EBA Engineering Consultants Ltd.

Creating and Delivering Better Solutions

March 31, 2002 EBA File: 0201-01-15178007

Government of Canada
Canadian Heritage, Parks Canada
Kluane National Park
P.O. Box 5495
Haines Junction, Yukon
Y0B 1L0

Attention: Mr. Bruce Sundbo

Subject: **Historical Review for Environmental Assessment Purposes**
White Pass Right of Way, Chilkoot Trail National Historic Site, B.C.

1.0 INTRODUCTION

This report has been prepared by EBA Engineering Consultants Ltd. (EBA) to present the results of a historical review of the White Pass right of way (Whitehorse-Skagway Pipeline and White Pass and Yukon Route railroad), and adjacent Parks Canada lands in Chilkoot Trail National Historic Site, British Columbia (the study area), for the purpose of completing an environmental assessment of the site.

This report incorporates and is subject to the attached EBA Environmental Report - General Conditions.

1.1 Authorization

This historical review was completed under the standing offer between EBA Engineering Consultants Ltd. (EBA) and Parks Canada. Final authorization to proceed was received from Mr. Bruce Sundbo by telephone on December 3, 2001 as per EBA's proposal of November 30, 2001.

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Mr. Kirn Dhillon, E.I.T., carried out the historical review, Mr. Ryan Martin, P. Eng., provided technical review, and Mr. Ken Armstrong, P.Eng. (Alberta), provided senior technical review of the report document.

1.2 Objectives

The objective of this historical review was to gather historical information regarding the site to identify potential site contamination. Canadian Standards Association *Standard* (CSA) *Z768-94, Phase 1 Environmental Site Assessment* has been used as a guide for the methodology of this historical review. The results of this historical review will assist in reducing uncertainty about potential environmental concerns associated with identified sites, and may be a basis for further investigation of this property (Phase II ESA). The National Classification System for Contaminated Sites was not applied; insufficient information was gathered within the scope of work to provide a meaningful rating.

In correspondence with Mr. Bruce Sundbo and Mr. Glenn Kubian of Parks Canada, it was agreed that the four previously identified areas of potential environmental concern (Joe Creek, Beaver Lakes 1 & 2, and Bare Loon Lake) would be combined into one Phase I examining the White Pass right of way and adjacent Parks Canada lands.

1.3 Scope of Work

The Whitehorse-Skagway Pipeline, as with the Haines-Fairbanks Pipeline, is a complex site in both an historical and geographical context. To date, there have been numerous studies on the pipeline. These have been carried out for both the federal government and the White Pass and Yukon Route (WP&YR or White Pass), the owner of the pipeline and railway right of way (ROW). Review of these reports indicates that proper Phase I ESA protocols were followed and the appropriate information resources were utilized. Also, since the reports were issued during and after the decommissioning process, it is EBA's opinion that the information presented and conclusions derived from these studies are, for the most part, still accurate in relation to their scope. Therefore, the main focus of this review was the literature pertaining to the site; the following tasks were completed as part of this historical review.

1. Records held at the Yukon Archives were reviewed for pertinent information regarding the study section of the ROW and adjacent Parks Canada lands.
2. Airphotos of the study area were viewed.
3. Anecdotal information was compiled.
4. Literature pertaining to the WP&YR pipeline (ROW) was reviewed.
5. Spills records held at Environment Canada – Environmental Protection Services were reviewed.
6. This letter report was prepared.

2.0 HISTORICAL BACKGROUND

2.1 White Pass and Yukon Route Railway

Construction of the White Pass and Yukon Route Railway commenced on May 28,1898. The construction reached Bennett on July 6, 1899 and Whitehorse the following year. During World War II, the U.S. Army operated the railroad and used it to supply the construction of the Alaska Highway. After the war, normal operations resumed, and the main cargo for the railroad was ore from mines in the Yukon hinterland. Diesel-electric locomotives first came into use on the railroad in 1954. By 1982, metal prices plummeted resulting in several mine closures. Mine closures coupled with the increasing popularity of truck transportation lead to the demise of the WP & YR railroad as being an economically viable form of commercial transportation. The railroad lay dormant for a period until it was reactivated in 1988 for use as a tourist excursion railway. Currently, the railway runs trains between Skagway and Bennett. Plans have been made to operate trains to Carcross, but nothing, as yet, has solidified.

2.2 Yukon Pipelines Ltd.

On April 29, 1942, the U.S. Army met with representatives of Imperial Oil Limited (I.O.L) and Standard Oil of New Jersey. The group came to a consensus and the Canol project was commenced on the following day. The group entered into a contractual agreement for construction with Bechtel-Price-Callahan, a joint venture of nine U.S. organizations. The contract was drafted and signed on May 4, 1942 and May 20, 1942, respectively. The Canadian House of Commons was informed of the project on May 15, 1942; the War Committee of the Cabinet approved the project on the May 16, 1942. No environmental concern was expressed and no ecological impacts were considered.

The Canol project involved the construction of four separate pipelines, one of which was a 114.3 mm (4½ inch outside diameter, 4 inch inside diameter) pipeline from Skagway to Whitehorse (Canol No.2). Bechtel-Price-Callahan commenced construction on the pipeline in October 1942. The first tanker load of gasoline was pumped on January 20, 1943 under the direction of the Northern Command Service, a joint operation of the armed forces of Canada and the United States.

The first closure of the pipeline occurred in 1946. This closure was brief and the pipeline was put back into operation the following year. White Pass briefly leased it for a one-year period in 1948, at the end of which, the Northern Command Service reacquired the pipeline, operating it continuously from 1949 to 1957 inclusively. In 1958, ownership of the Canadian portion of the pipeline was transferred to the Canadian Government, who in turn leased it to Yukon Pipelines Limited (YPL), a subsidiary of White Pass. YPL first offered to purchase this portion of the pipeline on June 14, 1960 and formal transfer was completed by 1962. Operation of the pipeline continued under the regulation of the National Energy Board of Canada, who became actively involved in 1962. YPL discontinued the commercial operation of the pipeline on October 7, 1994. It is estimated by the National Energy Board that during the course of operations the pipeline transported approximately 250,000 litres per day of refined petroleum products to Whitehorse.

On July 12, 1995 YPL applied to the National Energy Board to abandon the operation of the pipeline. Solid, liquid, and vapour phase products were removed from the entire pipeline during the summer of 1995. The pipeline was physically dismantled during the winter and summer of 1997 and the summer of 1998.

3.0 SITE DESCRIPTION

The YPL pipeline and WP&YR railroad occupy the same ROW for the most part. The ROW, beginning in Skagway and terminating in Whitehorse, is approximately 177 km (110 miles), with the Canadian portion representing 144 km. The section of interest (or study area) runs along the northeast edge of Chilkoot Trail National Historic Site (CTNHS) and lies between railway

Mileposts 40.6 and 31.5 (refer to Figure 1). The UTM coordinates of Log Cabin are 501 895 m E, 6 624 825 m N, and 500 054 m E, 6 634 000 m N for Bennett; the study area is located in Zone 8 on NTS map sheet 104 M15. The study area represents approximately 14.6 km of pipeline and railway track length. Surficial geology conditions within the pipeline ROW consist of coarse granular sands with some fine silty sands and wetland organic deposits[1]. The groundwater depth is not known; however it is believed that it is within 10 m of grade throughout the ROW, based on the local topography and the level of water bodies in the general area. This section starts at the Log Cabin (approximately 877 m asl) and continues on a decline until it reaches Bennett (approximately 659 m asl). Thus, regional surface drainage at this section of the pipeline is to the north (i.e. Bennett Lake). Prevailing winds likely come from the south.

Prior to the initiation of this study, Glenn Kubian of Parks Canada identified three areas of potential environmental concern (APECs); these sites are discussed as follows, refer to Figure 1 for locations.

3.1 APEC 1 - Joe Creek

This is a small creek crossing approximately one and a half miles south of Bennett. This creek flows from the mountains to the east into the north end of Lindeman Lake, upstream of the One Mile Rapids.

3.2 APEC 2 - Beaver Lake

This is a small lake that abuts the west side of the ROW in the vicinity of Milepost 37. Two creeks enter this small lake at its south end. It is not known what the pipe support configuration was at this area. However, at similar areas the pipeline generally ran in close proximity or adjacent to water bodies. In some cases, such as at Mileposts 24.8 and 35.3, the pipeline was submerged within the surface watercourse.

[1] *Status Report on Environment Site Assessment of The White Pass Petroleum Products Pipeline and Associated Infrastructure*, July 26, 1996, unpublished report prepared by Golder Associates for White Pass and Yukon Corporation Limited

3.3 APEC 3 - Bare Loon Lake

Bare Loon Lake is a popular camping site for hikers and is located approximately 500 m to 1 km to the west of the ROW. This small lake is hydraulically connected to Lindeman Lake through a creek which outlets at the north end. A small creek also exits at the south end into a series of dead-end pothole lakes.

Bare Loon Lake is formed within a shallow depression on glacially scoured bedrock. Some discontinuous veneers of muddy organic soils may be developed in ponds or small lakes; however, most of the area is rock with small, discontinuous pockets of very thin veneers (< 0.3 m) of vegetation mat with some weathered bedrock. Drainage is rapid[2].

4.0 RECORDS REVIEW

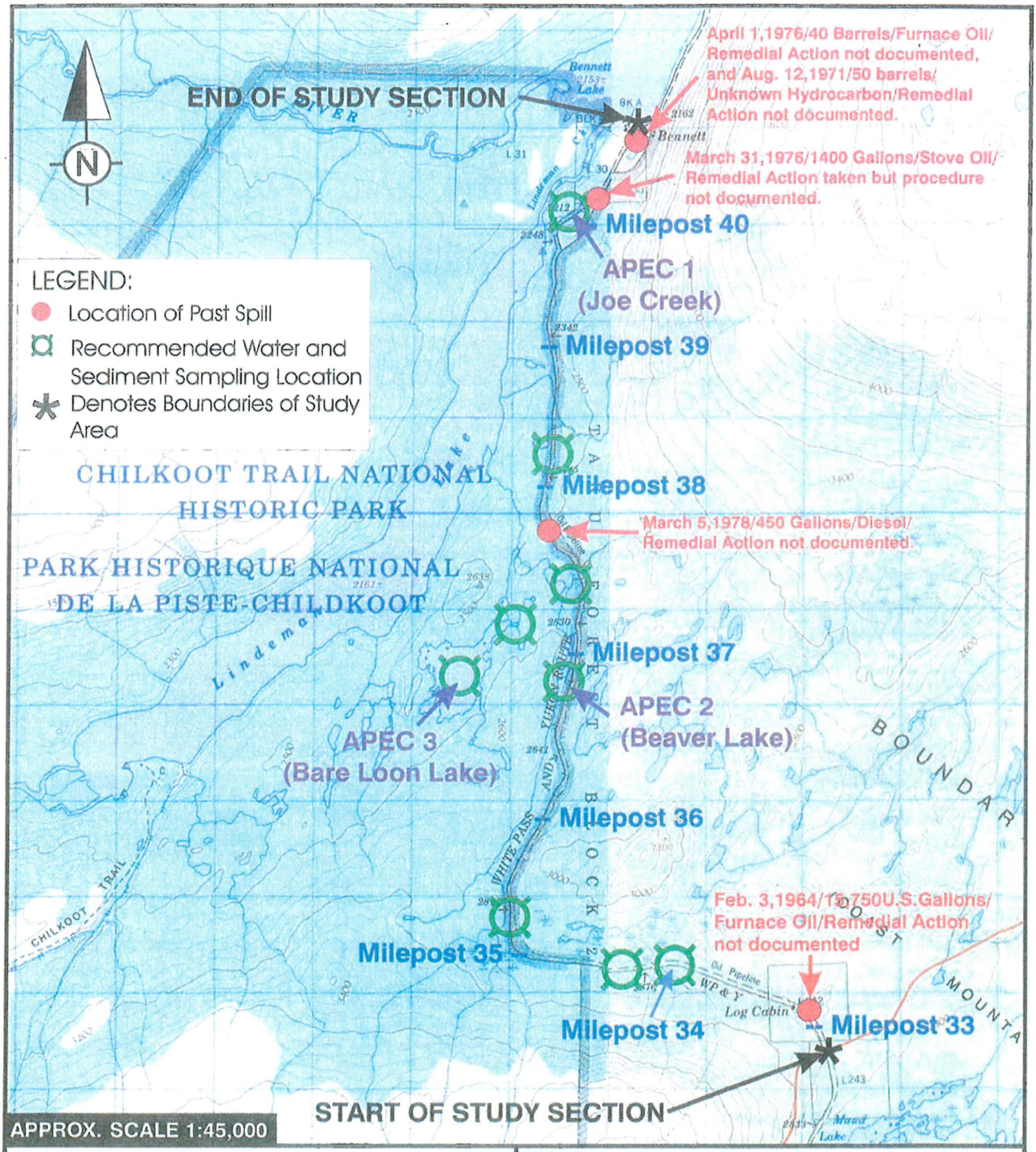
4.1 Land Ownership

The study area does not have a complex history of ownership. The ROW has been held by WP & YR railroad since 1898. The army briefly held operational and management control during World War II. YPL, a subsidiary of WP & YR who in turn is a division of Tri-White Corporation formally owns the pipeline.

4.2 Aerial Photography

Air photo interpretation was attempted for the study area. Aerial photography for the area has been taken at high altitude, thus providing a poor scale for interpretation purposes. Small details like vegetation kill zones, stressed vegetation or discarded railway ties are not easily discernible in the air photos available. However, aerial photography for 1975 was examined and is discussed below.

[2] The above surficial geology analysis is based on air photograph interpretation without field checking. This methodology has a relatively moderate level of reliability in the absence of field-checking or access to physical data acquired in the vicinity to verify geomorphological conditions.



EBA Engineering Consultants Ltd.			PROJECT: HISTORICAL REVIEW, WHITEHORSE-SKAGWAY PIPELINE CHILKOOT NATIONAL HISTORIC SITE, B.C.		
CLIENT: PARKS CANADA			TITLE: SITE MAP SHOWING SHOWING LOCATIONS OF DOCUMENTED SPILLS		
DATE: 02/03/14	DWN: KSD	CHKD: DJW	FILE NO.: 0201-01-15178007	DWNG: FIGURE 1	REVISION:

1975 (A25292-80,81,82) (1:70,000)
These are high altitude photos covering the WP & YR railroad from Log Cabin to approximately the north end of Lindeman Lake. The railroad is visible as thin line, and the pipeline is not distinguishable from the railroad. No structures or dumpsites are visible along the railroad.

There appear to be small clearings along the railroad at Mileposts 32.8, 33.5, 33.8, 34.9, 35.5, 37.5, and 40.0. The nature of these clearings cannot be ascertained, due to the scale of the air photos.

No other photograph years were available for review.

4.3 Environment Canada – Environmental Protection Services Spills Records

Environment Canada has maintained spills records within the Yukon since 1972. A review of these records indicated that three spills have been documented directly by Environment Canada. These spills, shown in Figure 1 all have the potential to cause adverse environmental impacts. In many cases the fuel spills occurred in winter and the remediation step taken was a controlled burn of the released product.

Further investigation uncovered a fuel spill in 1971 documented by White Pass and attached in an Environment Canada Report, and a fuel spill occurring 1964 documented by Golder Associates Ltd. in one of their reports to White Pass. There have been a total of five separately documented spills within the study area. Information suggests that spills occurred because of one of six reasons, (1) heavy equipment clearing snow from the track area or performing other works would accidentally rupture the pipe, (2) extreme cold temperature would cause the pipe to contract and form cracks, (3) debris would fall on the pipe, (4) valves would malfunction, (5) corrosion, or (6) high pressure. In one exceptional case, a bullet hole was purported to be the cause of a fuel spill.

5.0 INVOLVEMENT OF GOVERNMENTAL AGENCIES

5.1 National Energy Board

The National Energy Board (NEB) was created in 1959 to monitor the construction and operation of interprovincial and international pipelines. Under this mandate, NEB commenced regulating the YPL pipeline in 1962 following the issuance of Certificate OC-12. This document governed the operation of the pipeline until July 12, 1995 when YPL formally requested abandonment of the pipeline. NEB requested additional information and the completion of a Phase I ESA of the ROW. During a hearing held in Whitehorse on August 20, 1996, NEB granted approval to YPL to commence the removal of pipeline infrastructure. The meeting is summarized in the NEB report *Reasons for Decision Yukon Pipelines Limited MH-3-96* of September 1996. The majority of decommissioning work has now been completed. NEB still maintains its role with the pipeline, ensuring compliance with the terms of abandonment and addressing the concerns of stakeholder groups.

5.2 Environmental Protection Services

The Environmental Protection Services (EPS) Branch of Environment Canada has been actively involved in cataloguing spills reported by White Pass since 1973. An agent of the EPS usually conducted a site inspection after a spill would occur and, in some cases, would direct clean-up. This information would then be documented in a *Spill Record* kept on file at EPS local headquarters in Whitehorse. In September 1976, EPS used spills records and information furnished by White Pass to prepare the report *An Environmental Study of the White Pass & Yukon Route Pipeline from B.C. – Alaska Border to Whitehorse, Yukon.* The report is discussed in the *Literature Review.*

EPS is still involved in documenting spills. However, since the pipeline has now been decommissioned it is anticipated that EPS's role will lessen. EPS raised concerns to NEB early in the abandonment process that there were inconsistencies in the spill report data reported by Golder Associates Ltd. (Golder) on behalf of White Pass. It appears that these inconsistencies were later rectified, because no further issues with regards to EPS were documented.

5.3 British Columbia Ministry of Environment

The British Columbia Ministry of Environment (BC Environment), in a limited role, was involved by NEB as reviewers of the decommissioning work. There is currently no harmonization agreement between the BC and federal governments specifically relating to pipeline decommissioning. However, generally, pipelines are regulated federally under the NEB, and federal soil quality guidelines would apply to clean up within pipeline corridors. BC Environment requested that if material suspected to be contaminated is found by visual and olfactory observations, a qualified consultant should be retained to assess the site and forward a copy of the assessment report to BC Environment. Since the CTNHS is on federally administered land it is anticipated that BC Environment's role would be nominal and confined to liasing.

5.4 Department of Fisheries and Oceans

The Department of Fisheries and Oceans (DFO) of the Government of Canada submitted a letter to YPL and NEB on August 9, 1996. In it DFO stated that beds and banks of fish bearing watercourses and water bodies cannot be altered unless under the direction of DFO. Fish biologists were to monitor any water bodies where pipes had to be removed to ensure that any disturbance to the habitat was minimized. No further information has been documented with respect to DFO.

5.5 Canadian Heritage

Canadian Heritage is the parent agency of Parks Canada. In its letter of August 15, 1996, concerns were brought to the attention of YPL and NEB regarding the potential off-site spill migration adversely affecting drinking water, particularly in the Bennett Campground. YPL stated that water samples would be collected and submitted for analysis at locations known to be water sources for hikers. EBA did not obtain these results, as the sample locations lie outside of the study area. No further mention is given to Canadian Heritage or Parks Canada in subsequent reports; also, it is not known whether the initial request was made by local authorities or authorities from Ottawa acting on behalf of local authorities.

5.6 INAC – Waste Management

Indian and Northern Affairs Canada (INAC) Waste Management has not been involved in any work concerning the White Pass ROW, as stated by Rick Seaman, project officer of the Arctic Environment Strategy of INAC – Waste Management.

6.0 LITERATURE REVIEW

6.1 Golder Reports

Golder was retained in 1996 by YPL to perform environmental work related to the decommissioning requirements outlined by NEB. Upon examination, the reporting performed by Golder suggests that the main emphasis was placed on the ROW and meeting NEB requirements. Several reports prepared by Golder have been obtained as part of previous projects EBA has conducted for White Pass; these are summarized in the following paragraphs. Golder has prepared other reports, but the complete versions were not forwarded to EBA, because of client confidentiality.

Work Plan For An Environmental Site Assessment Of The White Pass Petroleum Products Pipeline And Associated Infrastructure, Golder Associates Ltd. February 26, 1996

This report discusses the approach that will be taken to conduct environmental site assessments (ESAs) for the pipeline. Golder discusses background information and identifies APECs. In this preliminary report no explicit APECs within the study area were identified. However, the report does recognize valves as being a collective APEC. Schematics of the pipeline were not supplied with any Golder reports, but there may be one or more valves within the study area.

Environmental Site Assessment Of The White Pass Petroleum Products Pipeline And Associated Infrastructure, Golder Associates Ltd. July 26, 1996

This document presents the results of the Phase I ESA completed by Golder. The APECs are more clearly defined by this stage; however, with respect to the study area, the APECs remain the same. Golder identifies that spills have occurred within the study area. Risk based assessment was applied to historical spills occurring within the study area.

To understand risk based assessment, it is useful to describe some of the key components of risk based assessment, based on industry standards and EBA's experience. The risk-based approach is applied under the premise that human and/or ecological receptors must come in contact with hazardous concentrations of contaminants to sustain adverse impacts. This is determined through an exposure pathway analysis. If there were several modes of contact (e.g. inhalation of vapour, consumption of dissolved phase product) then exposure pathway analysis would assess the risk as being high. Likewise, in situations where the contamination is contained and does not come into

contact with, or adversely affect, environmentally sensitive ecosystems, exposure pathway analysis would assess the risk to be low. Fundamental to exposure pathway analysis and risk assessment are the concepts of bioavailability and contaminant fate. A contaminant could be partitioned into many different components of an ecosystem such as in stream sediments, dissolved phase in lakes, and vapour phase in the atmosphere. Contaminant fate is quantifiable by using numerical contaminant transport and fate models, which describe contaminant transport, intermedia exchange, phase distribution, and biogeochemical transformations, in both water and sediments. Bioavailability is similar in principle to contaminant fate (or chemical environmental fate) but on a microscopic scale, examining specific organisms only. It is widely understood by the environmental science community that the response of an ecosystem is not dictated by the concentration of a contaminant in which a receptor resides, but only that portion which is biologically available. One good definition of bioavailability is the percentage of an ingested contaminant that is actually absorbed into the bloodstream, and thus, is available to the body for metabolic use. Once this percentage has been determined it can then by compared to known lethal concentration values determined for various contaminants. Risk can then be assessed based on this comparison. Monitoring is always prudent with such an analysis to verify that the contaminant fate model accurately represents field conditions.

In Golder's report, upon application of risk assessment principles, only two sites were recognized for site visits (Milepost 32.7, spill occurring on Feb. 3, 1964, and Milepost 40.6, spill occurring on April 1, 1976), as shown in Figure 1, along with spill information gathered from other sources. Golder uses standard field screening forms when examining sites; these have been attached in Appendix A. It appears that at these locations, where historical spills were noted, the risk analysis was performed based on the conditions noted at the site at the time of the inspection. This is evidenced by the following points related to this report:

1. Surface Water
   The fact that for both spill locations surface water was ignored as possible transport and residency media. This observation may have been true during the site inspection, which in some cases occurred more than 30 years after the original occurrence of the spill; however, at the time of the spills, surface water or run-off drainage would have been the dominant transport mode. The importance of surface water is particularly important in the Bennett Area (spill at Milepost 40.6) where there is large lake, a pothole lake, and at least two streams in the vicinity.
2. Aquatic Organisms
   Another discrepancy noted in Golder's field screening notes is that at both spills (Mileposts 40.6 and 32.7) groundwater is noted as a transport and residency media, yet at Milepost 40.6

only terrestrial receptors were confirmed as being potential ecological receptors, while at Milepost 32.7 no potential receptors are identified. If groundwater is known to be hydraulically connected to local water bodies such as stream and lakes, like Bare Loon and Bennett, then it is reasonable to conclude that aquatic life is a potential ecological receptor.

3. Terrestrial Organisms
   The *Potential Contaminant*, *Release Mechanisms*, and *Transport and Residency Media* sections of the field sheets for both sites are the same, but terrestrial organisms are only recognized at the Milepost 40.6 spill and not at the Milepost 32.7 spill. The justification for this conclusion is presumably based on the estimated distance to the nearest aquatic habitat and drinking water source given in the *Potential Exposure Pathways* section as being greater than 100 m. However, the Log Cabin Area, where the Milepost 32.7 spill occurred, is a known tourist landmark, a location of railway spurs (see the photo attached with Golder's field notes), and the entire railway corridor is used by hikers seeking an alternate route to the Chilkoot Trail or those who use the railway corridor to hike back to vehicles parked at the Log Cabin tourist site.

Assumptions on the level of remediation were made by Golder prior to the site inspection. The rationale for these assumptions is not documented in this Golder report. However, it is noted that some CCME guidelines have been reviewed and the petroleum hydrocarbon in soil standards are more recent than the 1996 report. This suggests that the assumptions and conclusions should be revisited in light of the new criteria.

Separate from the field sheets, Golder identifies aquatic life in the body of the report as being a potential receptor at the Log Cabin spill, contrary to information in the field sheets. Golder mentions "several species of water fowl" on page 26 of their report.

On page 26 of the report Golder states, "Since it [the spill] occurred during winter months, environmental transport would have been impeded and clean up of the release facilitated by the cold weather". Although it is true that cold weather impedes transport of fuel spills due to frozen ground and snow cover, EBA's experience shows that cold weather does not facilitate clean up. Actual experience shows that in some cases winter conditions may complicate the behaviour of spills. The reasons for this are as follows:

a) Fuel spills, if left dormant degrade at a slower rate over winter months due to the near absence of bacterial metabolic processes, which are suppressed under subzero temperatures.

b) Secondly, winter arctic high-pressure systems generally have a net downward force on vapours suppressing them from atmospheric migration.

c) Frozen ground and decreased infiltration could lead to farther surface runoff as a result of hindered absorption by soil. This would increase the surficial area of the spill and cause the surface distribution to be irregular in shape.

It is EBA's opinion that there would be stark contrast between the behaviour of winter and summer fuel spills, given a spill volume of nearly 60,000 litres, as reported by Golder on page 25 of their report. Winter infiltration of spills has been documented in several cases and complicated contaminant plumes have been observed, as a result of winter conditions. Spill abatement procedures have not been documented in the Golder report, and one is to assume that contaminant transport occurred under the conditions outlined by EBA. Golder's Phase I ESA conclusion for the section between Log Cabin and Bennett stated:

> "Only one release of heating oil occurred in this section of the pipeline during the winter when significant infiltration of product exposure to receptors would not likely have occurred."

This did not include the spills near Bennett. The current review includes these spills within EBA's Bennett to Log Cabin study area.

Environmental Site Assessment And Plan Of Restoration Yukon Pipelines Limited Pipeline Right-Of-Way Yukon, Golder Associates Ltd. February 24, 1998

This report discussed Phase II ESA work conducted by Golder on behalf of White Pass as part of the abandoning requirements outlined by NEB. The report states, "The pipeline was dismantled during the winter and summer of 1997 and approximately 30 percent of the pipe has been removed. The remaining pipe is currently scheduled for removal during the summer of 1998". The report details an earlier revised version of the list of APECs, none of which are within the study area.

Site Restoration National Energy Board Order MO-7-96 Yukon Pipelines Limited Pipeline Right-Of-Way Yukon And British Columbia, Golder Associates Ltd. September 27, 2001

EBA was provided with Figure 2 and Table 1 of this report; the report body was not provided. This information pertained to field organic vapour measurements (OVMs) that were collected on bagged samples within the ROW. Samples were collected every 0.16 km (0.1 mile); the sampling depth was not provided.

It is EBA's opinion that field screening for weathered hydrocarbon products using OVMs is valuable only as a semi-qualitative screening tool, as the volatile portion of hydrocarbons, in some cases, evaporates within two to three years of the occurrence of the spill. Any OVM readings higher than "background" may be indicative of potential hydrocarbon contamination. Therefore, small spikes in OVMs should be noted as possibly being contaminated.

In some cases, the lighter components of the hydrocarbon could be below regulatory standards while heavier components may go undetected through visual, olfactory, or OVM observations, but their concentration may be above regulatory standards. This also applies to additives used in the refining process, which are present in hydrocarbons; these include tetra-ethyl lead and methyl tertiary butyl ether.

Only analytical testing of field-collected soil samples at a *Canadian Association of Environmental Analytical Laboratories* (CAEAL) approved laboratory could confirm or disprove the absence of contamination. In light of this, Golder's data shows spikes in OVM data at Mileposts 32.6 - 33.0, 36.2, 37.8 - 38.2, and 40.3 - 40.6. Coincidentally, all but one of these locations were locations of documented historical spills.

6.2 EBA Report

Limited Phase 1 & 2 Environmental Site Assessment Of An Unnamed Creek At The South End Of Bennett Lake Chilkoot National Park, Bennett, BC, March 2002

Ryan Martin, P.Eng., of EBA Engineering Consultants Ltd. in Whitehorse prepared a report for Parks Canada presenting the results of Phase I and II ESA work in the Bennett Area, specifically sediment and water sampling of an unnamed creek inletting into Bennett Lake at its south end near the former Bennett townsite. The results concluded that there were concentrations of contaminants in excesses of regulatory standards. These most likely originated from historical hydrocarbon spills or as a result of railroad activity.

6.3 National Energy Board Reports

Report On An Inspection Of The Deactivated Skagway, Alaska To Whitehorse, Yukon Petroleum Products Pipeline, June 1995

This is the initial report on the decommissioning process written by NEB. In the report, the pipeline is inspected and assessed for deficiencies and environmental concerns. The pipeline was

drained in 1995 by a process known as "pigging" where a single pig run using a squeegee type tracking pig propelled by compressed air removed product. This was done in sections to facilitate timely recovery of hydrocarbon products. At the time of the report no pressure was observed in the pipe.

NEB noted that previous spills appear to be remediated, presumably based on visual and olfactory observations. A total of 57 known spill incidents have occurred since 1966. In most cases the fuel was burned off and the sites were monitored by YPL. The degree to which monitoring was performed is not specified. According to NEB, YPL states that it does not know of any existing contamination along the pipeline. At the time of the inspection, the study area was not accessible to NEB for inspection; therefore no inspection was done by NEB on previously identified spills occurring within the study area. NEB notes that, "Signs of herbicide use were present along some of the pipeline route, specifically adjacent to the railroad corridor where the railway is still in use. YPL indicated that the herbicide "Round-up" has been used for the past eight or nine years and that B.C. regulations with respect to the use of the herbicides have been followed". Finally, the report indicates the tetra-ethyl lead may be a contaminant of concern, because it used to be used in gasoline and could persist at gasoline spill sites.

Yukon Pipelines Limited MH-3-96 Environmental Screening Reports, September 1996

This report was intended to update previous information and came after consultations between YPL and NEB. It states that, "the solid, liquid, and vapour phase products were removed from the entire pipeline during the summer of 1995". The majority of the pipeline is on the ground surface (80 percent); a small portion (15 percent) is covered by a thin veneer of either railroad ballast or loose fill or combination of both, while an even smaller portion (5 percent) is located in standing water. The report proceeds to discuss work completed by Golder and concerns raised by governmental agencies, as previously discussed in the section titled *Involvement of Governmental Agencies.*

Reasons for Decision Yukon Pipelines Limited MH-3_96, September 1996

This is the definitive report on NEB's role with the decommissioning of the YPL pipeline. Although a large part of the report is reiteration of previously discussed information, some new material is presented. The reason for the closure of the pipeline is stated in the report as being the following:

> "The Board notes that the petroleum product transportation service provided by the pipeline is now provided by trucks. The Board also notes that the pipeline was built more than 50 years ago and accepts that technological advancements have rendered the Yukon pipeline obsolete. The Board is satisfied that subject facilities are no longer used or useful."

Further environmental concerns were brought to the attention of NEB and YPL by agencies and groups, both governmental and nongovernmental. The groups included: The Hillcrest Community Association, Yukon Conservation Society, City of Whitehorse, Yukon Territorial Government, B.C. Environment, Transport Canada, and Environment Canada. There is no evidence confirming the involvement of First Nations groups in the public consultations. Concerns were raised regarding potential contamination from past herbicide use, contamination of potable water supplies, off-site disposal for material associated with the pipeline, and financing of the abandonment and remediation activities, among others. The report states that, "YPL is committed to continuing consultations with appropriate government officials and other interested persons throughout the abandonment project". NEB was satisfied at the time of the report that no adverse environmental impact would occur as a result of the decommissioning process. They were also satisfied with the use of risk-based assessment and the Phase I ESA submitted by Golder on behalf of YPL. It was intended that YPL would dispose of any land or right-of-ways in locations were the pipeline deviates from the railroad ROW. This does not apply to the study section. It was anticipated that the cost of the environmental program would be recovered by revenue gained through the sale of the pipeline as scrap metal and the sale of land. In addition, water supply wells and other potable water supplies within 300 m of the pipeline ROW will be sampled as part of the Phase II ESA. In response to a concern raised by Canadian Heritage YPL collected samples of water at locations where campers use Bennett Lake

as a water source to confirm that there is no contamination of lake water. This would not cover Bare Loon Lake, and no mention is given to sediment sampling. Finally, the YPL commitment to public consultation is reiterated:

> "In regard to ongoing consultation with interested persons, YPL indicated that it would meet with the interested persons that have participated in the process to determine what their requirements are for ongoing consultation. YPL indicated that it is committed to getting input from interested persons, providing them with sufficient information and, where appropriate, incorporating the comments into its plans."

6.4 Environmental Protection Services Reports

An Environmental Study of the WPYR Pipeline from B.C. – Alaska Border to Whitehorse, Yukon. Environmental Protection Service, September 1976

Dave Munro of the Environmental Protection Service conducted a survey of the WPYR pipeline while it was still in operation in July 1976. Within the report, Munro identifies structural deficiencies, damage, environmentally sensitive areas and spill activities (between 1966 and 1976). Within the EPS account of spill activity, the closest spill to the Bennett Station (during this period) occurred one mile south of Bennett Lake (Mile 40.1) on March 31st 1976 and was investigated by EPS on April 1st 1976. The approximate volume of the spill was reported as 1400 Gallons by EPS. Included in Appendix I of the EPS report is a letter prepared by C. W. Kingston, Vice President of Administration for the White Pass and Yukon Corporation (WPYC) on August 13th 1976 indicating a spill at Mile 40.6 (which is the mileage of the Bennett Railyard) of furnace oil on April 1st, 1976 due to old dozer damage to the pipeline. Another letter included in Appendix I from Neil Wright, Supervisor Pipeline Division to EPS (September 14th, 1976) indicates that an 8-foot length of pipe was replaced and a repair clamp removed at Mile 40.6.

It is likely that these spills reported separately by EPS and WPYCL are both the same event, and that one location was recorded incorrectly. Therefore, since EPS specifically state that "the break occurred on a sandy flat, quite a ways from Lindeman or Bennett Lakes", it is presumed that the WPYC letter should have read M.P. 39.6 rather than M.P. 40.6.

It remains unclear whether one spill or two occurred. In this EBA report it is conservatively assumed that two spills occurred. Analysis of soil samples collected at these sites could confirm the presence of contamination.

6.5 K.Bisset & Associates Report

Research of Former Military Sites and Activities in the Yukon K. Bisset & Associates, April 1995

In 1995, K. Bisset and Associates researched and compiled information regarding environmental practices on former military sites in the Yukon as part of the Indian and Northern Affairs Arctic Environmental Strategy's Action on Waste Program. Some relevant information pertaining to the Canol No. 2 pipeline from Skagway to Whitehorse that is compiled within this report is presented below:

The Canol No. 2 pipeline was constructed by Bechtel-Price-Callahan between October 1942 and January 1943. This pipeline was primarily constructed in the right-of-way of the White Pass Railroad. The US Military originally operated the Canadian portion of the pipeline until 1958 at which time the ownership was transferred to the Canadian Government who leased the pipeline to the WPYC. In 1962 the Canadian portion of the pipeline was purchased by the WPYC. The pipeline transported fuel primarily in the winter, when the railroad was not operating to avoid operation hazards. White Pass ceased to operate this pipeline in 1994.

Bisset states that Environmental Protection Services (EPS) reports provided information on oil spills between 1966 and 1995; however, records prior to 1995 were not available for review. Several spills were documented within 2 miles of the Bennett Station, however there were no reported spills during this period closer than 0.5 miles (0.8 km) to the station.

Mr. Ken Steele of White Pass is interviewed in the Bisset report. He stated that the pipeline ceased to operate in October 1994. All fuel was removed during the summer of 1995. Outside of Whitehorse, most of the pipe is above ground. Mr. Steele said records of earlier spills are not available and most of the people who worked on the pipeline are gone. Earlier records would be

held by the military. The fuel transported was diesel, stove oil, and gasoline. Most of the fuel was pumped in the winter months. According to Mr. Steele, White Pass purchased the Skagway to Whitehorse pipeline in 1960. Mr. Steele confirmed that, "When there was a fuel spill, it was burned off; this was the technique of the day and usually worked okay".

7.0 ANECDOTAL INFORMATION

7.1 E-mail Correspondence with Glenn Kubian

Mr. Glenn Kubian is the chief park warden for the CTNHS. In an e-mail correspondence dated March 12, 2002, Mr. Kubian provided EBA with anecdotal information regarding possible contamination in the CTNHS. Mr. Kubian stated that the information, which lead to the identification of the APECs, was anecdotal accounts gathered from Parks Canada staff observations. Among the substances possibly used were: petro-chemicals and defoliants. There is speculation to the quantity of railway ties that may have been discarded along the ROW. Observations by Parks Canada staff confirm that for an indeterminate number of years railway ties were discarded along the ROW. Parks Canada staff also indicated that there have been a number of spills along the stretch between Bennett and Log Cabin.

7.2 Phone Conversation with Gary Hamilton, P.Geo. (B.C.)

Mr. Gary Hamilton, P.Geo., was the lead consultant charged with completing all work for White Pass. He was briefly interviewed by phone in March 2002. He said that the work performed by Golder was mainly focussed on the pipeline ROW. No sampling of creek sediments and water was done. The pipeline, to the best of his knowledge, has been completely decommissioned and no future work regarding the pipeline is planned. He could not provide EBA with copies of more recent reports due to client confidentiality.

8.0 FIELD WORK COMPLETED

To date, the majority of the environmental work completed along the railway corridor has been completed by Golder for White Pass. It is EBA's understanding that this arrangement is on-going. Site restoration reports have been issued as recently as September 2001, and it is conceivable that Golder is continuing to perform environmental work for White Pass within the ROW. The most recent reports issued by Golder suggest that Golder is beyond the Phase I, II and possibly Phase III stage. Some Phase III work may remain, but it appears that the focus now

is on site restoration. The commitment between Golder and White Pass is not limited to the pipeline, but all White Pass activities.

EPS prepared only one known report, as previously discussed. Being the main reporting agency, EPS is still mandated to document spills occurring along the former pipeline ROW. However, since the pipeline has been completely removed, further work by EPS pertaining directly to the pipeline is not likely in the foreseeable future.

NEB completed its inspection of the pipeline in 1995. The investigation was limited to portions of the pipeline that were accessible at the time of the inspection. The report recognized several problems and potential environmental concerns with regards to the pipeline. None of the concerns where found in the study area (Bennett to Log Cabin). No soil sampling was conducted and the observations were limited to visual and olfactory. After the initial inspection, NEB took on a strictly regulatory and review role. No further fieldwork was conducted by NEB.

EBA, to date, has completed one limited Phase I/II ESA of the unnamed creek flowing into Bennett Lake at the former townsite of Bennett. The work revealed exceedances of regulatory standards. Parks Canada is currently reviewing options for the implementation of the next phase of site work.

9.0 CURRENT STATUS OF PIPELINE AND RAILWAY

Currently the pipeline has been completely dismantled and removed; along with pump stations and the Upper Tank Farm in Whitehorse. This material was removed from the original sites to other White Pass properties. The original intention was to sell the pipeline as scrap metal. No future pipeline is planned and White Pass will transport fuel products by truck for the foreseeable future.

The White Pass & Yukon Route railway currently functions a tourist excursion railway between Bennett, B.C. and Skagway, Alaska. The railway is operated seasonally from mid-May to mid-September. The actual Skagway to Bennett excursions occur every Saturday, mid-June to late August. Plans are being devised to run the railroad as far as Carcross. One trip was made between Carcross and Skagway during the summer of 2000. The WP & YR railroad currently has a rolling stock of 20 diesel electric locomotives, one steam locomotive, one diesel hydraulic railbus and three 27,000 to 32,000-litre tank cars. The future of the railroad as viable tourist

service seems secure at present. The present arrangement with cruise ship operators will ensure that the railroad will be in operation for the foreseeable future.

10.0 CONTAMINANTS OF POTENTIAL CONCERN

Based on the information provided herein, within the Bennett to Log Cabin study area, the following may be contaminants of potential concern (COPCs):

10.1 Hydrocarbons

Up to five spills have been documented within the study area. Organic vapour measurements taken by Golder for White Pass show there are still noticeable spikes in organic vapours along the ROW. These sites were not documented by Golder, because they were winter spills, in many case the spills were burnt off, and subsequent site visits did not show any evidence, visual or olfactory, that there have been spills at the sites. However, it is the opinion of EBA that since some spills occurred approximately 30 years prior to the site visit; visual and olfactory observations may not be accurate gauges of subsurface contamination. Moreover, burning off hydrocarbons is not a complete form of remediation. Diesel or furnace oil, which was the fuel spilled in many cases, generally has a higher flashpoint than gasoline and requires heating. Therefore, under winter conditions in an aqueous environment, complete (100 percent) combustion of the hydrocarbon is unlikely. Typically it is the light portion of the hydrocarbon that burns easily, while the heavier portion is only partially burned.

Experience has shown that contaminant migration occurs in frozen soils. Snow is not a barrier to hydrocarbon migration, and although it may be true that frozen soil will preclude infiltration, this is entirely dependant on the type of hydrocarbon spilled, the grain size of the soil, and degree of ground saturation with water. The study area is located in a semi-arid environment, as the Coast Mountains act as a barrier to moisture migration. Therefore, ground saturation is unlikely; thus lessening the advantage of freezing conditions in precluding contaminant migration in frozen soils. As shown previously, winter weather can complicate hydrocarbon migration. Instead of faster surface absorption and infiltration, released product may travel a distance on the surface before soaking into the ground.

In light of the information presented, it is evident that hydrocarbon contamination may still be a concern. The light extractable petroleum hydrocarbons (LEPH) that are comprised of shorter hydrocarbon chains with less carbon atoms likely were volatilized during burn-off. LEPHs

remaining may have volatilized or been broken down by the natural environment. Heavy extractable hydrocarbons (HEPHs) tend to persist longer.

10.2 BETX Compounds

As discussed earlier, BETX compounds consist of benzene, ethylbenzene, toluene, and xylene, and are by-products of refining processes with almost indistinguishable odour. Of these, Benzene is a confirmed carcinogen; while it is uncertain what the effects posed to ecological receptors are for the remaining BETX compounds. BETX compounds generally tend to migrate farther than LEPHs and HEPHs. Sometimes the presence of BETX compounds is overlooked when the main focus of field investigations are hydrocarbons. Results can show low hydrocarbon concentrations closer to the centre of the plume, while samples taken farther can yield relatively high concentrations of BETX compounds, because the BETX plume front has advanced much farther. Therefore, BETX compounds are a COPC.

10.3 Tetra-Ethyl Lead

Tetra-Ethyl Lead (TEL) was used to increase the octane rating of gasoline. Tetra-ethyl lead is a liquid, which mixes thoroughly with gasoline and vaporizes completely. In the 1970s it was phased out of use, because it is toxic and inhalation of TEL could cause brain damage. There may have been gasoline spills during the time between 1943 and 1958 when the Northern Command Service operated the pipeline. The gasoline would have contained TEL, and therefore, it is a COPC.

10.4 MTBE

Methyl tertiary butyl ether (MTBE) is used as an oxygenate additive to gasoline. It was first used in the late 1970s in concentrations of ~2-7 % as a replacement for lead to boost octane and more recently in concentrations of 11-15 percent to promote complete burning and reduce emissions of carbon monoxide and organic combustion products. Leaded gasoline was phased out in the Yukon in the mid-1980s.

MTBE is especially problematic because it has a low taste and odour threshold, tends to migrate in subsurface systems much faster than other constituents of gasoline, is difficult to remove from water at low concentrations via conventional treatment processes, and poses a potential health

risk. The United States Environmental Protection Agency (USEPA) has included MTBE on its Contaminant Candidate List and considers it to be a possible human carcinogen. The agency further indicated that sufficient data about MTBE were lacking in the areas of health effects, treatment technologies, and occurrence. Since gasoline is one of the products that were carried by YPL, MTBE is considered a COPC at any undocumented spill locations past 1980.

10.5 Herbicides

The literature review revealed that White Pass uses a product known as Roundup, developed for weed control by Monsanto Company (Monsanto) of St. Louis, Missouri, U.S.A. in 1974. The main ingredient in Roundup is glyphosate, which is the common name for N-(phosphonomethyl)-glycine. Roundup kills entire plants from the leaves to the roots. According to material presented on Monsanto's website, glyphosate is degraded by soil microorganisms into naturally occurring elements such as carbon dioxide. The half-life of glyphosate in soil is 45 days. Studies conducted by Monsanto have shown that glyphosate is not bioavailable, and thus, there is minimal retention of glyphosate in tissue. The United States Environmental Protection Agency has classified glyphosate as a "Category E" herbicide; this means that there is evidence of non-carcinogenicity for humans. In the NEB inspection report of 1995, it is stated that White Pass had used Roundup nine (9) to ten (10) years prior. Therefore, herbicide use from 1985 on is not a concern.

The literature review did not indicate the type of herbicide used by White Pass and the Northern Command Service prior to 1985. Information presented in the Bisset report on military activities identifies some of the potential herbicides used by the military during the World War II and in postwar times; they include: Esteron 99, Esteron LV-600, Esteron T-6E, Tordon 101 Mixture Brush Killer, and 2,4-D 2,4,5-T Liquid Brush Killer LV96. Most of these persist for less than a year. Tordon 101 persists the longest at 3-5 years. On the Haines-Fairbanks pipeline, the military used 2,4D (2,4-dichlorophenoxyacetic acid; 485.1 kg/m3) and 2,4,5-T (2,4,5.-trichlorophenoxyacetic acid; 545.4 Kg/m3), which was made by the U.S. Army and was called 1Agent Orange, or simply, Agent Orange. Agent Orange contains harmful dioxin and was used in the Vietnam War during the years 1961 to 1971 in high quantities (20-40 times greater than for

agriculture usage). Dioxin has an environmental half-life of about three years or more and has shown up in the food chain. The effect of Agent Orange on humans has been an area of intense debate for the past two decades. It has now been thoroughly established that dioxin is a very potent poison. It can cause a wide range of organ and metabolic dysfunctions. In laboratory animals, dioxin has shown to be carcinogenic (causing cancer), teratogenic (causing birth defects), and mutagenic (causing genetic damage). The potential concern with Agent Orange on the YPL pipeline is obviously much less than during the Vietnam War, because it was applied in much less quantities and lower concentrations. However, due its proven adverse effects to ecological receptors, possible Agent Orange contamination is a concern.

10.6 Creosote

According to the anecdotal information provided by Mr. Glenn Kubian of Parks Canada, railway ties may have been dumped at points along the ROW. Prior to the development of newer, less environmentally harmful, wood products, creosote treated wood was prevalent. Creosote treated wood, which was first patented in 1838, was used whenever long term durability and protection from water decay was required. Creosote is a distillate of coal tar, a co-product of the coking of bituminous coal used in steel making. It contains over 160 compounds but is composed primarily of liquid and solid aromatic hydrocarbons as well as some tar acids and tar bases that provide protection against destructive insects and organisms. Creosote contains impurities that are toxic, carcinogenic and mutagenic. Leaching and weeping of creosote, especially in hot weather is a particular problem. It is very likely that older railway ties used on the WP & YR railroad have been treated with creosote, as this was very commonplace in former times. Although creosote treated wood is still used, its use is now being regulated in some jurisdictions. Since a large portion of railroad abuts or crosses water bodies between Bennett and Log Cabin there is a possibility that discarded railroad ties may have found their way into aquatic environments. Therefore the constituent contaminants of creosote (polycyclic aromatic hydrocarbons, phenols, and copper sulphate) are COPCs.

10.7 Polycyclic Aromatic Hydrocarbons

Polycyclic Aromatic Hydrocarbons (PAHs) are constituents of refined petroleum products. PAHs are not combusted during burn-off. Therefore, there may be residual PAHs present at site where hydrocarbons spills were burned-off.

10.8 Metals

The main metals of concern would be lead, copper, and zinc. These metals were found in ore extracted from the Faro Area of Yukon. Ore from Faro was hauled on the WP & YR during the 1960s and 1970s. Dust from the ore may have been spread along the ROW and contaminated soil and aquatic environments. The possibility of this occurring is dependant on the type of ore shipping cars used. In some cases, covered cars were used. If this were the case, the likelihood of metals contamination would be low. Further research into White Pass's ore hauling practices could confirm if there is a chance of contamination from ore dust. There may also be some documented or undocumented incidents of derailments. Some of the herbicides that were used may have been salt based. This is another way in which high metal concentrations could be introduced into the natural environment. A third source of metals is antioxidants or anti-knocking agents that are added to refined petroleum products, particularly gasoline. Therefore metals are a concern requiring further analysis.

11.0 CONCLUSIONS

Risk is potentially present to terrestrial and aquatic organisms in the study area. Based, on the accounts of Mr. Ken Steele in the Bisset report, earlier reports of spills prior to 1966 were not documented. The documentation of a spill in 1964 by Golder suggests that spills have occurred prior to 1966. Work practices usually tend to improve over the years to curtail costly errors and spills; therefore, it is likely that the frequency of fuel spills is higher in past years. Under today's legislation, companies are motivated to adopt environmentally friendly work practices and required to report spills. In the absence of such legislation, it is easy to understand why strict protocols were not followed for reporting spills. This was likely the case during White Pass's early years of ownership and during the Northern Command Services' entire tenure as operator of the pipeline. Further investigation of White Pass and military records is required to gain a more complete picture of the spills history of the study area and consolidate spills records of conflicting spills information deriving from various sources such as Golder, White Pass, and Environment Canada.

Many of the spills may have been burned. Burning is not a complete form of remediation. Residual contaminants are left behind as a result of burning and combustion is never 100 percent

complete. Therefore, there may still be residual contaminants at former spill sites, and Golder's organic vapour readings from along the ROW validate this. Contamination from pipeline fuel spills, possible discarding of railway ties, and herbicide use along the ROW lead to a list of COPCs that include creosote, PAHs, and tetra ethyl lead, among others mentioned herein. The reports prepared by Golder for the NEB and White Pass; therefore, do not fully address Parks Canada's concern of contamination of the CTNHS due to off-site contaminant migration from the ROW. Furthermore, assumptions used in the Golder reports may be based on guidelines or standards respecting contaminant concentrations that have since changed.

12.0 RECOMMENDATIONS

Based on the findings of this report, the following recommendations are made for future work:

1. The National Energy Board, as the governmental agency responsible for the decommission of the pipeline, should be made aware of Parks Canada's concerns with regards to offsite contaminant migration. Similarly, Transport Canada may have some jurisdiction over the environmental practices of the railway.

2. White Pass should be approached to gain full access to their records. As stated in this report, White Pass is committed to public participation in the pipeline decommissioning process.

3. If possible, military archives located in Ottawa and Washington should be investigated to find spill records. The best approach to conducting this work is to hire a sub-consultant or an archive researcher from these cities to look at files there.

4. It is recommended that all locations of former spills be visited and a complete survey of the west side of the ROW be made. At visible vegetation kill zones and spill areas, samples should be obtained at depth and analyzed for hydrocarbons to confirm that remediation has occurred.

5. It is recommended that water and stream/lake sediment samples be collected from the locations shown in Figure 1. These locations were selected for one of three reasons: (1) they are among the APECs defined by Mr. Glenn Kubian of Parks Canada, (2) they are locations of pipeline stream crossings or locations where the pipeline was submerged in a surface watercourse, or (3) they are surface water courses close to former spill sites. Lab testing parameters, which would address contaminants of potential concern, are LEPHs, HEPHs, VOCs, PAHs, Phenols, Metals, and Acid Extractable Herbicides.

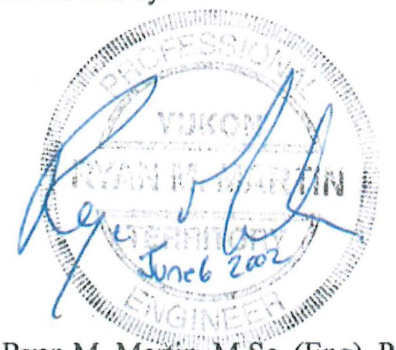
13.0 LIMITATIONS & CLOSURE

This report has been prepared for the exclusive use of Parks Canada, for the purposes as described in Section 1 of this report. The report has been prepared in accordance with generally accepted geo–environmental practices. Additional information regarding the use of this report is presented in the Environmental Report - General Conditions, which form a part of this report.

EBA trusts this report meets your requirements at this time. If you have questions or require additional information please contact the undersigned.

Respectfully submitted,
EBA Engineering Consultants Ltd.

Reviewed by:



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REFERENCES

Books

Bloom, Arthur L. 1991. Geomorphology: A Systematic Analysis of Late Cenozoic Landforms. New Jersey: Prentice Hall.

Cherry, John A. and Freeze, Allan R. 1979. Groundwater. Englewood Cliffs, New Jersey: Prentice Hall.

Journal Articles

Chuvilin, E.M., Miklyaeva, E.S., Kozlova, E.V., Volkov, N.G., and Instanes, A. Influence of freezing on accumulation and redistribution of hydrocarbon in soils. ARCSACC '01. Edmonton, Alberta: 267 – 272.

Instanes, A., Markarova, M., and Leibman, M. Oil spills on permafrost Russian experience and remediation techniques. ARCSACC ' 01. Edmonton, Alberta: 273 – 280.

Governmental and Consultant Reports

EBA Engineering Consultants Ltd. Limited Phase 1 & 2 Environmental Site Assessment of an Unnamed Creek at the South End of Bennett Lake. February 2002. File Number: 0201-01-15178005.

Environmental Protection Services. An Environmental Study of the White Pass & Yukon Route Pipeline from the B.C. – Alaska Border to Whitehorse, Y.T. September 1976.

Golder Associates Ltd. Work Plan for an Environmental Assessment of the White Pass Petroleum Products Pipeline and Associated Infrastructure. February 26, 1996. File Number: 962-1818.

Golder Associates Ltd. Report on Work Plan for Phase II Environmental Site Assessment of the Yukon Pipelines Limited Petroleum Products Pipeline and Associated Infrastructure. October 3, 1996. File Number: 962-1818.

Golder Associates Ltd. Status Report on Environmental Site Assessment of the White Pass Petroleum Products Pipeline and Associated Infrastructure. July 26, 1996. File Number 962-1818B.

Golder Associates Ltd. Report on Environmental Site Assessment and Plan of Restoration Yukon Pipelines Right-of-Way Yukon. February 24, 1998. File Number: 962-1818B.

Golder Associates Ltd. Report on Site Restoration National Energy Board Order MO-7-96 Yukon Pipelines Limited Pipeline Right-of-Way Yukon and British Columbia. September 27, 2001. File Number: 962-1818B

K.Bisset & Associates. Research of Former Military Sites & Activities in the Yukon. April 1995.

National Energy Board. Report on an Inspection of the Deactivated Skagway, Alaska to Whitehorse, Yukon Petroleum Products Pipeline. June 1995.

National Energy Board. Yukon Pipelines Limited MH-3-96 Environmental Screening Report. September 1996.

National Energy Board. Reasons for Decision Yukon Pipelines Limited MH-3-96. September 1996

Websites

www.atsdr.cdc.gov

www.lyghtforce.com/HomeopathyOnline/issue5/articles/ritchie_orange.html

www.monsanto.com

www.nature.nps.gov/toxic

www.neia.org/policies/wat9201.htm

www.whitepassrailroad.com

Regulations

Canadian Council of Ministers of the Environment. 1999(updated). Canadian environmental quality guidelines. Canadian Council of Ministers of the Environment, Winnipeg.

This report incorporates and is subject to these "General Conditions".

A.1 USE OF REPORT

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA's client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

A.2 LIMITATIONS OF REPORT

This report is based solely on the conditions which existed on site at the time of EBA's investigation. The client, and any other parties using this report with the express written consent of the client and EBA, acknowledge that conditions affecting the environmental assessment of the site can vary with time and that the conclusions and recommendations set out in this report are time sensitive.

The client, and any other party using this report with the express written consent of the client and EBA, also acknowledge that the conclusions and recommendations set out in this report are based on limited observations and testing on the subject site and that conditions may vary across the site which, in turn, could affect the conclusions and recommendations made.

The client acknowledges that EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the client.

A.2.1 Information Provided to EBA by Others

During the performance of the work and the preparation of this report, EBA may have relied on information provided by persons other than the client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

A.3 LIMITATION OF LIABILITY

The client recognizes that property containing contaminants and hazardous wastes creates a high risk of claims brought by third parties arising out of the presence of those materials. In consideration of these risks, and in consideration of EBA providing the services requested, the client agrees that EBA's liability to the client, with respect to any issues relating to contaminants or other hazardous wastes located on the subject site shall be limited as follows:

(1) With respect to any claims brought against EBA by the client arising out of the provision or failure to provide services hereunder shall be limited to the amount of fees paid by the client to EBA under this Agreement, whether the action is based on breach of contract or tort;

(2) With respect to claims brought by third parties arising out of the presence of contaminants or hazardous wastes on the subject site, the client agrees to indemnify, defend and hold harmless EBA from and against any and all claim or claims, action or actions, demands, damages, penalties, fines, losses, costs and expenses of every nature and kind whatsoever, including solicitor-client costs, arising or alleged to arise either in whole or part out of services provided by EBA, whether the claim be brought against EBA for breach of contract or tort.

A.4 JOB SITE SAFETY

EBA is only responsible for the activities of its employees on the job site and is not responsible for the supervision of any other persons whatsoever. The presence of EBA personnel on site shall not be construed in any way to relieve the client or any other persons on site from their responsibility for job site safety.

A.5 DISCLOSURE OF INFORMATION BY CLIENT

The client agrees to fully cooperate with EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The client acknowledges that in order for EBA to properly provide the service, EBA is relying upon the full disclosure and accuracy of any such information.

A.6 STANDARD OF CARE

Services performed by EBA for this report have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Engineering judgement has been applied in developing the conclusions and/or recommendations provided in this report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of this report.

A.7 EMERGENCY PROCEDURES

The client undertakes to inform EBA of all hazardous conditions, or possible hazardous conditions which are known to it. The client recognizes that the activities of EBA may uncover previously unknown hazardous materials or conditions and that such discovery may result in the necessity to undertake emergency procedures to protect EBA employees, other persons and the environment. These procedures may involve additional costs outside of any budgets previously agreed upon. The client agrees to pay EBA for any expenses incurred as a result of such discoveries and to compensate EBA through payment of additional fees and expenses for time spent by EBA to deal with the consequences of such discoveries.

A.8 NOTIFICATION OF AUTHORITIES

The client acknowledges that in certain instances the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

A.9 OWNERSHIP OF INSTRUMENTS OF SERVICE

The client acknowledges that all reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

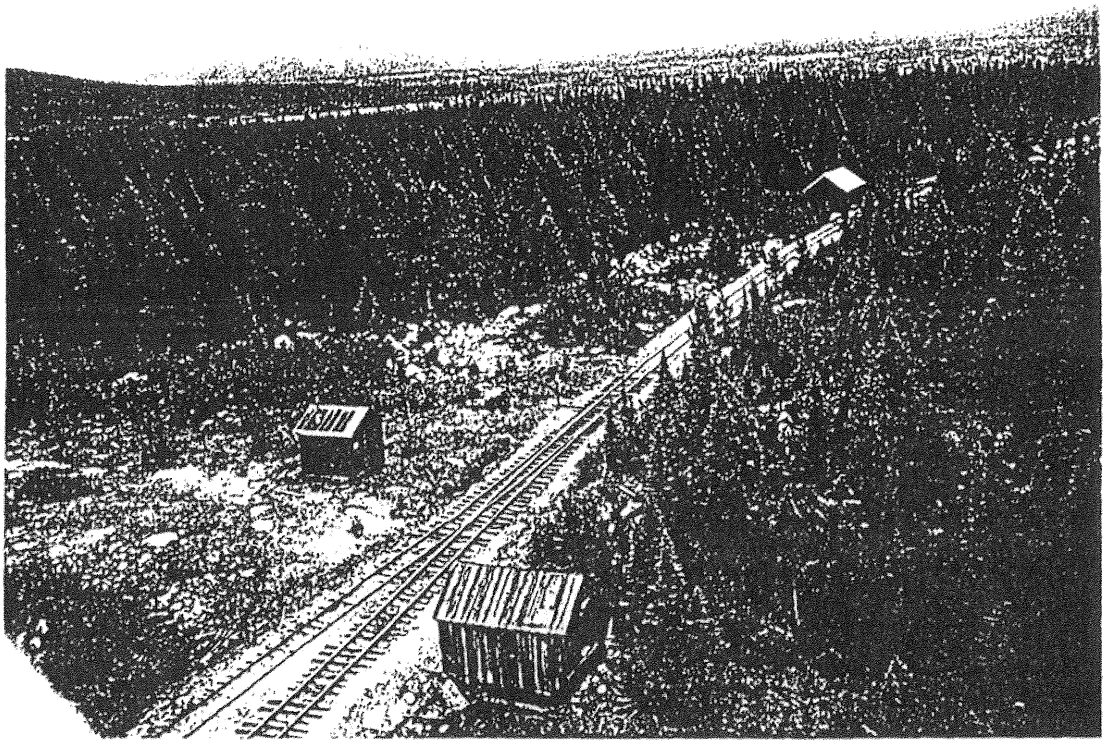
A.10 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

The Client recognizes and agrees that electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

Appendix A:
Golder Field Sheets



PHOTOGRAPH 38

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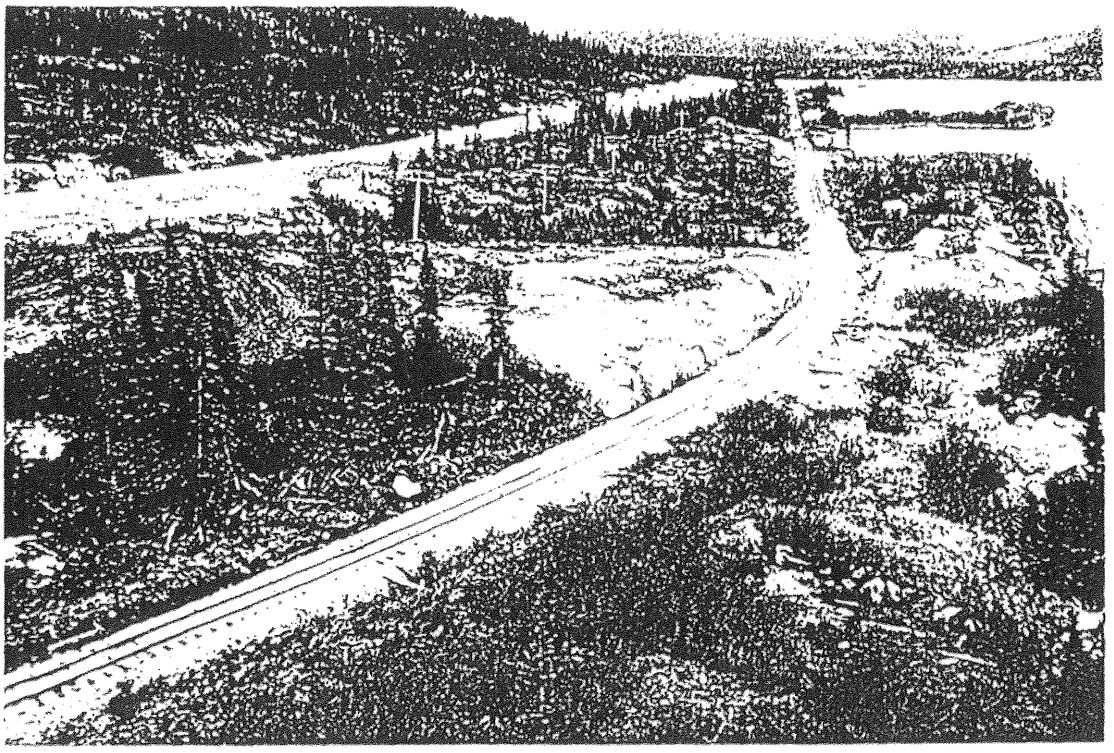


PHOTOGRAPH 39

Mile marker: 30.5

SITE IDENTIFICATION NO.:_____

FIELD CHECKLIST FOR SITE INSPECTION - WHITE PASS 962-1818

White Pass Pipeline and Whitehorse Tank Farm

I. General Site Characteristics/Information:

a. spill date (if known): *Feb. 3/64 55,125 L furnace oil*
b. location:
Mile Marker: *32.7*
GPS (latitude/longitude) : *59°45.66W 134°57.79W*
c. location marked on map (1:50,000 NTS):____
d. photographs taken (enclosed): *35*
e. video taken:__✓__
f. general description of contamination: gasoline, *diesel*, crater grease, sludge, other_____
g. estimated area of contamination (m^2): _____
h. estimated depth of contamination (m):_____
i. proximity to rail spur: 1-3m_✓_3-5m___>5m___
j. other signs of stress: _____
k. habitat (*marsh*, grassland, tundra, forest): _____
l. proximity to aquatic life: crosses river
adjacent to river
adjacent to lake
other_____
m. geology:
regional geology: : *bedrock*
site geology: : *bedrock - rubble fill*
surface soil type (*fill*/native): :_____
permafrost: : *no*
n. hydrogeology
regional hydrogeology: *fracture flow*
local drainage : *SE*
groundwater recharge/*discharge* :_____
o. topography of area (flat, valley, high elevation): *plateau*
p. historical use :_____
q. current land use :_____
r. aerial photographs available :____
s. climate: _____

II. Potential Contaminant:

a. Preliminary site investigation data results:_____

_____

b. White Pass information: ***spill***
c. regulatory history (reported contaminants): ***furnace oil/diesel***
d. information from employee interview: yes/no
e. obvious evidence of contamination: ***no***
f. free phase product present: ***no***
g. surface soil staining:__*no*__ h. subsurface soil staining:____
i. surface soil odours:____ j. subsurface soil odours:____
k. surface soil OVM reading:____ l. subsurface soil OVM reading:____
m. surface soil shake test:____ n. subsurface soil shake test:____
o. surface samples taken:_____
p. subsurface samples taken:_____
q. other samples taken:_____

r. list likely contaminants:_____

III. Release Mechanisms:

a. leaching:__✓__ b. wind erosion:____
c. volatilization:_✓__ d. vehicular erosion:____
e. run-off:__✓__ f. flood potential:____

IV. Transport and Residency Media:

a. groundwater:__✓__ b. air:__✓__
c. surface water:____ d. soil:__✓__
e. dust:____

V. Potential Exposure Pathways:

a. estimated depth of contamination (m):____
b. estimated distance to nearest aquatic habitat (m): ***> 100 m***
c. estimated distance to drinking water source (m): ***> 100 m***
d. estimated groundwater flow direction: ***SE***
e. estimated depth to water table: ***3 -5 m***
f. evidence of contaminant migration (yes/*no*):_____
g. ingestion:_____
h. inhalation:_____
i. transdermal:___✓_____

VI. Potential Receptors:

a. habitat description (at contamination): alpine tundra___
mountain hemlock___
engelmann spruce-subalpine fir___
spruce willow birch___
boreal white/black spruce___

b. habitat description (down gradient): alpine tundra___
mountain hemlock___
engelmann spruce-subalpine fir___
spruce willow birch___
boreal white/black spruce___

c. receptors observed:_____

_____

d. evidence of receptors observed:_____

_____

e. potential ecological receptors:
terrestrial: aquatic:

f. human receptors:_____
distance to nearest roadway/settlement:_____

V. Further Work:

a. evidence of active biodegradation:_____
b. further site investigation recommendation: _____

SITE IDENTIFICATION NO.:_____

FIELD CHECKLIST FOR SITE INSPECTION - WHITE PASS 962-1818

White Pass Pipeline and Whitehorse Tank Farm

I. General Site Characteristics/Information:

a. spill date (if known): ***Apr. 1/76 6,300 L furnace oil***
b. location:
Mile Marker: ***40.6***
GPS (latitude/longitude) : ***59°50.88N 134°59.70W***
c. location marked on map (1:50,000 NTS):____
d. photographs taken (enclosed):____
e. video taken:__✓__
f. general description of contamination: gasoline, ***diesel***, crater grease, sludge, other_____
g. estimated area of contamination (m^2): _____
h. estimated depth of contamination (m):_____
i. proximity to rail spur: 1-3m___3-5m_✓_>5m___
j. other signs of stress: _____
k. habitat (marsh, grassland, tundra, ***forest***): ***sandy - Bennett Town***
l. proximity to aquatic life: crosses river
adjacent to river
adjacent to lake
other_____
m. geology:
regional geology: : ***fluvial deposits***
site geology: : ***glacial/fluvial sands and gravels***
surface soil type (fill/native): :_____
permafrost: : ***no***
n. hydrogeology
regional hydrogeology: ***porous flow***
local drainage : ***NW***
groundwater recharge/***discharge*** :_____
o. topography of area (flat, ***valley***, high elevation): ***Bennett***
p. historical use :_____
q. current land use :_____
r. aerial photographs available :____
s. climate: _____

II. Potential Contaminant:

a. Preliminary site investigation data results:_____
_____
b. White Pass information: *spill*
c. regulatory history (reported contaminants): *furnace oil*
d. information from employee interview: yes/no
e. obvious evidence of contamination: *no*
f. free phase product present: *no*
g. surface soil staining:__*no*_ h. subsurface soil staining:____
i. surface soil odours:____ j. subsurface soil odours:____
k. surface soil OVM reading:____ l. subsurface soil OVM reading:____
m. surface soil shake test:____ n. subsurface soil shake test:____
o. surface samples taken:_____
p. subsurface samples taken:_____
q. other samples taken:_____

r. list likely contaminants:_____

III. Release Mechanisms:

a. leaching:__✓__ b. wind erosion:____
c. volatilization:__✓_ d. vehicular erosion:____
e. run-off:__✓__ f. flood potential:____

IV. Transport and Residency Media:

a. groundwater:__✓__ b. air:__✓__
c. surface water:____ d. soil:__✓__
e. dust:____

V. Potential Exposure Pathways:

a. estimated depth of contamination (m):____
b. estimated distance to nearest aquatic habitat (m): *300 - 400 m*
c. estimated distance to drinking water source (m): *> 5 km*
d. estimated groundwater flow direction: *NW*
e. estimated depth to water table: *5 - 10 km*
f. evidence of contaminant migration (yes/*no*):_____
g. ingestion:___✓_____
h. inhalation:____✓_____
i. transdermal:_____

VI. Potential Receptors:

a. habitat description (at contamination): alpine tundra___
mountain hemlock___
engelmann spruce-subalpine fir___
spruce willow birch___
boreal white/black spruce__✓_

b. habitat description (down gradient): alpine tundra___
mountain hemlock___
engelmann spruce-subalpine fir___
spruce willow birch___
boreal white/black spruce___

c. receptors observed:_____

d. evidence of receptors observed:_____

e. potential ecological receptors:
terrestrial: aquatic:

f. human receptors: *~ 200 - 300 m*
distance to nearest roadway/settlement: *town of Bennett, one resident family*

V. Further Work:

a. evidence of active biodegradation:_____
b. further site investigation recommendation: *no*

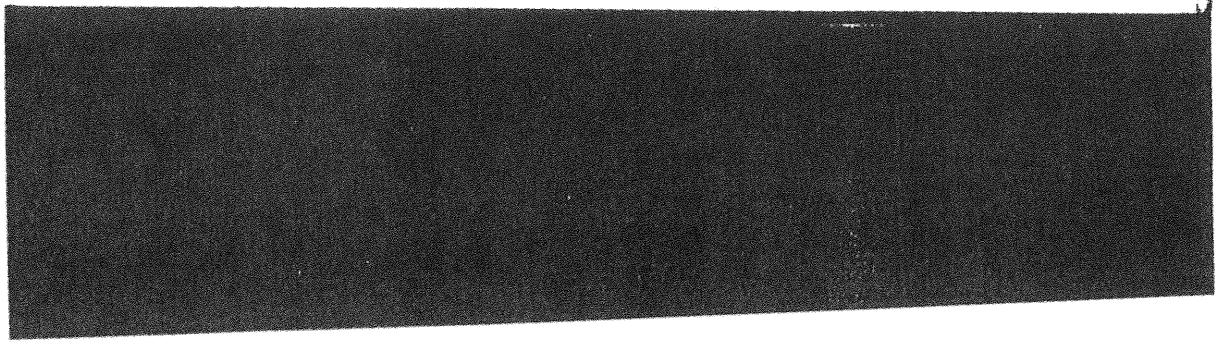
SITE IDENTIFICATION NO.:_____

FIELD CHECKLIST FOR SITE INSPECTION - WHITE PASS 962-1818

White Pass Pipeline and Whitehorse Tank Farm

I. General Site Characteristics/Information:

a. spill date (if known): *June/64 5,250 L furnace oil*
b. location:
Mile Marker: *41.0*
GPS (latitude/longitude) : *59°51.07N 134°59.39W*
c. location marked on map (1:50,000 NTS):____
d. photographs taken (enclosed):____
e. video taken:__✓__
f. general description of contamination: gasoline, *diesel*, crater grease, sludge, other_____
g. estimated area of contamination (m^2): _____
h. estimated depth of contamination (m):_____
i. proximity to rail spur: 1-3m___3-5m_✓_>5m___
j. other signs of stress: _____
k. habitat (marsh, grassland, tundra, *forest*): _____
l. proximity to aquatic life: crosses river
adjacent to river
adjacent to lake
other_____
m. geology:
regional geology: : *bedrock*
site geology: : *colluvium*
surface soil type (*fill*/native): :_____
permafrost: : *no*
n. hydrogeology
regional hydrogeology: *fracture flow*
local drainage : *west*
groundwater recharge/*discharge* :_____
o. topography of area (flat, *valley*, high elevation): *Bennett Lake*
p. historical use :_____
q. current land use :_____
r. aerial photographs available :____
s. climate: _____



II. Potential Contaminant:

a. Preliminary site investigation data results:_____
_____
b. White Pass information: *spill*
c. regulatory history (reported contaminants): *furnace oil*
d. information from employee interview: yes/no
e. obvious evidence of contamination: *no*
f. free phase product present: *no*
g. surface soil staining:__*no*_ h. subsurface soil staining:____
i. surface soil odours:____ j. subsurface soil odours:____
k. surface soil OVM reading:____ l. subsurface soil OVM reading:____
m. surface soil shake test:____ n. subsurface soil shake test:____
o. surface samples taken:_____
p. subsurface samples taken:_____
q. other samples taken:_____

r. list likely contaminants:_____

III. Release Mechanisms:

a. leaching:__✓__ b. wind erosion:____
c. volatilization:__✓_ d. vehicular erosion:____
e. run-off:__✓__ f. flood potential:____

IV. Transport and Residency Media:

a. groundwater:____ b. air:__✓__
c. surface water:__✓_ d. soil:____
e. dust:____

V. Potential Exposure Pathways:

a. estimated depth of contamination (m):____
b. estimated distance to nearest aquatic habitat (m): *~ 10 m*
c. estimated distance to drinking water source (m): *> 5 km*
d. estimated groundwater flow direction: *west*
e. estimated depth to water table: *3 - 5 m*
f. evidence of contaminant migration (yes/*no*):_____
g. ingestion:_____
h. inhalation:_____
i. transdermal:__✓_____

VI. Potential Receptors:

a. habitat description (at contamination): alpine tundra___
mountain hemlock___
engelmann spruce-subalpine fir__ *rocky store*
spruce willow birch___
boreal white/black spruce_✓_

b. habitat description (down gradient): alpine tundra___
mountain hemlock___
engelmann spruce-subalpine fir___
spruce willow birch___
boreal white/black spruce___

c. receptors observed:_____

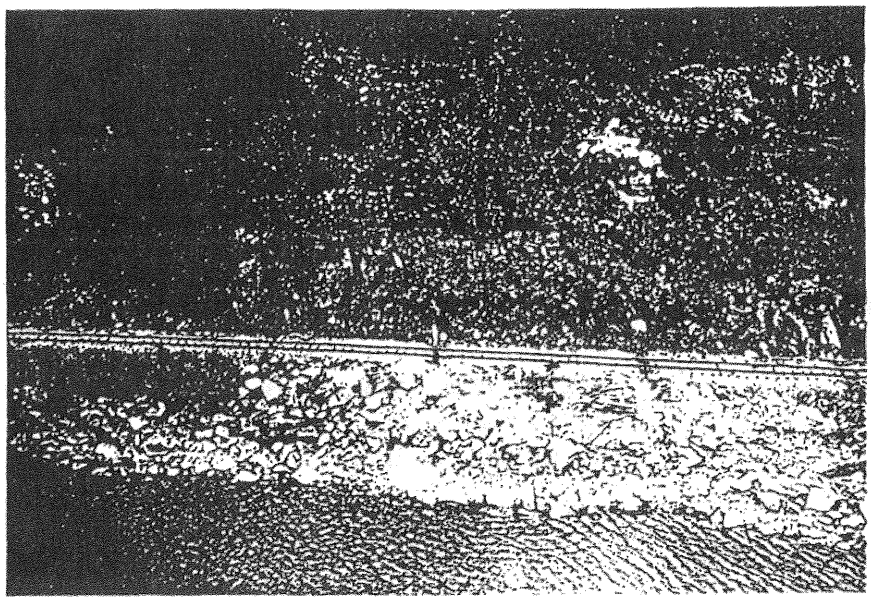
d. evidence of receptors observed:_____

e. potential ecological receptors:
terrestrial: *aquatic:*

f. human receptors: ***> 5 km***
distance to nearest roadway/settlement: ***> 5 km***

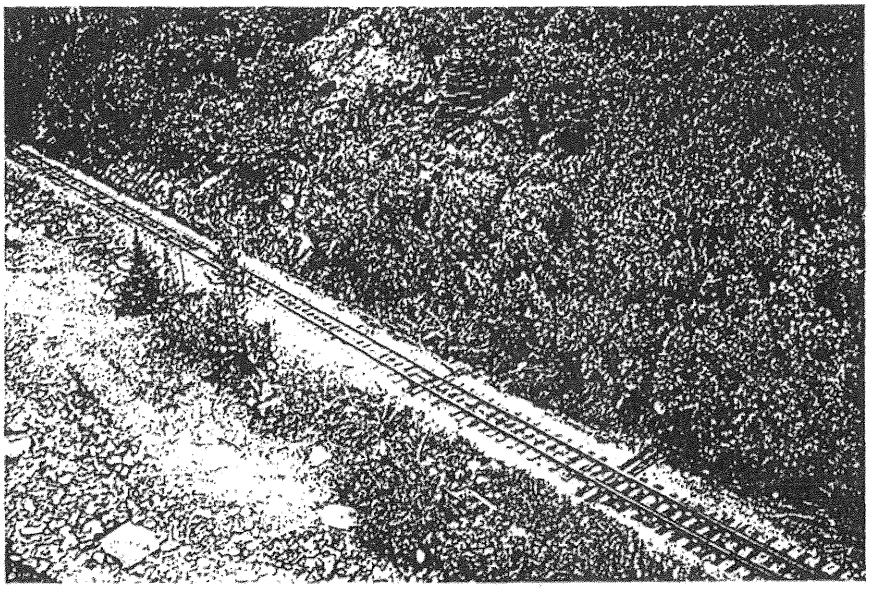
V. Further Work:

a. evidence of active biodegradation:_____
b. further site investigation recommendation: ***no***



PHOTOGRAPH 36

Mile marker: 41.8



PHOTOGRAPH 37

Mile marker: 41.0