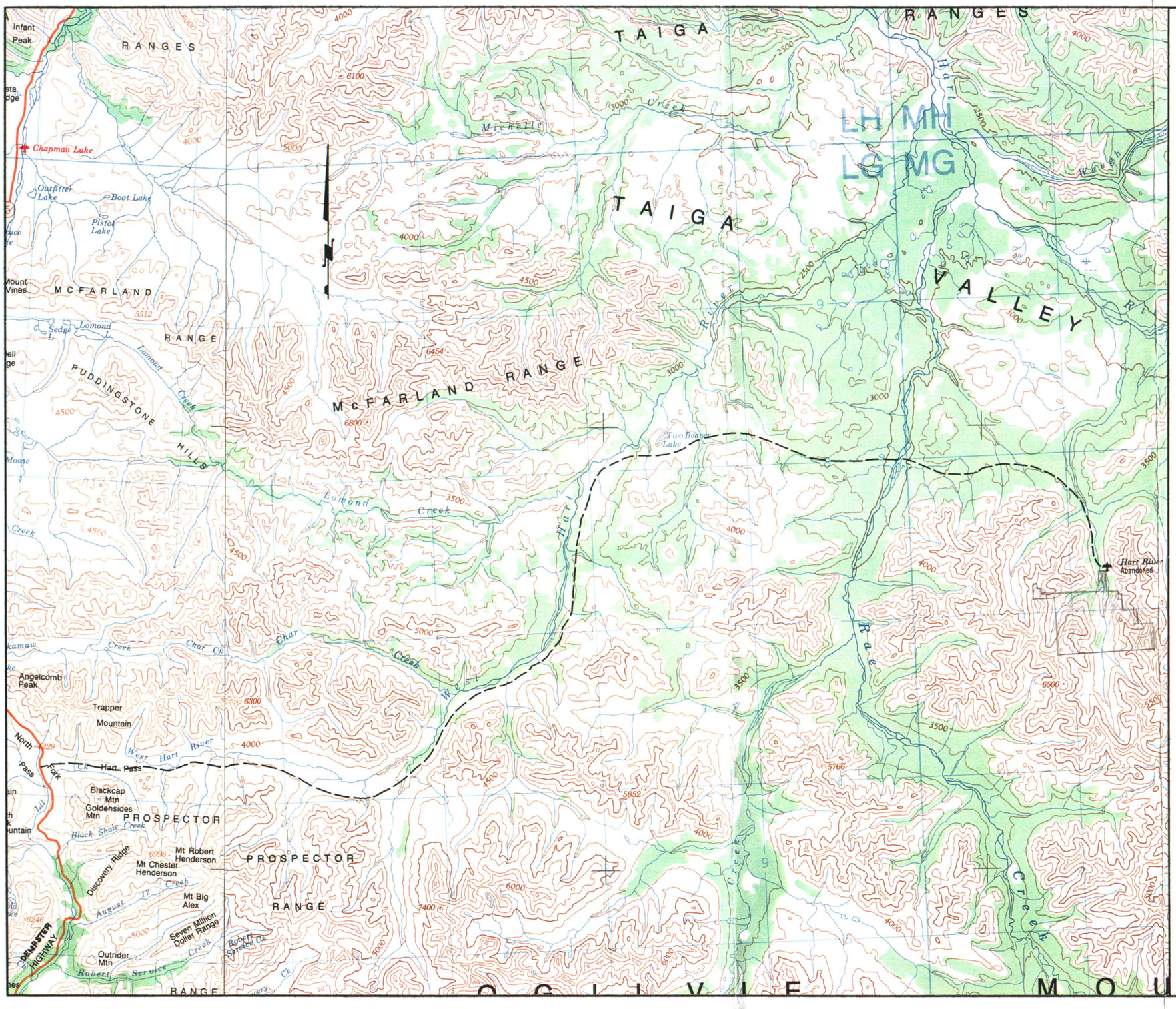
FIGURE 2 - SITE PLAN

FIGURE 3 - AIRSTRIP AREA

FIGURE 4 - CAMP AREA

FIGURE 5 - SHOP AND ADIT AREA

FIGURE 6 - VEGETATION



HART RIVER MINERAL EXPLORATION PROPERTY SITE ASSESSMENT

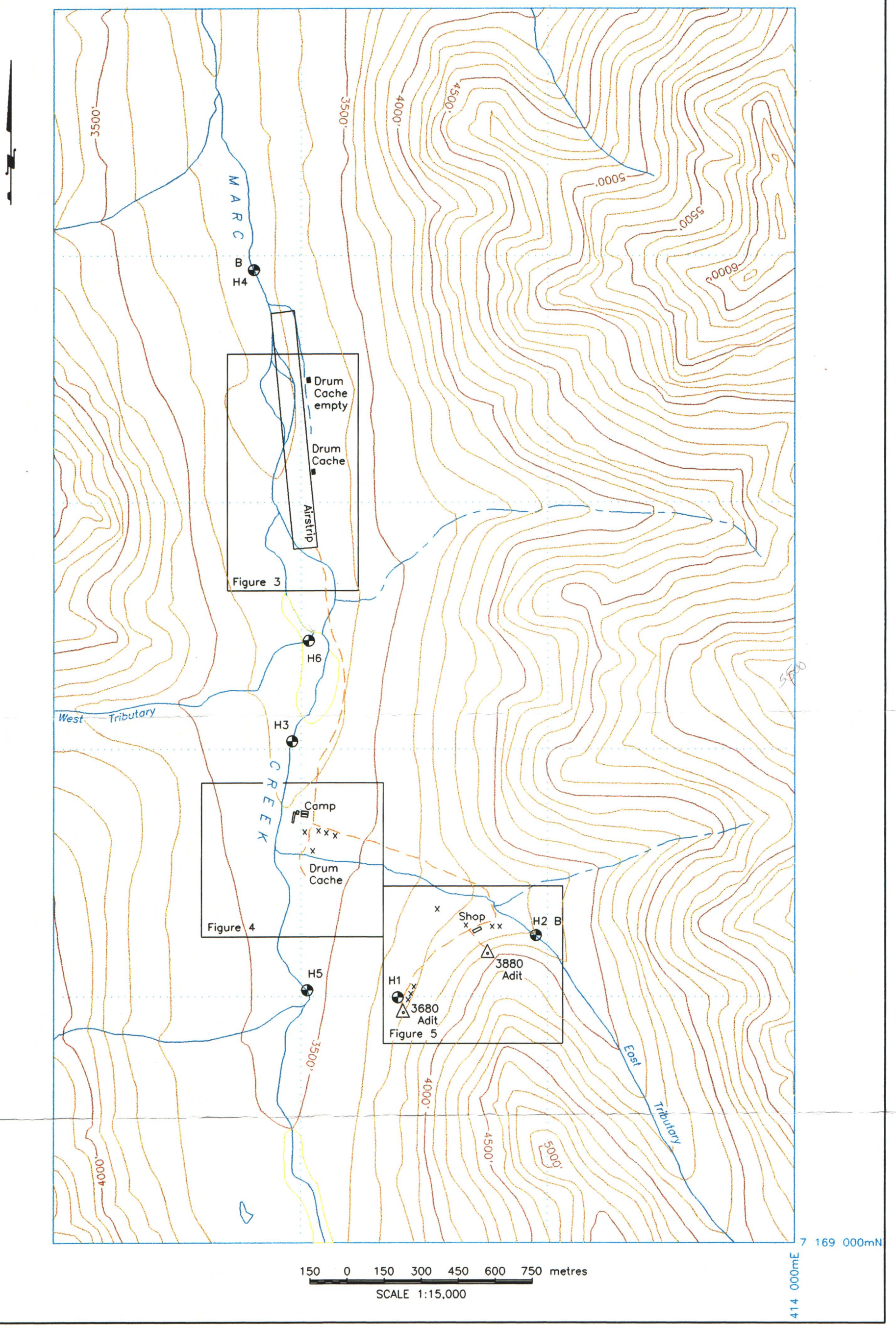
FIGURE 1 – SITE LOCATION

2 0 2 4 6 8 10 km

SCALE 1 : 250,000

LEGEND

Winter Road used in 1968/69



HART RIVER MINERAL EXPLORATION PROPERTY
SITE ASSESSMENT
FIGURE 2 – SITE PLAN

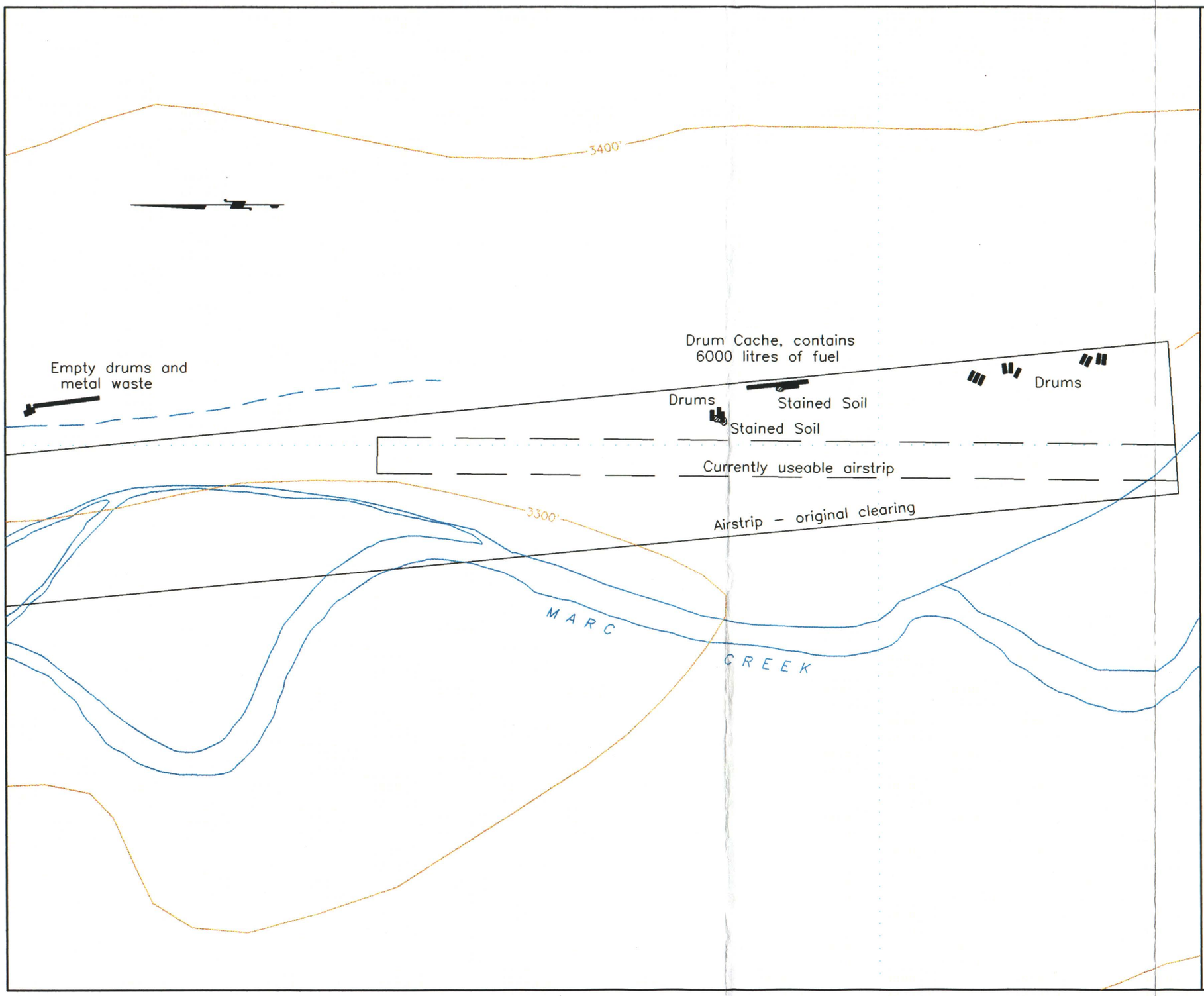
x	5000 Gallon Above Grade Fuel Tank
▬	Drum Cache
H1 ⊕	Water/Sediment Site
B	Benthos Site

HART RIVER MINERAL EXPLORATION PROPERTY SITE ASSESSMENT

FIGURE 3 – AIRSTRIP AREA

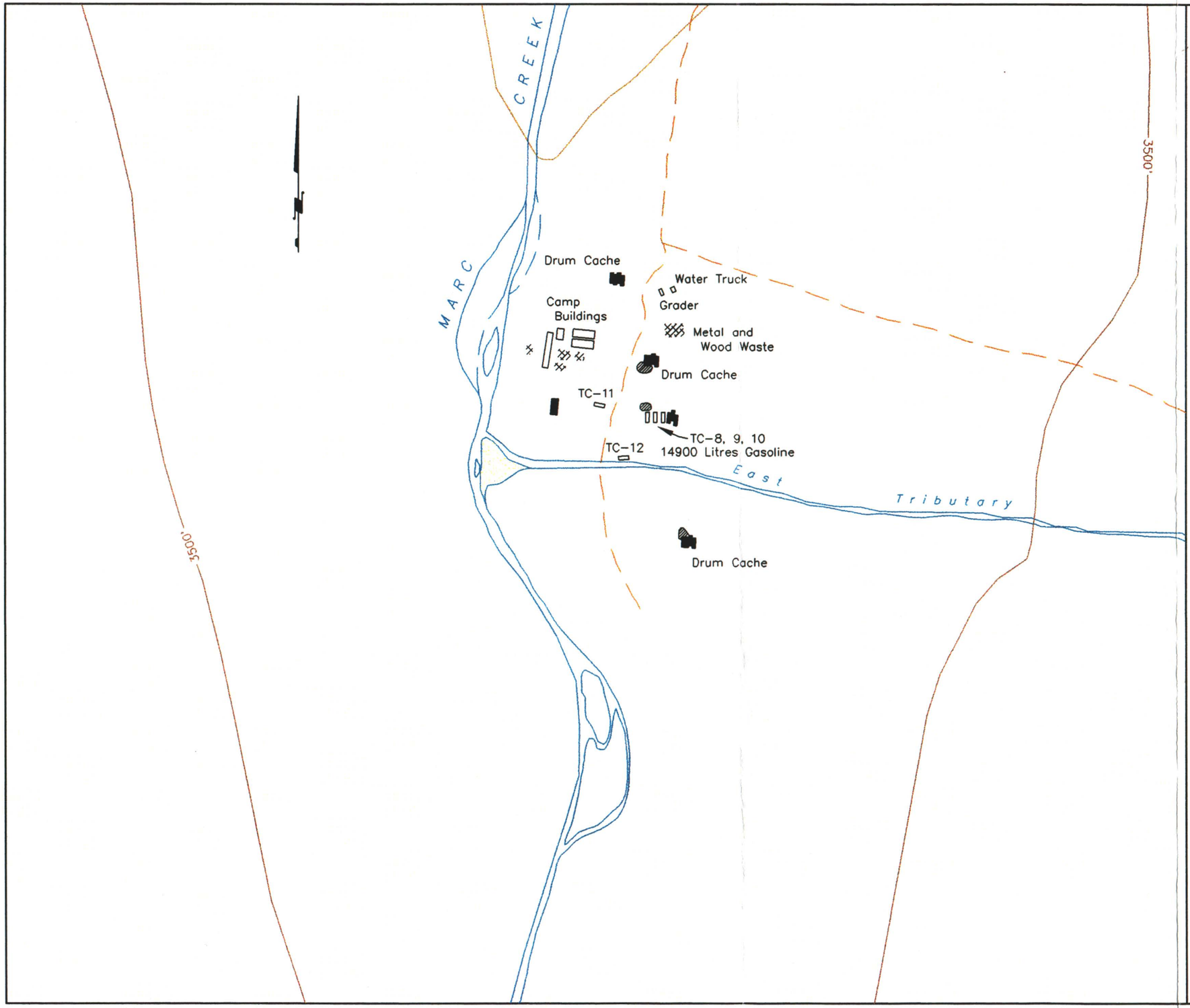
20 0 20 40 60 80 100 metres

SCALE 1:2500



LEGEND

- 5000 Gallon Above Grade Fuel Tank
- Drum Cache
- H1 Water/Sediment Site
- B Benthos Site
- Stained Soil



HART RIVER MINERAL EXPLORATION PROPERTY SITE ASSESSMENT

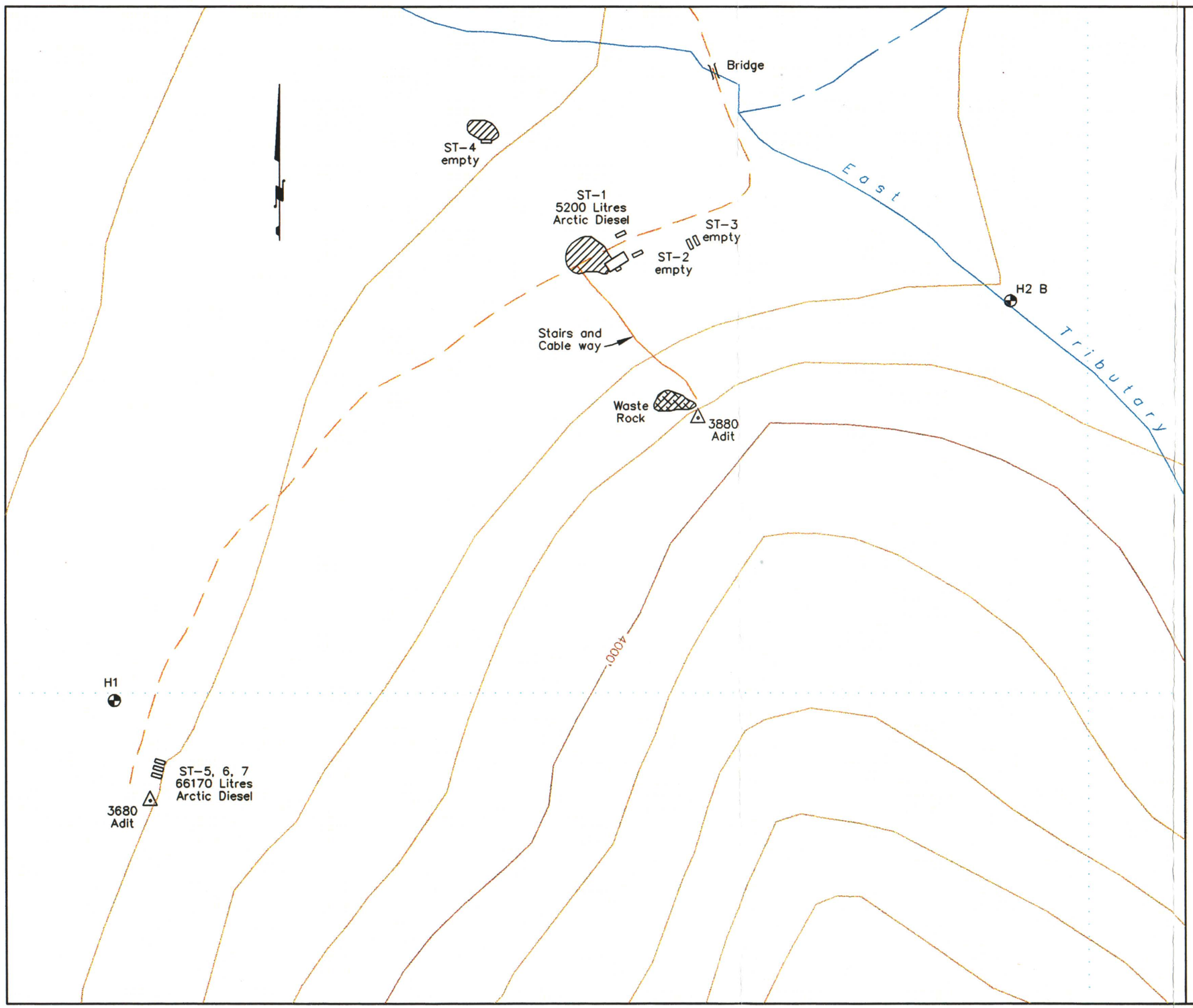
FIGURE 4 – CAMP AREA

20 0 20 40 60 80 100 metres

SCALE 1:2500

LEGEND

- TC-11 — 5000 Gallon Above Grade Fuel Tank
- Drum Cache
- H1 — Water/Sediment Site
- B — Benthos Site
- Stained Soil



HART RIVER MINERAL EXPLORATION PROPERTY SITE ASSESSMENT

FIGURE 5 – SHOP and ADIT AREA

20 0 20 40 60 80 100 metres

SCALE 1:2500

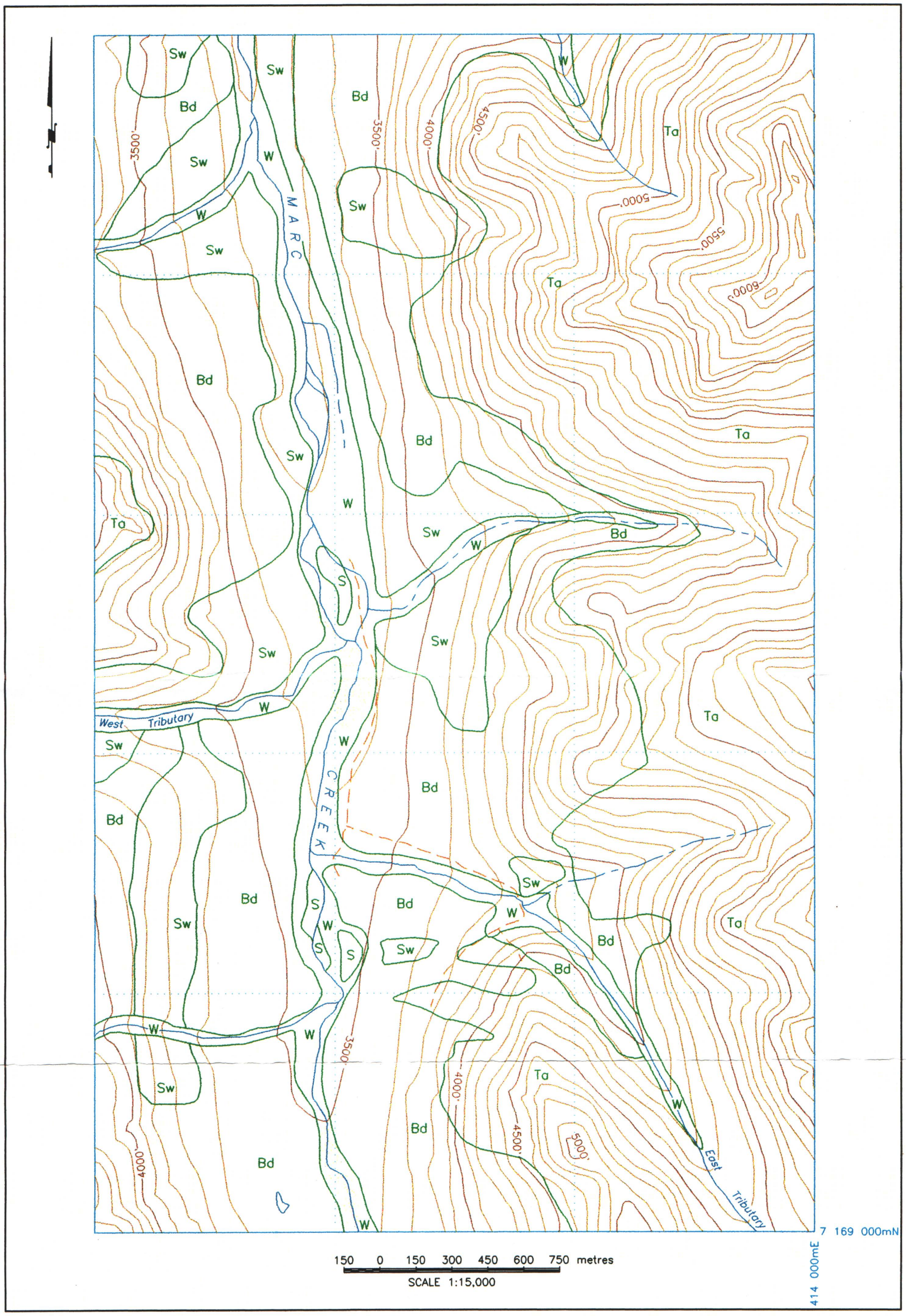
LEGEND

ST-4 — 5000 Gallon Above Grade Fuel Tank

Drum Cache

H1 / B — Water/Sediment Site / Benthos Site

Hydrocarbons Detected in Soil



HART RIVER MINERAL EXPLORATION PROPERTY
SITE ASSESSMENT

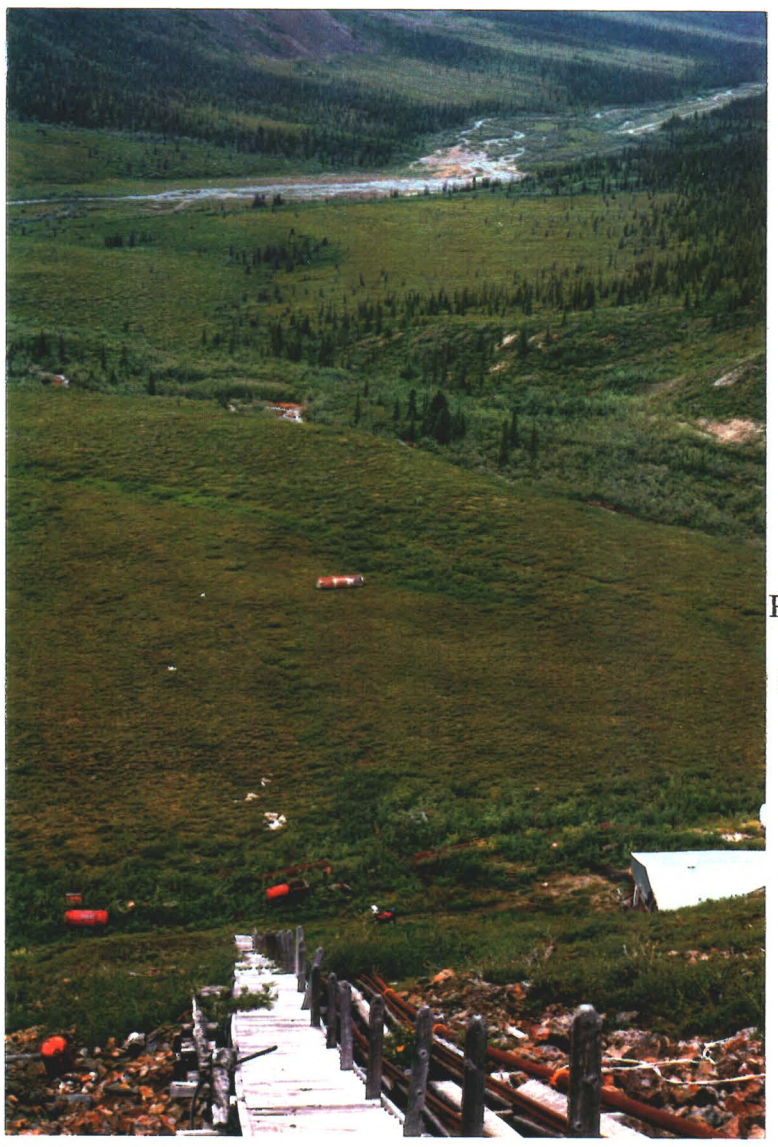
FIGURE 6 – VEGETATION

Sw – White Spruce Forest
Bd – Dwarf Birch/Willow
S – Sedge/Dwarf Shrub
W – Riparian Willow
Ta – Tallus/Rock

Photograph # 9: Shop, storage tank ST - 1 at left side.

Photograph # 10: Storage tank ST - 1, contains 5,200 litres diesel fuel.

Photograph # 11: Shop sampling grid.



Photograph # 12: Looking down
from above shop.
Storage tank ST - 4 in background.

Photograph # 13: Shop, core rack, generator, ST - 1.

Photograph # 14: Camp at confluence of East Tributary and Marc Creek.

Photograph # 15: Camp buildings. Propane tanks and storage tank TC - 11.

Photograph # 16: Storage tanks TC - 8, 9, and 10. Contain 14,900 litres spoiled gasoline.

Photograph # 17: Water truck and grader at camp.

Photograph # 18: Drum cache south of camp, 8 drums containing 1,600 litres engine oil.

Photograph # 19: Looking South at airstrip, camp in background.

Photograph # 20: Drum cache at airstrip. Total of 100 drums. 34 containing a total of 6,000 litres of fuel, mostly diesel. All drums at lower portion of photo are empty.

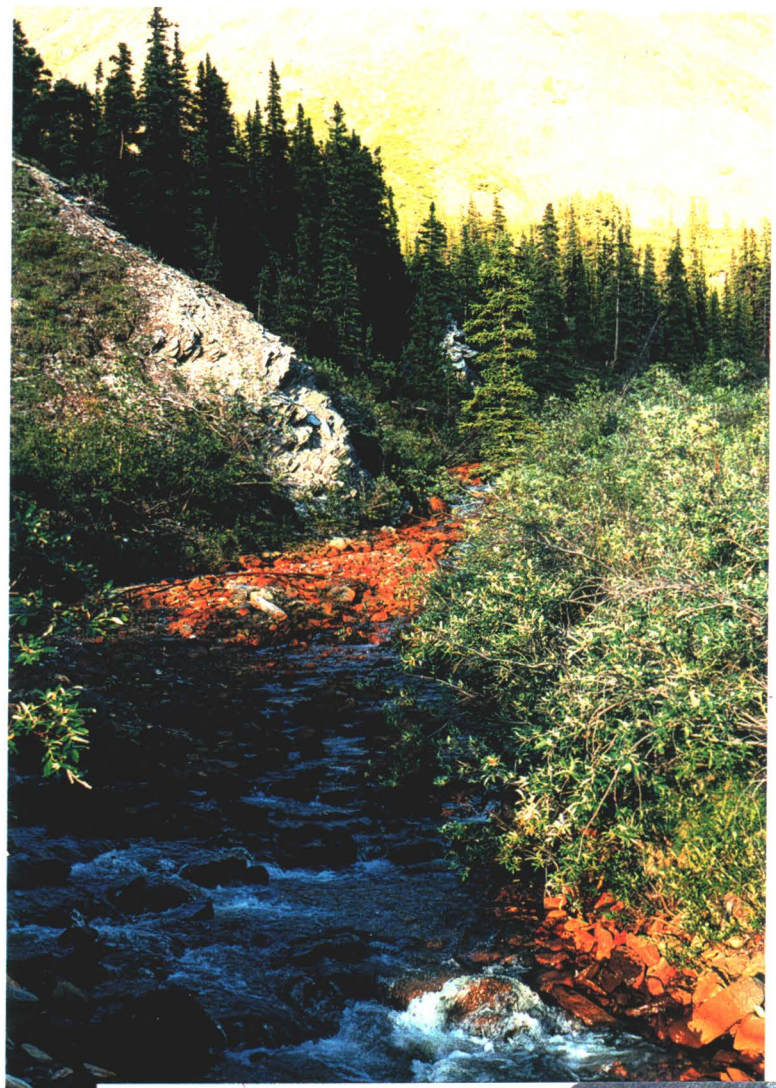
Photograph # 21: Drums at south end of airstrip, all contain product.

Photograph # 21: Drum cache at south end of airstrip. Leaking. Have been flooded.

Photograph # 22: Looking north towards camp, airstrip in background.

Photograph #1:looking East at camp, shop and mine openings in background.

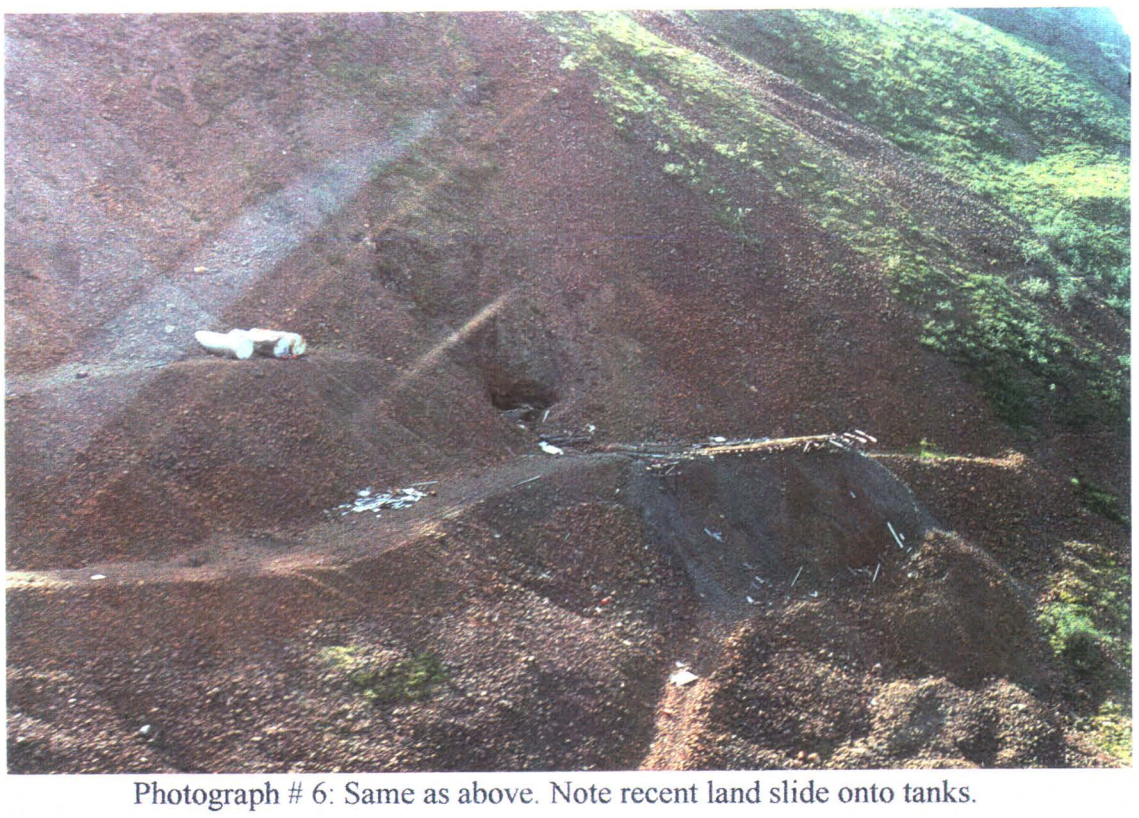
Photograph #2:



Photograph #3: East Tributary,
sample site H - 2

Photograph #4: Marc Creek sample site H - 5

Photograph # 5: 3680 Adit, Storage tanks ST 5, 6, and 7. Contain 66,170 litres diesel fuel.



Photograph # 6: Same as above. Note recent land slide onto tanks.

Photograph # 7: 3880 Adit, shop.

Photograph # 8: 3880 Adit opening.