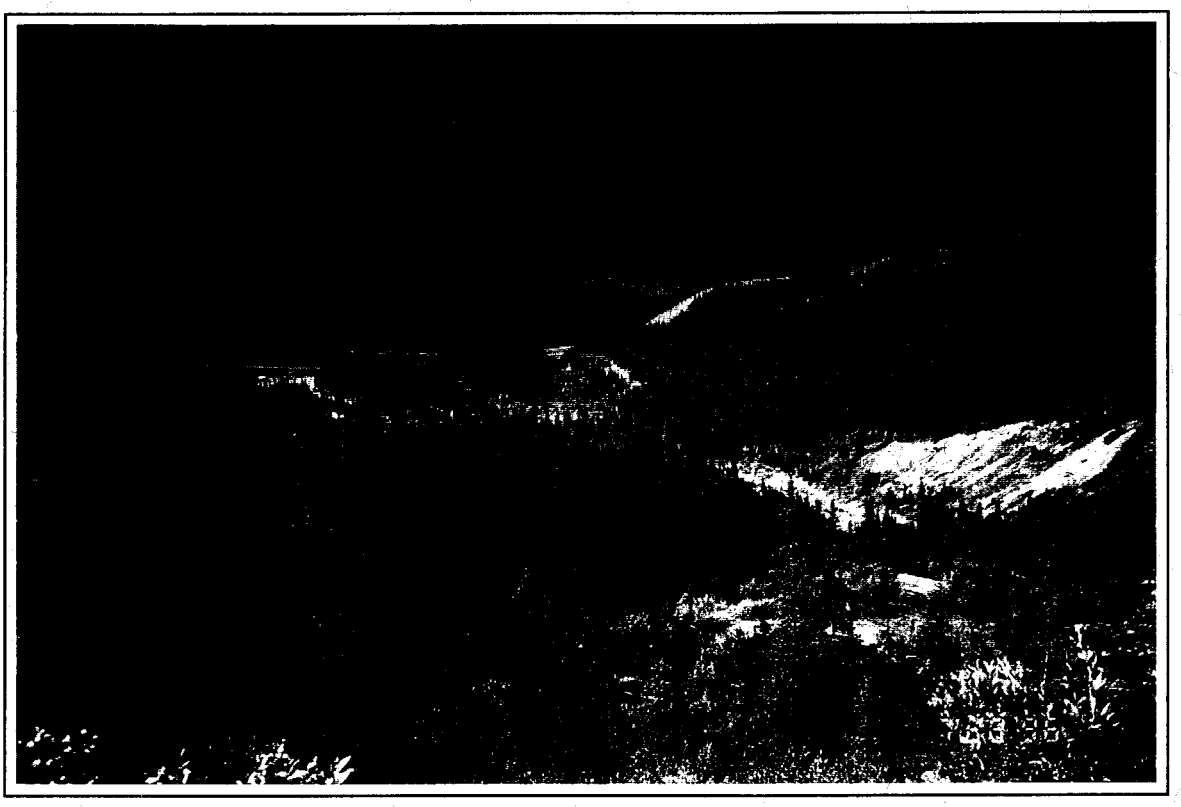
MN-079

PWGSC

Quality in Environmental Services

PHASE II ENVIRONMENTAL ASSESSMENT OF THE TALLY HO ABANDONED MINE SITE



prepared for:

Action on Waste Program
Indian and Northern Affairs Canada

prepared by:

Environmental Services
Public Works and Government Services Canada

March 1997

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

Canada

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EXECUTIVE SUMMARY

A phase II environmental assessment was conducted at the Tally-Ho abandoned mine site (60^0 14'53" N, 135^0 03'54" W) in July, 1996 by Environmental Services, Public Works and Government Services Canada for the Action on Waste Program, Indian and Northern Affairs Canada. Based on the findings of the Phase I investigation performed in 1993 by DIAND Technical Services, a phase II assessment was conducted to a) identify potential environmental and human health risks associated with the present condition of the mine site, and b) provide recommendations for remediation of those risks.

A field investigation of the abandoned mine site was conducted to evaluate environmental and human safety concerns with respect to: mine openings and workings; buildings and infrastructure; waste disposal areas; waste rock disposal areas; surface water (including adit and waste rock seepage, and receiving waters); and hazardous and non-hazardous materials on the site.

The results of the investigation concluded that the mine openings have been adequately secured from public access. An assessment of the acid rock drainage potential for the waste rock and adit shows that the small volume of waste rock at the site is not acid generating and there has been little or no impact on the adjacent stream's water quality.

Aesthetic concerns arise from 15 empty barrels and three wood platforms remaining at the site.

The recommendation is to burn the wood platforms and bury the ashes on site and to crush the barrels and bury with the ashes. No further test work is recommended on the waste rock.

Table 1: Summary of Potential Hazards at Tally-Ho Mine Site

ASSESSMENT COMPONENT	RISK	RECOMMENDATION
1. Building, Infrastructure, Equipment		
None		
2. Non-Hazardous Waste Material		
15 empty barrels	Aesthetic concern	Crush and bury on site
3 wood platform	Aesthetic concern	Burn and bury ashes on site
3. Hazardous Materials		
None		
4. Water Quality		
Mine Seepage - low vol. at lower adit	Low environmental risk	None
Site Drainage - yes	Low environmental risk	None
Receiving Waters - Tally-Ho Cr. into Wheaton River	Low environmental risk	None
5. Waste Rock Disposal Areas		
Waste Rock - no ARD potential	Low environmental risk	None
6. Mine Openings		
2 Adits - 1 not located (& probably sealed; 1 sealed	None	
7. Tailings		
None		

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1.0 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 and/or mitigation work, as appropriate.

At the Tally-Ho abandoned mine site, the 1993 report recommended further investigation into possible environmental impacts resulting from the previous mining activities. According to this report, the potential areas of concern included only an aesthetic concern with regard to metal waste remaining at the site. No rock, tailings, soil or water samples were collected in this assessment.

In light of these preliminary findings, Indian and Northern Affairs Canada has determined that further investigation is warranted. Environmental Services, Public Works and Government Services Canada was retained to conduct an environmental assessment of the Tally-Ho abandoned mine site to a) identify specific environmental and human safety risks; and b) provide clean-up recommendations.

1.1 LOCATION

The Tally-Ho abandoned mine site is situated at 60°14'53"N latitude and 135° 03'54"W longitude. It is approximately 21 km northwest of the village of Carcross and 25 km southwest of Robinson on Tally-Ho Mountain in the Boundary Ranges (Coast Mountains). The site is between 1700 and 1750 m above sea level.

1.2 OVERVIEW OF SITE DEVELOPMENT

The property was first staked in 1906. The underground development work completed by 1910 consisted of a 90 m drift; a 3 m winze; a 12 m raise, and a cross cut about 5 m long. Additional underground development work was reported by D.D. Cairnes of the GSC in his 1921 field report.

Prior to 1966 the property had been explored by means of two adits, one about 215 m long and the other less than 150 m. Limited crosscutting and drifting was done. In 1966, an access road was built to the old workings from Mile 18 on the Carcross-Yukon Antimony road.

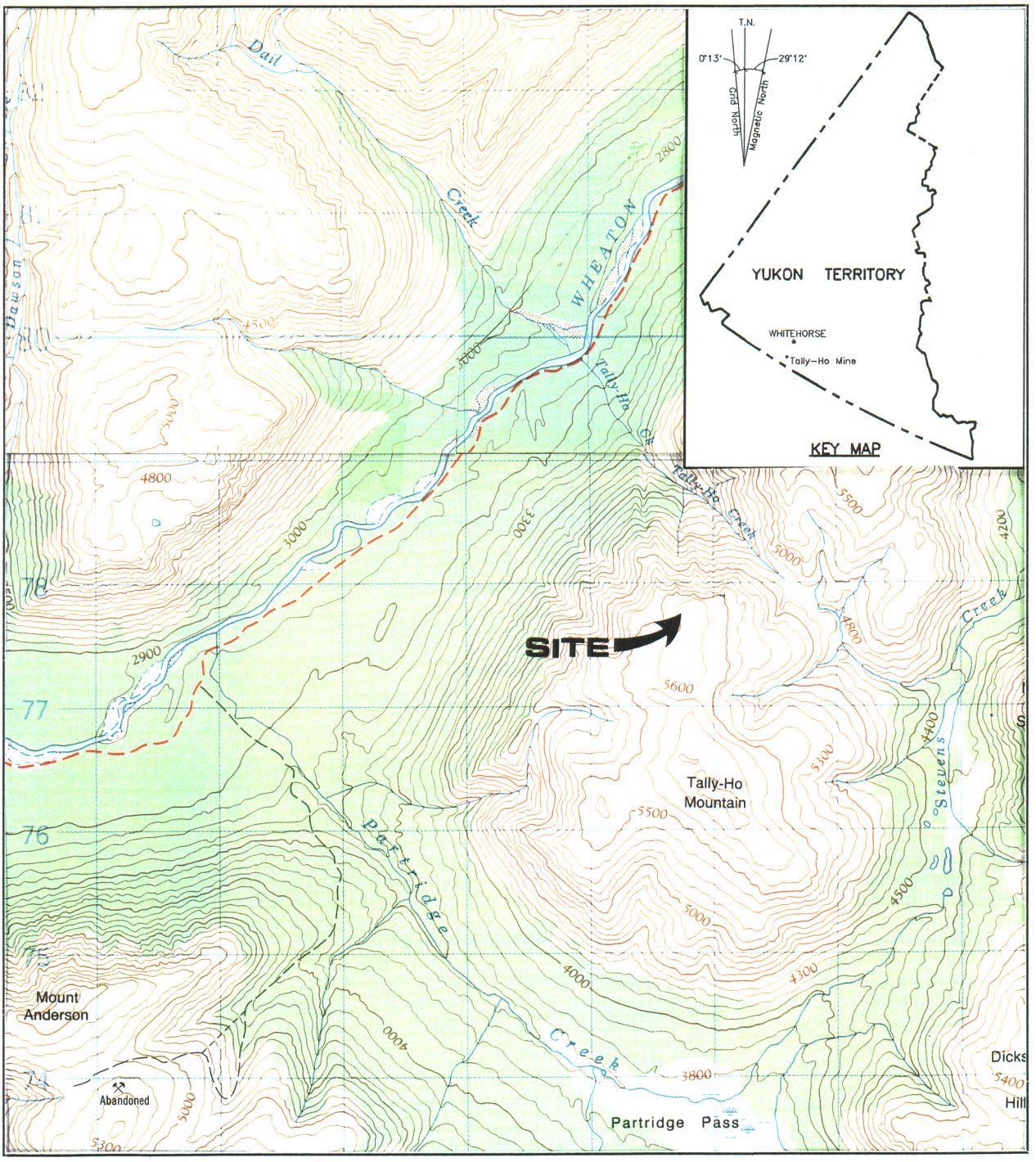

Figure 1. **Location of Tally-Ho Mine - 1:50,000, NTS- 105 D/3 [Energy Mines and Resources Canada: 1986]**

The underground workings were rehabilitated in 1966 and again in 1983. Road construction was conducted during 1986. The upper adit was sealed prior to 1992 and the lower adit was sealed between 1992 and 1996.

1.3 SITE ACCESS

The site can be reached by first travelling approximately 25 km on the Wheaton River valley road (Annie Lake Road) from the Robinson intersection south of Whitehorse on the South Klondike Highway. From the Wheaton River valley road at Tally-Ho Creek, the site is reached by travelling approximately 3.5 km up a trail parallelling Tally-Ho Creek. The trail is very steep and is only accessible to all terrain vehicles once the snow has melted after the end of June. The trail rises very steeply from the intersection at Tally-Ho Creek, a rise of over 800 m to the site.

2.0 PURPOSE AND SCOPE OF WORK

The following assessment activities were completed:

- 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 adit and waste rock seepage, and receiving waters) and barrel contents;
- Identification and inventory of hazardous and non-hazardous materials on the site;
- Identification of potential or actual environmental pathways and receptors for site contaminants; and
- Assessment of human safety hazards and potential for accidental or deliberate access to hazardous areas.

Upon completion of these activities, recommendations were generated to meet the following remediation/mitigation requirements:

- Physical stabilization of waste rock disposal areas;
- Chemical stabilization of the waste rock disposal areas as appropriate to local and background conditions, taking into account impact, on-site resources, and accessibility;
- Sealing of all mine openings;

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 used as clean-up benchmarks based upon intended land use. Remediation criteria 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.

Contaminated Sites Regulations (draft) (Yukon Government, 1996)

According to these draft regulations a site is contaminated if it is used for agricultural, commercial, industrial, parkland, or residential land use and contains a substance in concentration greater than or equal to:

(I) the generic numerical soil standard of Schedule 1, or
(ii) the matrix (pathway specific) numerical soil standards of Schedule 2

and, surface or groundwater used for aquatic life, irrigation, livestock, or drinking water which exceeds a concentration greater than or equal to:

(I) the generic numerical water standard of Schedule 3, or
(ii) the local background concentration of that substance in the soil, surface water, or groundwater.

Below 3 m of the surface, commercial land use criteria is applicable.

Mine Reclamation in Northwest Territories and Yukon (INAC, 1992)

This report defines factors which are to be considered in reclamation of abandoned mine sites operating in northern climates. Factors include:

- open pit and underground mines;
- special mines such as uranium, sand and gravel, and coal;
- waste rock and tailings disposal;
- acid generation and leaching; and
- estimating cleanup costs.

3.2.2 Application of Criteria and Guidelines

For the Tally-Ho abandoned mine site assessment the following criteria were used:

A. Soils:

CCME:	Remediation Criteria for Soil - Commercial/Industrial standard
YUKON RENEWABLE RESOURCES:	Draft Contaminated Sites Regulations - used for hydrocarbon screening parameters

B. Water:

ENVIR. CANADA:	Metal Mining Liquid Effluent Regulations and Guidelines - are compared to seepage from mine openings, and river/stream water quality
BACKGROUND:	Downstream water quality results of rivers and streams are compared to the results of upstream (background) water quality.
CCME:	Remediation Criteria for Water - Freshwater Aquatic Life guideline for river and stream water quality

[Note: In this screening assessment of water quality, analytical results are primarily compared to background values which may more accurately characterize the local environment.]

C. Mine Clean-Up and Reclamation:

INAC: Mine Reclamation in Northwest Territories and Yukon Territory

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 Tally-Ho abandoned 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.

Contaminated Soil Areas were measured and sampled to determine the degree and type of contamination and estimate soil volumes for remediation.

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 and adits, waste rock disposal areas, on-site sampling locations, and any other pertinent information.

3.3.3 Sampling Methods and Quality Assurance

Test Pit Sampling

Test pits were excavated to a depth of about 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 2 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 mm in size was discarded. The sample was coned and quartered, discarding opposite quarters, until a 2 kg sample was obtained.

For test pit walls showing clearly-distinguishable horizons (distinguishable by the sulphide and carbonate contents), the horizons were sampled individually.

Water Sampling

Samples were collected from surface streams upstream and downstream of mine related flows, and from representative seeps emanating from waste rock, tailings, pit walls, and/or adits.

250 ml water samples were collected by hand, facing upstream, ensuring that the sample was not contaminated by disturbed sediment, debris and other floating

materials. Sample bottles were rinsed three times with water from the sample stream prior to collecting the sample.

2 ml of HNO_3 were immediately added to water samples destined for metals analyses. For analyses of non-metallic parameters, water samples were brim-filled to minimize head space, placed in a cooler, and maintained at 4° C until delivery to the laboratory.

Soil Sampling

Soil lithology was recorded from observations of the side walls of the test pit, and soil samples for both field and laboratory testing were collected. Observations were recorded for each soil sample site, including soil particle size, consistency, colour, moisture, discoloration, stratification, odour, and any other observations of significance.

Samples were collected at depth intervals selected on the basis of stratigraphic observations and anticipated or apparent contamination. The lab samples were collected using disposable latex gloves and decontaminated stainless steel sampling utensils. All samples intended for organic analyses were stored in laboratory-cleaned 250 ml glass jars; samples intended for metals analyses were placed in new "Whirl-Pak" bags. All samples were placed in a cooler for shipment to the laboratory.

Barrel Sampling

Barrels containing hydrocarbons were sampled with 1.2 m clean hollow glass rods ("drum thieves"), capable of extracting up to 25 ml of product. The rods were inserted into the drum or pail, and the uppermost open tip was sealed to maintain the sample within the rod as it was extracted from the drum or pail. The sampled hydrocarbon was then drained into a 40-ml laboratory-cleaned vial. The extractions were repeated until at least 20 to 30 ml of product was obtained. The vial was then sealed and placed in a container for shipment to the laboratory. Each used drum thief rod was subsequently destroyed to prevent accidental re-use.

Since hydrocarbon samples were collected only for analyses of Total Halides and metals, no cooling or other preservative was required.

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 labeling 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.

4.0 ENVIRONMENTAL SETTING

4.1 MINERALIZATION

Mineralization at the Tally-Ho site, principally argentiferous galena (PbS), occurs in a quartz-filled fault-breccia zone cutting granodiorite.

4.2 SURFACE HYDROLOGY

Both the site and regional drainage are to the north via the seasonal headwaters of Tally-Ho Creek draining into Wheaton River (see Figure 1).

Hydrological and water quality data are not available for Tally-Ho Creek running below the site. Water seepage was noted near the approximate location of the lower adit, however, it could not be determined whether this water was the result of mine seepage or a natural spring. The seep was located in a seasonal stream bed which formed Tally-Ho Creek below the site. Surface water flow was limited to a distance of less than 5 m before disappearing below ground and flow volumes appeared to be low.

The site topography lends itself to seepage through portions of the waste rock pile adjacent to the lower adit as a result of site drainage and surface infiltration from precipitation.

4.3 CLIMATE

The closest climatological information is from the town of Carcross, 60° 11' N, 134° 41' W; 663 m above sea level (Environment Canada, 1980). Total annual precipitation is 211.4 mm. This consists of 118.7 mm of rainfall and 101.3 mm of snowfall. Highest levels of rainfall occur in August and highest levels of snowfall occur in January. Temperatures range from -19.4° C in January to 12.7° C in July. The mean annual temperature is -1.4° C. Due to its higher elevation, it is assumed that Tally-Ho mine site experiences colder temperatures.

4.4 VEGETATION

Tally-Ho mine site occurs within the Yukon Stikine Highlands ecoregion. Alpine tundra dominates at higher elevations with vegetation including scrub heather, dwarf birch, willow, grass and lichen. At lower elevation, including the Tally-Ho mine site, subalpine areas consist of white spruce and alpine fir. These were the dominant vegetation at the site. Disturbed areas were either dominated by fireweed or were bare.

4.5 FISH AND WILDLIFE RESOURCES

Typical carnivores in the area include grizzly and black bear and wolf. Arctic ground squirrel were the most common rodents noted at the site. Bird species representative of this subalpine habitat include blue grouse and grey-cheeked thrush. A number of raptors hunt and nest in the area, and waterfowl such as mergansers and harlequin ducks are found in Wheaton River valley north of the site.

4.6 SITE TOPOGRAPHY AND SOILS

The soils within the Yukon Stikine Highlands ecoregion are predominantly brunisolic and regosolic. Occasionally, cryosolic soils, dystric brunisols and eutric brunisols are also found.

The site is located on the north side of Tally-Ho Mountain at a subalpine elevation. Access between the two adits is by a steep hair pin road cut into the mountain side. An ephemeral stream has cut a steep ravine straight down the mountain side directly west of the lower adit. The valley below the site levels out near the Annie

Lake Road adjacent to Wheaton River. Rock outcroppings were evident above the site, however, little erosion was noted.

4.7 PERMAFROST

Tally-Ho is in an area of discontinuous permafrost. No evidence of permafrost was discovered during the site visit and is not likely to affect project components.

5.0 SITE DESCRIPTION AND FINDINGS

5.1 BUILDING, INFRASTRUCTURE, EQUIPMENT

No buildings, infrastructure or equipment were observed at the site.

5.2 NON-HAZARDOUS WASTE MATERIALS

The non-hazardous waste material observed in and around the site are listed in Table 2.

Table 2: Non-Hazardous Waste Materials

Waste Material	Number/ Volume	Location
wood platforms	3 - 16 m^2	~20 m east of lower adit along access road
empty barrels	15	adjacent to wood platform

5.3 HAZARDOUS MATERIALS

No hazardous waste was observed at the site.

5.4 SURFACE WATER QUALITY

Table 3 identifies the significant findings of the sampling program conducted to determine the potential impact of the site on surface water bodies. Sample TH-WQ-S301 was collected from a small spring or seep, amongst boulders in the approximate area of the lower adit, as shown in Drawing 1. The water flowed

across the surface for less than 5 m before disappearing under boulders below the site.

Field measurements of pH and conductivity were taken from the spring to guide the sampling for laboratory analysis, as well as for a secondary measurement. The pH was 6.87 and the conductivity was 170 μS/cm for sample TH-WQ-Str301. Sample TH-WQ-Str302 was collected approximately 500 m downstream of the mine site in Tally-Ho Creek, shown in Drawing 1. The site is located near the headwaters of the local watershed and, therefore, no upstream water samples were available. Complete analytical results are provided in Appendix B.

Although conductivity results are moderate to high at the seep/spring, metal concentrations for both samples were below the analytical detection limit for most parameters. The water quality of the spring/seep sample is below the criteria outlined in Schedule 1 of the Metal Mining Liquid Effluent Regulations and Guidelines for all parameters. The sample results did show concentrations above CCME criteria for aluminum, copper, iron and zinc. For some metals, detection limits were above background values.

No metal parameters from the downstream sample yielded any results above method detection limits. No background sample was available for comparison values, however, based on downstream concentrations of these metals, the spring/seep is not affecting downstream water quality. The pH results are within acceptable range and above or approximately neutral for both samples.

Table 3: Surface Water Samples - Significant Results

Sample ID	Sample Location	pH	Conductivity (μmhos/cm)	Metallic Parameters
TH-WQ-Str301	seep/spring at lower adit	6.87	1700	Al, Cu, Fe & Zn
TH-WQ-Str302	Tally-Ho Cr. ~50 m below second stream crossing	7.87	130	none

5.5 WASTE ROCK DISPOSAL AREAS

The volume of waste rock produced from the historical underground development is in the order of 10,000 tonnes (11,000 tons). The volume of waste rock observed during the site assessment was less than 10,000 tonnes. It is likely that waste rock was used to backfill the mine openings and is therefore no longer on the site surface.

Two samples were collected at the site. One sample was collected from the waste rock remaining at the upper adit (TH/WR/P301) and one from the lower adit (TH/WR/P302). These samples were submitted for Acid Base Accounting (ABA) tests and determination of metals. Complete analytical results of these analyses are listed in Appendix B.

Samples P301 and P302 had paste pH values of 8.27 and 8.69, respectively. Total sulphur contents were low (0.07%). The Neutralization Potential to Acid Potential (NP:AP) ratios of 19.4 and 11.5 indicate that the samples are not acid generating. Metal contents of the samples were low, except for moderate chromium (mean of 98 ppm) and manganese (mean of 588 ppm) concentrations. Accounting test results are shown in Table 4.

Table 4: Summary Acid/Base Accounting Test Results

Sample #	Paste pH	Total S (%)	SO_4 (%)	AP	NP	Net NP	NP/AP
TH/WR/P301	7.84	7.00	no assay	2.19	42.38	40.19	19.37
TH/WR/P302	6.77	7.00	no assay	2.19	25.13	22.94	11.49

5.6 MINE OPENINGS AND EXCAVATIONS

Two adits were driven at elevations of 1204 m and 1280 m. The upper adit has been collapsed. The lower adit was not located and it is probable that the opening was collapsed some time in the past. Table 5 shows the results of the mine openings investigation.

Table 5: Mine Openings

Adit	Location	Drift Length	Condition
lower adit	1204 m elevation adj. to Tally-Ho Cr. ravine	137 m	not located; assumed to be collapsed
upper adit	1280 m elevation adj. to Tally-Ho Cr. ravine	213 m	collapsed

5.7 TAILINGS

No ore was processed at the site and, therefore, there are no tailings.

6.0 CONCLUSIONS

The only concern at the site is the aesthetic appearance of the empty barrels and three wood platforms discarded near the approximate location of the lower adit.

6.1 HEALTH AND SAFETY

No health and safety concerns were identified at this site.

6.2 ENVIRONMENTAL RISKS

The small volume of waste rock at the site poses few environmental risks. The material is not acid generating and contains low metal concentrations. It does not appear to be causing a negative impact on the environment.

6.3 AESTHETIC CONCERNS

Aesthetic concerns arise from approximately 15 barrels and three wood platforms remaining near the approximate location of the lower adit.

7.0 RECOMMENDATIONS

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

Recommendation 1.

It is recommended that the wood platforms be burned and the ashes buried on-site for aesthetic reasons. The empty barrels should be crushed and with the ashes on site using locally available labour.

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APPENDIX A

SITE PHOTOGRAPHS

TALLY HO

Photographic Record

July 28, 1996

Photos	Description
T.H. # 1	Area East of Lower Adit including Wood Platforms
T.H. # 2	Seasonal Runoff Channel above Lower Adit
T.H. # 3	Seasonal Runoff Channel below Lower Adit
T.H. # 4	Access Road between Lower and Upper Adits

Photo # 1 - Area East of Lower Adit including Wood Platforms

Photo # 2 - Seasonal Runoff Channel above Lower Adit

Photo # 3 - Seasonal Runoff Channel below Lower Adit

Photo # 4 - Access Road between Lower and Upper Adits

APPENDIX B

ANALYTICAL RESULTS

RESULTS OF ANALYSIS - Water File No. G3765

			WM-WQ-S 201	TH-WQ-Str 302	TH-WQ-S 301	SM-WQ-Str 101	AC-WQ-Str 101
			96 07 28	96 07 28	96 07 28	96 07 29	96 07 26
Physical Tests							
Conductivity (umhos/cm)			106	252	424	59.9	44.5
pH			7.60	7.80	7.33	5.11	6.82
Dissolved Anions							
Acidity		CaCO3	1.7	3.5	10.8	4.7	3.1
Alkalinity - Total		CaCO3	61.4	61.4	171	<1.0	11.8
Sulphate	SO4		1.7	27.2	58.9	23.9	7.4
Total Metals							
Aluminum	T-Al		0.2	<0.2	1.6	0.3	0.3
Antimony	T-Sb		<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	T-As		<0.2	<0.2	<0.2	<0.2	<0.2
Barium	T-Ba		0.02	0.10	0.16	0.08	<0.01
Beryllium	T-Be		<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	T-Bi		<0.1	<0.1	<0.1	<0.1	<0.1
Boron	T-B		<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	T-Cd		<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	T-Ca		17.0	36.2	42.0	4.16	6.08
Chromium	T-Cr		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	T-Co		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	T-Cu		<0.01	<0.01	0.03	0.03	<0.01
Iron	T-Fe		<0.03	<0.03	3.21	0.23	<0.03
Lead	T-Pb		<0.05	<0.05	0.06	<0.05	<0.05
Lithium	T-Li		<0.01	<0.01	0.01	<0.01	<0.01
Magnesium	T-Mg		2.72	6.85	27.2	1.31	0.80
Manganese	T-Mn		<0.005	<0.005	0.231	0.033	<0.005
Molybdenum	T-Mo		<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	T-Ni		<0.02	<0.02	<0.02	<0.02	<0.02
Phosphorus	T-P		<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	T-K		<2	<2	2	<2	<2
Selenium	T-Se		<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	T-Si		2.30	1.90	4.13	6.57	1.45
Silver	T-Ag		<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	T-Na		<2	2	7	2	<2
Strontium	T-Sr		0.026	0.307	1.88	0.046	0.031
Thallium	T-Tl		<0.1	<0.1	<0.1	<0.1	<0.1
Tin	T-Sn		<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	T-Ti		<0.01	<0.01	0.02	0.01	<0.01
Vanadium	T-V		<0.03	<0.03	<0.03	<0.03	<0.03

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

RESULTS OF ANALYSIS - Water File No. G3765

		WM-WQ-S 201	TH-WQ-Str 302	TH-WQ-S 301	SM-WQ-Str 101	AC-WQ-Str 101
		96 07 28	96 07 28	96 07 28	96 07 29	96 07 26
Total Metals						
Zinc	T-Zn	<0.005	<0.005	0.073	0.139	<0.005

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

Appendix 1 - QUALITY CONTROL - Replicates

File No. G3765

Water		TH-WQ-S 301 96 07 28	TH-WQ-S 301 QC # 69471
Total Metals			
Aluminum	T-Al	1.6	1.6
Antimony	T-Sb	<0.2	<0.2
Arsenic	T-As	<0.2	<0.2
Barium	T-Ba	0.16	0.16
Beryllium	T-Be	<0.005	<0.005
Bismuth	T-Bi	<0.1	<0.1
Boron	T-B	<0.1	<0.1
Cadmium	T-Cd	<0.01	<0.01
Calcium	T-Ca	42.0	42.5
Chromium	T-Cr	<0.01	<0.01
Cobalt	T-Co	<0.01	<0.01
Copper	T-Cu	0.03	0.03
Iron	T-Fe	3.21	3.26
Lead	T-Pb	0.06	0.07
Lithium	T-Li	0.01	0.01
Magnesium	T-Mg	27.2	27.4
Manganese	T-Mn	0.231	0.234
Molybdenum	T-Mo	<0.03	<0.03
Nickel	T-Ni	<0.02	<0.02
Phosphorus	T-P	<0.3	<0.3
Potassium	T-K	2	2
Selenium	T-Se	<0.2	<0.2
Silicon	T-Si	4.13	4.16
Silver	T-Ag	<0.01	<0.01
Sodium	T-Na	7	7
Strontium	T-Sr	1.88	1.90
Thallium	T-Tl	<0.1	<0.1
Tin	T-Sn	<0.03	<0.03
Titanium	T-Ti	0.02	0.02
Vanadium	T-V	<0.03	<0.03
Zinc	T-Zn	0.073	0.073

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

Appendix 1 - QUALITY CONTROL - Replicates

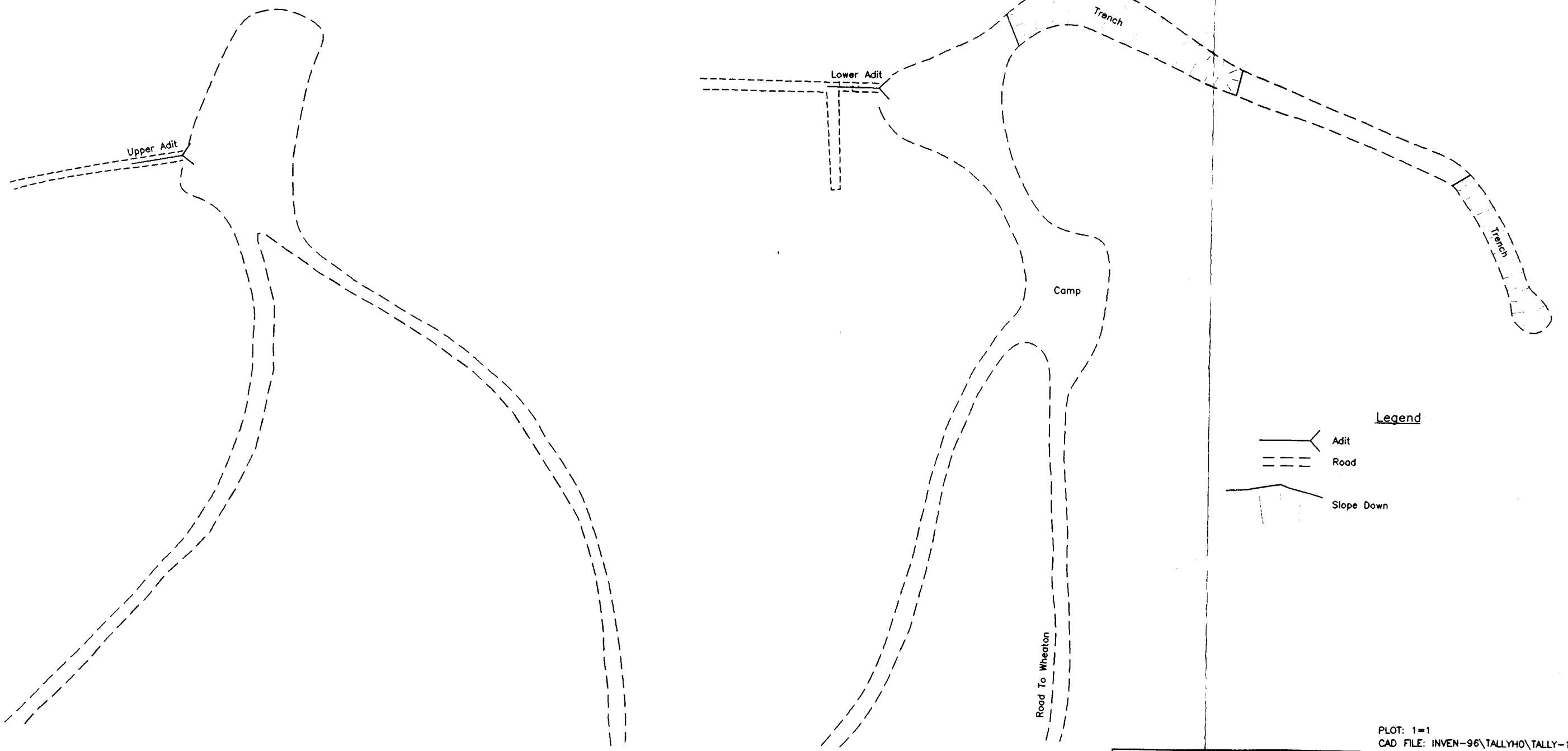
File No. G3765

Water			TH-WQ-S 301 96 07 28	TH-WQ-S 301 QC # 69471
Physical Tests				
Conductivity (umhos/cm)			424	424
pH			7.33	7.43
Dissolved Anions				
Acidity		CaCO3	10.8	9.4
Alkalinity - Total		CaCO3	171	170
Sulphate	SO4		58.9	55.9

< = Less than the detection limit indicated.
Results are expressed as milligrams per litre except for pH and Conductivity (umhos/cm).

APPENDIX C

DRAWINGS



Approx. Scale: 1:1000

PLOT: 1=1
CAD FILE: INVEN-96\TALLYHO\TALLY-1

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

Architectural & Engineering Services
Western Region

Tally Ho Mine
Site Development
Yukon Territory

626967

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