

J.R. Paine & Associates Ltd.

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**PRELIMINARY ENVIRONMENTAL
INVESTIGATIONS AT VARIOUS SITES
THROUGHOUT THE YUKON
SITES #3, 4, 5, and 6
Contract 96-6134-1**

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4 - Te 24
5 - Te 25
6 - Te 26

Submitted to:
INDIAN and NORTHERN AFFAIRS CANADA
ARCTIC ENVIRONMENTAL STRATEGY
ACTION ON WASTE PROGRAM

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EXECUTIVE SUMMARY

J. R. Paine & Associates Ltd. was retained by Indian and Northern Affairs, Action on Waste Program to conduct preliminary environmental investigations at four suspected waste sites along the Alaska Highway in south east Yukon. The sites were numbered 3 to 6 and were identified as the Rancheria Dump, the Pine Lake Airstrip, the former Camp 10.5E, and the Swift River Bridge, respectively. The purpose of the study was to determine if any known or potential environmental liabilities were associated with the subject properties, to perform the necessary analysis to determine the risk associated with these liabilities, and to provide recommendations for further assessment, monitoring, or remediation activities which may be required.

A phased approach was employed to satisfy the project objectives. The first phase involved an extensive data search, records review, and interview program. Following this, a detailed field work program was initiated, consisting of an environmental survey, geophysical program, and test pit program. Samples retained from the test pit program were tested both for physical and chemical considerations. Finally, all data obtained in the above programs was collated in order to provide the necessary interpretations and recommendations.

The Phase I aspect of the work program was instrumental in identifying the various possible waste sites at each study area and in determining the types of contaminant sources that may have occurred at each site. The results of the geophysical program indicated that for each site tested, magnetic and electromagnetic anomalies were relatively weak and of limited lateral extent. This suggests that only a small quantity of buried metal exists at those sites surveyed.

The results of the detailed test pit program indicated that the majority of sites did not have contamination present in the subsurface. Further, few contaminant sources were present in most areas. However, of the 10 separate tests studied, there were three areas which contained known or potential contamination. The Rancheria Dump appeared to contain domestic wastes such as empty bottles, cans, and plastic items which have derived from the Rancheria Lodge between the early 1950s and early 1970s. The waste material is restricted to the north perimeter of the clearing and is an average thickness of 1.0 metre. From the field and laboratory programs, there does not seem to be

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leachate production or other impurities adversely affecting the underlying soil as a result of this waste material. However, the risk assessment portion of the analysis identified several uncertainties in relation to the potential impact on the ground water resource and subsequently the users of the Rancheria Lodge which is located hydraulically down-gradient from the dump area. In order to alleviate this uncertainty, it was recommended to proceed with a drilling, hydrogeologic characterization, and water quality testing program.

There were two areas at the Pine Lake Site where soil contamination was encountered. There was a pit located at the former camp area (sub-area P1) of the Pine Lake Airstrip which was most likely used as a pit privy during the construction of the airstrip when the camp was occupied. However, this pit later became a disposal area for various debris, including old drums. It appears that a small amount of an oil petroleum product had spilled onto the underlying gravelly sand soil. Using an inside-out excavation technique, the lateral and vertical limits of the impurity were identified and the total contaminated soil volume was estimated at 1.0 - 2.0 m³. Similarly, in the immediate vicinity of the former generating unit (sub-area P3), an oil impurity was encountered within the soil profile. Although of relatively high concentrations, the contaminated soil volume was minimal with an estimated volume of 2.0 - 3.0 m³.

A detailed risk assessment was conducted in order to determine the hazard and exposure potential which the contaminated soil poses. The results of this analysis indicated that the risk is relatively low for this area. Although it is not envisioned that these small oil releases will necessitate remediation considerations under the Contaminated Sites Regulations, it may be prudent to perform an excavation, removal, and disposal remediation program. This will eliminate the contamination in an expeditious and cost effective manner and will avoid complicating the land claims selection process which is currently under way in this area.

From the Phase I and II investigations, the Sites of the former Camp 10.5E and the Swift River Bridge did not appear to contain contaminant sources or the presence of impurity within the soil profile. As such, further analysis or monitoring of these areas for environmental considerations is not deemed necessary.

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1.0 INTRODUCTION

1.1 General

The following report presents the results of the Preliminary Environmental Investigations which our firm has conducted in the Swift River - Rancheria area in Yukon. J.R. Paine & Associates Ltd. was retained by Indian and Northern Affairs, Action on Waste Program to perform environmental evaluation services at suspected waste sites identified as the Rancheria Dump, the Pine Lake Airstrip, the former Camp 10.5E, and the Swift River Bridge area (Sites 3 through 6, respectively). The study area and relative location of each subject site is depicted on Figure No. 1.

This project was part of a thorough study initiated by Action On Waste (AOW) which was purposed to gather an accurate inventory of existing contaminated sites in the Yukon. These sites are primarily associated with the original construction of the Alaska Highway and supporting infrastructure and have been identified from previous investigative work. It was the intention of this study to verify if environmental liabilities were associated with the suspected waste sites and to provide the necessary recommendations for further study, monitoring, or remediation.

The site locations were identified from various information provided by the Action on Waste personnel upon contract award. This essentially consisted of a collection of data obtained from excerpts of the Reger, 1983 report, the Edey, 1976 report. Also, various maps were provided which derived from recent survey plans or from the Public Road Administration (PRA) Maps of 1943. This information was utilized at the outset of the project to familiarize ourselves with each particular study area.

Authorization to proceed with the investigation and analysis was granted by Mr. Brett Hartshorne from the Action on Waste Program on September 20, 1996. The work program was conducted in accordance with the Call-up against a standing offer contract 96-6134-1 and with the J.R. Paine & Associates proposal of 28 August, 1996.

1.2 Scope of Work

The project objectives and scope of work were determined through conversations with Brett Hartshorne during the tendering process. The study was intended to provide a preliminary environmental site assessment consisting of the following phased approach:

- Phase I Determine the site history and contaminant profile based on literature, archival information, records, and interviews.
- Phase II Determine the presence of contaminants on site. Develop and carry out a sampling regime, ensuring quality assurance/quality control in order to characterize the existing contamination.
- Phase III Perform a preliminary environmental impact assessment which considers the nature and extent of contamination, the migration pathways, and the perceived risk of the contamination. This will be done by analyzing and interpreting the Phase II results.
- Phase IV Develop recommendations for further assessment, monitoring, or remediation work in consideration of the results of this study.

1.3 Report Format

The report is structured to generally reflect the various stages of the project. The results of the data review services are presented in the Phase One ESA chapter. The various components of the field and laboratory programs are detailed in the Phase Two ESA chapter as well as summary information regarding the nature and extent of contamination at each site. Following the Phase Two component, only those areas which necessitate further consideration in regards to the impact of known or probable contamination are dealt with in the preliminary impact assessment portion of this report. Finally, the necessary recommendations for further work are detailed in the recommendations section of the report.

2.0 PHASE I ENVIRONMENTAL SITE ASSESSMENT (ESA)

2.1 Methodology

The purpose of the Phase I ESA was to perform the necessary data searches in order to become familiarized with each site and to determine all known or potential environmental liabilities which exist at each site. The searches essentially consisted of a review of existing data and an interview program, each of which is detailed below.

At the outset of the project, the following information was reviewed for environmental considerations at each site:

- aerial photographs for terrain analysis and land use change considerations
- surficial geology maps from the Geological Survey of Canada
- topographic maps
- land titles information for private and government interests
- Environment Canada spills records (note: no relevant records obtained)
- existing reports related to the study
- archival pamphlets and books related to the study
- records from the Government of Yukon, Aviation Branch and Transportation Engineering departments including existing records, the PRA maps of the original Alaska Highway construction, and borehole data from the recent reconstruction of the Alaska Highway near the study area.

Several potential interviewees were identified from the records search. An interview program question list was designed and the relevant persons were contacted for interview purposes. The interview program was conducted primarily at the outset of the work program but continued throughout the contract duration as necessary.

The information gained from the above data searches and interview program was collated and summarized for each study area.

2.2 Site 3 - Rancheria Dump

The Rancheria Dump is located approximately 300 metres west of the Rancheria Lodge and Restaurant at Mile Post 710 on the Alaska Highway. The relative location of the dump with respect to the Lodge is depicted on Figure No.2. The dump is immediately adjacent to the right of way for the Alaska Highway and is bounded to the north by pine forest and a relatively steep incline. The hill marks the northern limit of the historic floodplain of the Rancheria River. The surficial geology is dominated by alluvial bottom deposits with gravel and sand representing the near surface soil types.

From a title search at the Land Titles office, it was determined that the area of the dump is federally owned. The Rancheria Lodge has been owned by the Rancheria Hotel Ltd. since 17 Nov., 1993. William (Bud) Simpson owned the Lodge as far back as 17 Dec., 1955. The Lodge was purchased by Bud Simpson from the British Yukon Navigation Co. Ltd. (BYN) who were first awarded title of the property on 19 Feb., 1953. The above titles information was somewhat inconsistent with the interview results obtained from the current and previous owners of the Rancheria Lodge. For instance, Art Semler, the current owner of the Lodge, remarked that he has owned it for around 15 years. Further, Bud Simpson noted that he had owned the property between the dates of 1946 and 1974. For the purposes of this study, we have assumed that the interview results most accurately represent the dates of ownership of the Rancheria Lodge. It is evident that the Rancheria Lodge has been occupied since its inception in the early 1940s when it was used as a surveyors headquarters. Since this time, the Lodge has been used as a refuge for Alaska Highway travellers.

Historical records on the construction of the Highway were limited and thus very little information is available regarding the Rancheria area. The PRA maps of 1943 show the area as a large Highway construction camp with up to 28 buildings located in the general area of the existing Lodge. There was no indication of the dump on the PRA maps. In reviewing the Bisset, 1995 report, the Rancheria Dump was referred to as one of the worst on the highway (Bisset, p163), however, there was no further discussion to substantiate this claim. The Reger, 1983 study provided cursory information regarding the dump site and general use of the area. In regards to past or present problems with the site, Reger commented that the water at the Rancheria lodge had a smell of hydrocarbons.

There was no specific information uncovered at the Yukon Archives in relation to the Rancheria Lodge or the dump.

As detailed in Table One, air photos from 1948, 1961, and 1992 were observed in order to determine if significant land use changes had occurred at the subject site over time. The area of the Rancheria Lodge and associated Rancheria Campground has not changed significantly since 1948 other than some regeneration at the campground area. In regards to the specific area of the dump, there may have been a small clearing which appears to coincide with the shape of the east portion of the existing dump (where TP#R-e is depicted on Figure No. 3). The photo of 1961 was of too small scale and of too poor quality to make determinations regarding the conditions of the dump. The conditions noted on the 1992 photo essentially reflect the current shape and size of the dump.

As detailed in the interview results located in Table Two, Bud Simpson noted that the dump was not there when he began working at the Lodge in 1946. He said that the dump was developed by himself in order to dispose of domestic waste deriving from the Lodge. He did not know of any dump or other disposal area associated with the presence of the former highway camp. Art Semler noted that the dump was there when he took ownership approximately 15 years ago. He remarked that he never used this area for waste disposal or other purposes.

From the data searches described above, it appears that the dump was primarily developed for domestic waste disposal deriving from the Rancheria Lodge. As a domestic disposal area, waste material would consist primarily of empty containers, household garbage, and various construction wastes. Although there appears to be a small clearing in this area in 1948, the origin is uncertain and contaminant sources are not known.

2.3 Site 4: Pine Lake Airstrip

The Pine Lake Airstrip is accessed along a road 2.1 km north of the Alaska Highway at Km 1162, or approximately 800 m west of the Upper Rancheria River crossing. The airstrip is directly adjacent to the Rancheria River as seen on Figure No. 4. The area falls within a glaciofluvial deltaic deposit

and as such is flat and has a surficial dominated by silt, sand, and gravel deposits. This area is rich in gravel material as evidenced by previous borrow developments both in connection with the airstrip and with the maintenance of the Alaska Highway.

Following a title search, the airstrip and access road was surveyed in 1945 and is registered as Lot 1, Group 756, Plan 40320 CLSR. This lot is federally owned but was set aside on 24 January, 1974 as reserve for the Government of Yukon for use as an emergency landing strip. Associated with this agreement, the Yukon Government has been responsible for maintenance of the airstrip, an activity which has been performed in the summer months only. A subsequent survey was conducted in 1953 in connection with Lot 7, Group 756, Plan 41889 which is the general location of the previous camp area at the airstrip (refer to Figure No. 4). This lot is also owned by the federal government.

From archival data, this airstrip and access road was originally constructed by the US Army in connection with the Northwest Staging Route development in the early 1940s. This was an initiative purposed to develop a series of fuel stops and landing strips leading from Edmonton to Alaska. The project involved a phased approach where initially, main airports were constructed at 200 mile intervals at Grande Prairie, Fort St. John, Ft. Nelson, Watson Lake, and Whitehorse in 1939. The next phase came with the agreement by the Canada United States Permanent Joint Board of Defence in November, 1940 to develop the Alaska Highway. Associated with the original highway project, flight strips were constructed by the United States at suitable intervals adjacent to the highway. These were used only for 'contact flying' where the highway could be used as a guide by the pilot. The purpose was to provide facilities for rapid movement of construction and maintenance personnel as well as emergency landing areas along the highway. The Pine Lake Airstrip was one of several airstrips located at 100 mile intervals along the highway. From archival data, construction started in July, 1943 and was suspended in December, 1943. Stabilizing of the surface occurred in the summer of 1944. In reviewing the PRA maps of 1943, the access road to the Pine Lake Airstrip was shown near mile post 722.

In regards to facilities at the airstrip, the following information was gained from various sources.

From the original survey of 1945, there was a camp consisting of 3 buildings located along the access road where Lot 7 is located. Also depicted on this survey was a beacon tower, power house (incomplete), and airstrip lighting. There was also a windsock and cabin on the airstrip. However, all facilities with the exception of the beacon tower have since been removed. The Edey, 1976 study noted that portions of 3 buildings occurred in the area of the former camp, 2 collapsed buildings and scattered wood debris existed near the locator tower, and tent frames and 5 grease kegs were located at sub-area P5 (J.R.Paine designation as depicted on Figure No. 4). Also noted by Edey were 2 log buildings and 1 wood frame building located on the 'loop road' at the beginning of the access road. In this study, Edey recommended that several restoration activities be initiated to return the site to its natural state, including removing and burning all wood structures with the exception of the log structures along the 'loop road'. In discussing this report and the proposed work with Ron Sedoryk and Kevin Ristau, the current and former RMOs for Watson Lake, neither had knowledge of this restoration work having been completed.

Air photos of the subject site for the years of 1948, 1961, 1989, and 1992 were obtained for the purpose of a temporal review of land use changes. Several clearings were noted on the 1948 photo in connection with the airstrip development. Besides the obvious clearing for the airstrip there were clearings at sub-areas P1, P4, and P5 (as depicted on Figure No. 4). Sub-areas P2 and P3 fell within the original large clearing area associated with the airstrip. The 'loop road' was not present in 1948 and the alignment at the beginning of the access road was approximately 100 m further east than its existing location. This alignment appears to have changed by 1961 with the addition of the 'loop road' at the beginning of the access road. The only discernible change noticed on the air photos dated 1989 and 1992 was extensive regeneration occurring along the east and west edges of the airstrip (resulting in a decrease in airstrip width from 180 m to 60 m) and at sites P1 through P5.

As detailed in Table Two, several interviews were carried out with key persons who may have been associated with the Pine Lake Airstrip in the past. Jeff Sheldon has been working as a trapper in this area since 1948. He did not recall a US military presence at the airstrip but he did recall that the Hudson's Bay Mining Co. Ltd. (HBMC) had an exploration camp located at Lot 7 on the access

road. This consisted of temporary wall tent structures for a short duration in the early 1950s. He did not recall any dump sites located at the subject site, nor did he recall the use of chemical spraying in connection with the airstrip or HBMC camp. He did remember that there were lights on the runway and that they functioned infrequently.

In order to gain a perspective on the type of generating unit which most likely would have serviced such a facility, YECL personnel were contacted for more detailed information. Joe Suffix, a long time employee in the Watson Lake area was asked about the type of generating unit which would have been employed in such a facility and about the possible contaminants which would have derived from this unit. Joe remarked that a low voltage 240 V system most likely would have been utilized at the airstrip. Such a unit operated on an 'air blast' system and therefore would not have PCB oils contained in it. In Joe's opinion, the only contaminant sources that could have derived from such a facility would have been diesel, motor oil, and perhaps cleaning solvents.

Vern Finster was a previous YECL employee with invaluable knowledge of the old NSR airports and the associated electrical facilities. To his knowledge, the Pine Lake Airstrip was strictly an emergency landing strip and did not have the facilities of a primary airport like Whitehorse or a secondary facility like Snag. That known PCB contamination had occurred at Snag, we requested further information so as to compare this site in relation to a facility like Snag. He had worked in Snag in 1948 and remarked that it was a large operation with 5 - 100 kilowatt generators which were in service all year round and during the night. In comparison, he said that the Pine Lake Airstrip most likely had one 15 kilowatt, low voltage generator for its temporary needs.

From these interview results and the historical information obtained in regards to the airstrip, it appears that minimal facilities existed at this site in connection with the emergency airstrip at Pine Lake.

Further, there has been little active use of the facility in the past and there were no identified waste disposal or hazardous sites identified in this data review aspect of the work program.

2.4 Site 5: Camp 10.5 E

The subject site identified as #5 in the call up offer is located at the previous location of Camp 10.5E at historic mile post 727.3 as depicted on the PRA Map of 1943. The site is adjacent to the existing km 1170 post on the recently reconstructed portion of the Alaska Highway.

The site of the former camp is flat, clear of vegetation, and is bounded to the south and west by a steep embankment. The surficial geology is characteristic of glaciofluvial deposits containing silt, sand, and gravel. Borehole data obtained from YTG, Transportation Engineering reveals near surface gravel to a depth of approximately 1.0m with silty sand predominating below this to a maximum depth of drilling of 4.5 m.

There is no registered title for this property as it has remained in Federal control. However, 45 m on either side of the highway centre line is under reserve to YTG in connection with the Alaska Highway.

From the aerial photo review, the clearing for the former camp area was noticed on the 1948 photo and remained in the 1961 and 1992 photos. One building was present in the 1948 photo and no buildings were noticed in photos of subsequent years. Besides the approximate 100 m by 200 m rectangular shaped clearing associated with the camp area, there was also a small clearing just south of the camp and a road leading to a clearing to the south-east of the camp. These two additional clearings have been described on Figure No. 10 as C2 and C3, respectively. There have been no apparent changes in the camp area over the years other than the realignment of the highway in 1993. The new highway was relocated to the south and as such was placed over a portion of the previous camp location.

There was no extensive information obtained from the records review. On the PRA map of 1943, 12 buildings were shown to exist at the camp, the majority of which were small and most likely temporary wall tent shelters. There was no dump identified on the drawing in connection with the camp.

Plan and profile drawings of the recent realignment of the highway in this area were obtained by YTG, Transportation Engineering. Further, interviews were conducted with key persons associated with the construction activities during the realignment. Eric Biensch was involved in the monitoring aspect of the road construction and had recalled this clearing from the project. He noted that the clearing was used to dispose of 'waste soil' during construction. 'Waste soil' consists of undesirable fine grained silt and sandy silt material which does not represent adequate sub-base for the road construction. During this work, he did not recall any building foundations, waste items, disposal pits, or other like items that may be related to a contaminant source. The waste soil was levelled out and seeded for aesthetic reasons. It appears that the highway realignment has effectively buried the previous camp area, making the site characterization component of the work program difficult to perform. Other interviewees questioned about the camp area did not recall buildings, waste sites, or other conditions which could be attributed to environmental considerations at this site.

2.5 Site 6: Swift River Bridge

This study area is located where the Alaska Highway crosses the Swift River near km post 1166, approximately 12 km east of the Swift River Highway Maintenance Camp and service station. There was some uncertainty as to the exact location of the study area due to limited information provided with the call up document. An excerpt from the Reger, 1983 study was provided, along with a copy of the relevant PRA map of 1943. The area was identified as a circle around the bridge at Swift River on the PRA map. Also, the Reger excerpt depicted the site in question as being at the Swift River Bridge but it also stated that the site was 100 m from the Swift River. Thus the initial intent of the data search was to clarify the exact location of the study area.

As noted in Table One, Mary Reger was interviewed for more definitive information on the Swift River Bridge site. However, Ms. Reger could not recall the exact location of the disposal area. Further, she did not remember the description or the contents of the subject site.

From the air photo review performed on photos dated 1948, 1961, and 1992, there appears to be two small clearings in the vicinity of the bridge. One is located immediately adjacent to the bridge on the south east side of the highway and the other one east of the Swift River Bridge on the north side of the highway.

Following the title search, it appears that the area immediately surrounding the Swift River Bridge is federally owned but falls within the 300m by 300m bridgehead reserve that the Government of Yukon has in connection with the Alaska Highway.

As with Site # 5, the recent realignment of the Alaska Highway has affected the study area. The new highway is further to the south than the previous highway as depicted on Figure No. 11 and there has been significant earth work performed in this area. The new highway covers a portion of the clearing which was located to the south east of the bridge. In discussing this construction activities with Eric Biensch of YTG, Transportation Engineering, he did not recall encountering any waste material or disposal sites during construction. During the site reconnaissance trip of 96/09/24, there was a clearing located to the south-east of the bridge, however the clearing to the north east of the bridge was not distinguishable at the time of the investigation. This area was most likely altered by the various construction activities performed in connection with the realignment work in 1993.

Following the initial searches, uncertainty remained as to the exact location of the suspected waste site and as to whether the altered site conditions warranted further investigative measures. We proposed to the AOW personnel that a geophysical survey be conducted at the site to the south-east of the bridge and progress with the investigation if the results warranted such measures.

3.0 PHASE II ENVIRONMENTAL SITE ASSESSMENT (ESA)

3.1 Overview

The Phase I aspect of the project was successful in determining past uses as they relate to environmental considerations at each site. Several areas were identified where contamination may have occurred and various contaminant sources were determined from the searches. However, it was necessary to augment this work with a detailed field and laboratory work program to confirm the presence and extent of contamination at each known or potential contaminant zone. Thus, a Phase II work program involving a geophysical study, a test pit program, and a laboratory program was initiated to satisfy these objectives. Briefly, this section describes the methodology for each particular aspect of the Phase II program and provide specific results for each study area.

3.2 Geophysical Survey

Several geophysical surveys were conducted by our professional sub-consultant Associated Mining Consultants Ltd. (AMCL). The purpose of the surveys was to detect the presence of buried metallic objects at suspected waste areas identified from previous searches. There were several advantages of performing these surveys, including:

- contaminant sources such as hazardous chemicals or petroleum products are typically within or near metallic objects such as drums, cans, tanks, etc..
- the geophysical survey technique covers larger areas than do invasive techniques such as drilling or test pitting
- these surveys can be conducted with little to no disturbance of the existing vegetation and site conditions

Prior to initiating the geophysical program, Michael Billowits of J.R.Paine conducted a reconnaissance trip to each site on 96/09/24. Several potential areas were identified from the results of the Phase I ESA component of the project. The site visit aspect was necessary to confirm exact locations for the geophysical test plots based on existing features and site conditions at each possible contaminated area.

Mark Bowman, Senior Geophysicist with AMCL mobilized to the study area on 96/10/02 and conducted seven geophysical test surveys between the dates of 96/10/03 and 96/10/04. A detailed description of the methodology and results of the geophysical program is provided in the AMCL report enclosed in Appendix A. Briefly, the methodology included conducting a survey at each site identified by J.R.Paine utilizing either a Total Field Magnetic method or an Electromagnetic method. Due to vegetative constraints, the Total Field Magnetic method was the preferred choice at the majority of test sites. Exception to this was at the Swift Rive Bridge and C1 sites where the conditions were more favourable for the EM61 instrumentation.

The survey involved mapping out each test site with a 5m by 5m grid and taking readings at 2.5 m intervals. During this time, an environmental site survey was conducted by Michael Billowits of J.R.Paine. This essentially involved directly observing each particular test site and surrounding area for objects, vegetative or topographic conditions which may be related to environmental considerations. Examples include disturbed soil, anthropogenic objects such as drums or building components, and depressions which may derive from former waste sites. All relevant features were located relative to existing grid markers and are presented on the site sketch for each particular test site.

The results of the geophysical survey are presented as a colour contour map illustrating lateral variation in magnetic intensity at each test site. Also included in the AMCL report is detailed interpretation of each identified anomalous response. The general conclusion of the study was that the magnetic and electromagnetic anomalies encountered at each test site were relatively weak and of limited lateral extent. This suggests that only a small quantity of buried metal exists at those test areas surveyed. However, it was our intention to confirm the source of each significant magnetic anomaly through a test pit program.

In reviewing the results of the geophysical survey, it was decided that 8 of the 14 magnetic anomalies necessitated verification through test pitting. Those anomalies which were not considered necessary due to weak response or obvious presence of surface metals included P1-b, P1-c, P2-c, P4-a, C1-b, and C2-a. All other areas were incorporated into the test pit program and as such are described more thoroughly in subsequent sections.

3.3 Test Pit Program

The purpose of the test pit program was to determine if buried metallic objects identified from the geophysical survey or if any features identified in the data search and environmental survey had caused contamination of the subsurface. Once the above potential contaminant sources were identified, the lateral and vertical orientation of the test pit matrix was determined and the field work was initiated.

The test pit program was conducted between the dates of 96/10/23 and 96/10/24 utilizing a Koehring 6620 backhoe on contract with Deadman Creek Enterprises of Teslin, Yukon. Michael Billowits was the J.R.Paine on site representative during the excavation program. The program involved excavating test pits within each known or potential contaminant zone. During each excavation, qualitative descriptions were taken of contaminant sources uncovered, impurity existing within the soil, and existing soil conditions. Samples were retrieved for both physical and chemical laboratory testing purposes. Chemical test samples were stored in air tight glass jars and stored at or below 4°C at all times.

The area which each test pit encompassed is described on the attached site sketches. Where the test pit had uncovered impurity, the excavation progressed until the lateral and vertical extent of the impurity was realized. All test pits were located laterally relative to existing site features and all disturbed trees were felled to avoid potential hazards.

The results of the test pit program were collated and presented on the individual test pit logs enclosed in Appendix B. These logs essentially consist of vertical profile information for each particular test pit location. More specifically, the following relevant data is provided on each soils log:

- i. Soil description for each stratum
- ii. USC Classification
- iii. Depths at which changes in lithology occur
- iv. Sample depth and type
- v. Physical and chemical laboratory results
- vi. Description of contaminant sources present

The specific results of the test pit program are described for each specific test site in section 3.5, following.

3.4 Physical and Chemical Laboratory Program

The purpose of the physical laboratory program was to characterize the soil material at the study area as it relates to contaminant transport. This essentially consisted of performing moisture content and grain size analyses on each physical test sample retained.

The chemical laboratory program was purposed to determine the presence, type, and level of impurity within the soil profile. The test matrix was based on several factors, including:

- i. Contaminant sources identified from the Phase I ESA. This essentially consisted of impurities arising from facilities at the Pine Lake Airstrip site and from domestic waste located at the Rancheria dump.
- ii. Qualitative descriptions taken during sampling and characterization of the impurity.
- iii. Contaminant sources identified during the field work program. Examples of this include drums containing petroleum products or cans with Ethylene Glycol labels still intact.

Although a hydrocarbon vapour extraction unit was employed in order to get a semi-quantitative indication of hydrocarbon presence, it was not effective for several reasons. For the most part hydrocarbon impurities encountered consisted of heavier end products such as oil which do not readily partition to the vapour phase. Further, the impurity has been severely weathered in the estimated 25 years that it has occurred within the subsurface. That the vapour unit primarily measures hydrocarbons in the vapour form, the instrument was not reliable in this particular application. As such, the results of this screening test were excluded from the analysis. However, qualitative observations (smell, oil sheen) were sufficient in selecting soil samples for chemical laboratory testing.

The chemical test program was conducted at our associated laboratory ASL Ltd. with whom we have dealt extensively in the past. The test results are presented in the ASL report enclosed in Appendix C.

Discussion and interpretations of the results are provided in the subsequent section which describes each test site individually.

3.5 Summary of Results for Each Study Area

The general site conditions as determined from the data review component of this study were presented in Chapter 2. This section will detail the actual site conditions and contaminant sources encountered at each test site during the various field work programs. It will also describe the results of the geophysical and test pitting programs along with the associated laboratory results.

Site #3: Rancheria Dump

The location of the Rancheria Dump in relation to the Rancheria Lodge and Restaurant is depicted on Figure 2. The site conditions during the reconnaissance trip and the subsequent test pitting programs essentially reflect those detailed on Figure 3 and on Photo 1.

The cleared area for the dump was approximately 200 metres by 50 metres with a layout as shown on the plan map for the site. The surrounding area was forested with semi-mature to mature pine trees with a narrow trail encountered in the general location depicted on Figure 3. The majority of waste material appeared to be located at the north periphery of the clearing. The fill material was approximately 600 mm higher in elevation than the natural ground surface at the northern edge. This is best displayed in Photo 2. Judging by the configuration of the dump, the waste material was most likely end dumped in the north portion of the site and covered with soil fill material deriving from the southern portion of the clearing.

The clearing was partially vegetated with willow, grasses, fireweed, and young pine trees. Exposed soil consisted of fine to medium grained sand. Visible surface garbage included metal cans, tires, plastic containers, and various metal debris.

A geophysical survey was not conducted in this area as there would have been excessive interference in the readings from the large amount of metal debris at the ground surface.

The test pit locations were chosen to ensure representative coverage throughout the clearing area and to uncover those areas which appeared to be more actively used in past for disposal purposes. As depicted in the test pit logs enclosed in Appendix B, the test pits encountered silty sand fill material to an average depth of 0.2 metres. An exception to this was the area of TP#R-b which had 1.2 m of overlying fill material. Below this, garbage intermixed with soil was encountered with an average thickness of approximately 1.0 metres. Specific details of the garbage items are provided on the individual test pit logs, however, the great majority of items consisted of tin cans, glass jars, bottles, and other domestic wastes. With the presence of plastic materials at all depths, it was surmised that this waste material did not derive from the US Army presence here in the early 1940's. Other than domestic wastes, there was some garbage items associated with machinery such as filters, empty grease cans, and a car chassis.

Below the garbage fill material there occurred a native sandy silt material in TP#R-a with a grain size distribution depicted as sample 16 in Appendix B. Below this, and at all other test pit locations below the garbage, a well graded fine to medium grained sand was encountered. This material was damp, brown, and with a typical grainsize distribution as displayed on sample 17. The underlying native sand material did not appear to be adversely affected by the garbage fill material.

Based on qualitative descriptions made at the time of the site investigation, there was no odour, sheen, or other indication of impurity within the soil. Further, there was no sign of a contaminant source either as free product within the soil void space or as residual product adsorbed onto mineral surfaces.

The majority of chemical test samples were taken from the soil within the garbage fill or from the underlying native sand material. The chemical tests involved leachable cations/anions and metals which typically serve as indicators for leachate production deriving from landfills.

Further, where a petroleum contaminant source was located, the extractable petroleum hydrocarbon analysis was incorporated into the chemical test matrix. That potential contamination may exist at this site, more detailed interpretations and analysis will be provided in Chapter 4.0.

Site 4: Pine Lake Airstrip

The results of the Phase I ESA indicated that the Pine Lake Airstrip contained several sub-areas which have been used in the past and may have resulted in contamination of the subsurface. From the data review detailed in Chapter 2, sub-areas P1, P2, P3, P4, and P5 were identified for the geophysical program and/or the test pitting program.

The relative location of each sub-area is depicted on Figure 4, the overall site plan for the Pine Lake Airstrip study area. Also provided on this drawing is a sketch of the 'loop road' which is located at the beginning of the access road to the airstrip. This area consists of old cabins and a wall tent which is currently used by Jeff Sheldon.

The results of the environmental survey for this area indicated that two empty drums and some scattered empty tin cans comprise the extent of possible contaminant sources. It was decided that this did not necessitate further investigative work for environmental considerations. However, the five sub-areas which were included in the subsequent work program are described separately, below.

Sub-area P1 - Old Camp

Sub-area P1 is located along the access road approximately 380 metres south of the southern edge of the airstrip. The location of the test site relative to existing survey posts is depicted on the overall plan drawing on Figure 5. This area was identified as the previous camp location for the US Military during the construction of the airstrip and for the HBMC during their exploration work near the airstrip in the early 1950's.

The site conditions at the time of the investigation are depicted on the site sketch enclosed as Figure 5. The area was relatively flat and regenerated with semi-mature pine throughout. There was no evidence of past structures, however, there was a pit with a collapsed wooden structure over top.

This was most likely constructed for and utilized as a pit privy while this area was an active camp. Within the pit there were 2 or 3 visible drums with other assorted garbage dispersed along the pit bottom. There was also a glass cable support found on a tree with some old electrical wire on the ground. The area was flat with 6 distinct piles of size and orientation shown on Figure 5. These piles appeared to be composed of organics and soil from previous clearing activities.

Judging by the well established pine vegetation around the piles, they most likely have been there since the development of the camp area in the early 1940s.

The geophysical survey covered approximately a 50 m by 60 m area which seemed to encompass the former camp location. This was based on existing features such as the pit and piles and also on the variation in vegetation which provides an indication of the former area of development. The results of the survey indicate that significant buried metal occurs in the area of the existing pit only. This confirms that the soil piles do not contain contaminant sources deriving from metallic objects.

A large test pit was excavated where the existing pit was located. The results of the excavation are depicted on the test pit log TP#P1-a found in Appendix B. The garbage material in the pit was composed of various wood debris, several empty cans of ethylene glycol (US Army label), glass, empty 10 gallon drums, and some more recent plastic garbage. A photo of the test pit excavation is provided as Photo 8. The native soil below the garbage consisted of sandy gravel with a typical grain size distribution displayed as sample #1. There was some soil staining in the immediate vicinity of the drums. The test pit was excavated both laterally and vertically beyond the location where the stained soil was encountered to determine the limits of the impurity in the subsurface. Based on qualitative observations made during the inside out excavation technique, the total contaminated soil volume is estimated at 1.0 - 2.0 m³.

Following chemical laboratory testing, the impurity in the soil is an oil product which has most likely derived from the drums in the pit. With the possibility that PCBs may have occurred within the oil product, sample 4 was tested for this particular parameter. However, there were no PCB's in the soil within detection limits. Further, a soil sample was tested for ethylene glycol due to the presence of the empty cans in the pit. Once again, the suspected impurity did not occur within detection limits.

From the above geophysical, test pit, and laboratory programs, there was a small amount of soil contaminated with an oil impurity encountered in the existing pit area. No other contaminated zones, either known or potential, were identified in the P1 sub-area.

Sub-area P2 - Old Windsock and Cabin

As seen on Figure 4, this area is located on the west edge and approximately 920 m north of the southern limit of the airstrip. This is the site of the old windsock and former cabin identified from historical searches. The site conditions in this area at the time of the investigation are best represented by Figure 6 and Photo 4.

A 60 m by 50 m grid was established for the environmental survey and geophysical work. There were no significant visible contaminant sources or disposal pits located in this area, however, there were two piles of dirt with the shape and location depicted on Figure 6. The results of the geophysical survey indicated that buried metal was located in areas P2a, P2b, and P2d which coincide with the existing piles of dirt. An anomalous response was also encountered in the area of P2e. The test pit program involved performing an excavation in each of these locations.

The test pit log TP#P2-a represents the conditions encountered in test pits P2-a and P2-b. These excavations encountered various garbage items such as lumber, window frames, and metal scraps which most likely derived from the demolition of the former cabin which was located in this general area. There was also a metal cable with an estimated length of 20 metres. This was probably a part of an old cable driven piece of equipment which was used at the time of the airstrip construction (as apposed to hydraulic machinery which has been used more recently).

After uncovering the majority of the pile, there was no contaminant source identified nor was there a presence of impurity within the native sand and gravel material below the debris.

The test pit located at area P2-d also encountered various garbage items within the existing pile. As with area P2-a, the debris consisted primarily of scrap metal and lumber. That two small drums were encountered in this pile, a soil sample was retrieved in their immediate vicinity for the purposes of laboratory testing. However, there was no impurity within the soil profile as determined by qualitative observations and verified by chemical laboratory testing.

A large test pit was excavated in the area of P2e, however, no metal or evidence of disturbed soil was encountered in this area.

From the above field and laboratory programs, this site did not uncover substantial sources of contamination, nor was impurity encountered in any of the test pit locations. As such, no further consideration was deemed necessary for the P2 sub-area.

Sub-Area P3 - Beacon and Powerhouse

Sub-area P3 refers to the area surrounding the beacon tower and the former powerhouse located on the west side and approximately 1140 metres north of the south edge of the airstrip. The test area and general site conditions are depicted on Figure 7 and on Photos 11 and 12.

A grid of approximate dimensions 70 m by 60 metres was established in this area for the purpose of the environmental survey and geophysical work. Although the beacon tower was intact, the powerhouse which contained the generating unit was no longer there. All that remained in the area of the powerhouse was some decomposed lumber, roof shingles, and a concrete base. Further east toward the airstrip there occurred a small drum and piece of plywood. A recent metal windsock pole was located at the edge of the airstrip in the southeast area of P3.

The area was vegetated of sparse semi-mature pine throughout the test site with thicker stands of trees along the north and west perimeters.

The results of the geophysical survey indicate that magnetic response had occurred in areas P3a, P3b, and P3c, however, areas P3a and P3b were attributed to large surface metal interferences. It was decided to confirm the subsurface characteristics in each location.

In total, four test pits were excavated in the P3 sub-area. In each test pit, the soil profile consisted of near surface organics underlain by a well graded sand material. At an approximate depth of 0.5 m, the test pits encountered a sandy gravel material with cobbles present to 5% of the total soil volume. Such a subsurface soil profile is characteristic of the glaciofluvial depositional history of this area.

In consideration of significant soil disturbance noted near the windsock pole, TP#P3-a was excavated to confirm that no buried metallic objects occurred in this area. There was no buried debris or other contaminant sources encountered in this test pit location.

TP#P3-b was excavated in the area of the previous powerhouse area. As seen on Figure 7, the lateral orientation of the test pit essentially encompassed the footprint area of the former powerhouse containing the generating unit. The soil profile appeared undisturbed, however, there was some buried electrical cable encountered at a shallow depth and in the vicinity of the metal pipe leading into the ground. Once the end of this metal pipe was exposed, it became apparent that it was most likely used as a mast for supporting electrical wires associated with the generating unit. There was no underground storage tank encountered in this area.

Sampling was performed at regular intervals in order to obtain representative sample throughout the excavation area and depth. Some hydrocarbon staining was encountered on soil samples deriving from the west-central area of the excavation and extending to a maximum depth of 1.0 metres. Samples 7, 8, and 10 were taken from within the area affected by the hydrocarbon impurity.

The results of the chemical tests indicate that the impurity consists of an oil product which does not contain PCBs within detection limits. Based on qualitative descriptions made during the inside-out excavation technique, the maximum soil volume affected by the impurity is estimated at 2.0 -3.0 m³ and at a maximum depth of occurrence of 1.0 metres below the existing ground surface.

TP#P3-c was excavated in the area of magnetic anomaly P3-c, however there was no presence of buried metal nor was there an indication of disturbed soil. TP#P3-d was excavated in the vicinity of the drum and plywood (refer to Figure 7). Once again, there was no indication that the subsurface soil profile had been adversely affected by the garbage debris in this area.

From the detailed field work and laboratory testing programs described above, it appears that contamination at the P3 sub-area consists of a small amount of soil affected by an oil hydrocarbon impurity encountered in the immediate vicinity of the previous generating unit. More discussion regarding the significance and probable risk deriving from this contamination will be discussed in Chapter 4.

Sub-Area P4 - Gravel Pit

As depicted on Figure 4, this area is located on the west side of the access road approximately 60 metres south of the southern edge of the airstrip. The subject site was located relative to existing survey posts as identified on the overall plan of area P4 shown on Figure 8. The site conditions at the time of the investigation essentially reflect the details on the site sketch enclosed as Figure 8 and the picture presented as Photo 9 in Figure 12.

The area occurs within a depression which has most likely derived from gravel borrow activities in the past. This was intimated from the clearing noted on the air photo of 1948 and the obvious characteristics of a gravel pit such as an access road and near-vertical pit wall with little to no vegetative growth. The area of the pit floor was flat and sparsely vegetated with semi-mature pine trees.

There were two empty 1 and 5 gallon drums, a vehicle door, and three small gravel piles located on the pit floor. There was also a cable traversing the pit floor in a north-south direction. That abandoned gravel pits of this sort typically have been used as disposal areas in the past, a geophysical survey was deemed necessary. However, as displayed in the AMCL report, there was no significant magnetic anomalous response deriving from buried metal at this sub-area.

This area appears to have been used strictly for gravel borrow purposes and did not appear to contain contaminant sources which required further investigation for environmental considerations.

Sub-area P5

This area is located on the east side of the airstrip approximately 160 metres east of sub-area P2. The relative location of this area is depicted on Figures 4 and 9.

This area was identified as a clearing on the air photo of 1948 and was mentioned in the Edey, 1976 report as containing temporary tent structures and 5 grease kegs.

At the time of the site investigation, there was no evidence of debris or other items related to environmental considerations at this area.

There was a narrow road leading to a small clearing adjacent to the Rancheria River. There did not appear to be any sign of soil disturbance or other indications that this area had been used for disposal purposes. As such, this area was not considered necessary for geophysical survey techniques.

At the time of the test pit program, it was decided to excavate one test pit in the small clearing located in sub-area P5. The general location and orientation of the test pit is depicted on Figure 9. There was no waste material encountered and there was no indication of disturbed soil within the 6.0 metre depth of excavation. The soil profile was relatively uniform, consisting of sandy gravel with cobbles and boulders present to an estimated 10% of the soil volume.

At a distance of just 10 m and with a difference in elevation of perhaps 1.0 metres from the Rancheria River, it was unusual that ground water was not encountered within the 6.0 metre excavation at TP#P-a. From the investigative work described above, sub-area P does not appear to contain contaminant sources or evidence of contamination deriving from past uses.

Site 5: Camp 10.5E

Three sub-areas were identified for further investigation work at the site of the former Camp 10.5E. The site conditions at the time of the investigation and the specific locations of sub-areas C1, C2, and C3 are depicted on the site sketch shown as Figure 10. The purpose and results of the field work for each sub-area are described separately, below.

Sub-Area C1

The majority of the camp area has either been covered by waste material or is below the existing highway as a result of the work associated with the realignment of the highway in this area.

Refer to Photo 13 which illustrates the recent construction activity and seeding that has occurred at the former camp area. That the geophysical survey equipment will not detect metals at depths approaching 3.0 to 4.0 metres, the majority of the clearing was not suitable for such a program due to the extensive fill placed here. However, there did not appear to be much fill at the southern perimeter of the clearing and as such, an EM-61 survey was attempted at sub-area C1.

The results of the geophysical test indicate that possible buried metal objects may occur in the areas C1a and C1b as depicted on Figure 4b in the AMCL report. The subsequent excavation program incorporated the C1a area but not the C1b area since the latter was not identified on the draft report provided to J.R. Paine prior to mobilizing for the test pit work. However, the area at C1b does not appear to represent a significant amount of buried metal. The excavation for TP#C1-a did not uncover buried metallic objects within the 5 m by 5 m area and 6 m depth at the area of the anomalous response. The soil profile at this test pit consisted of approximately 0.4 metres of silty clay fill (waste material from highway construction) underlain by native, undisturbed sandy gravel.

Sub-area C2

Sub-area C-2 is located in the area of the former small clearing that was identified from the air photo of 1948. The site conditions during the investigative work are depicted on Figure 10.

The area had been regenerated with semi-mature pine trees throughout. There were several small piles present as shown in Figure 10. One particular pile had exposed scrap metal that appeared to be banding material used for shipping lumber or like products. There was an engineered pit in this area which was similar in shape and size to the one encountered at the P1 sub-area. It is expected that this pit was also used as a pit privy in connection with the previous camp facilities.

The results of the geophysical survey indicate that there are no significant magnetic anomalies other than in the area of the known surface metals described previously. Based on the environmental and geophysical survey results, this area was not considered necessary to include in the test pit program.

Sub-Area C-3

Sub-area C-3 is located to the south-east of the former camp area as depicted on Figure 10. This area was identified as a road leading to a clearing on the air photo dated 1948.

There has been extensive regeneration of the forest since that time with semi-mature pine throughout. Following a visual survey of the area for environmental considerations, two features were noted:

- a. A small mound with two old tires of US Army vintage. (refer to Photo 15)
- b. A depression located at the southern edge of the clearing. (refer to Photo 14)

To determine if hazardous material had been placed in these areas, TP#C3-a and TP#C3-b were excavated. However, there was no indication that either of these areas contained disposal items within the soil profile. Further, the soil did not appear to be disturbed. Considering that neither contaminant sources nor contaminated soil were encountered in any of the sub-areas at the former Camp 10.5E site, chemical laboratory testing and further analysis was not considered necessary.

Site 6: Swift River Bridge

As concluded from section 2.5, there was not definitive information obtained from the initial searches as to the exact location of the suspected waste site, the contaminant sources, or whether the site had not been completely altered as a result of the extensive construction activities in this area. However, in consultation with AOW personnel, it was agreed that the area to the south-east of the existing bridge would be designated as the appropriate location for a geophysical survey.

A 48 m by 44 m grid was established in the location depicted on Figure 11 and as illustrated on Photo 16. The area consisted of approximately 0.6 m of fill material placed over the surrounding muskeg. It is not certain as to the origin of the fill material. The only debris item encountered was an old oxidized cable at the south-west portion of the site.

As displayed in the AMCL report, there were no significant anomalous responses during the survey. This suggests that the fill material placed in this area likely consists of clean soil rather than garbage fill.

Based on the information obtained in the data search and geophysical survey, the Swift River Bridge site was excluded from further environmental assessment considerations.

4.0 PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

4.1 Overview

The results of the Phase I and II studies were successful in identifying the presence and extent of contamination at each particular study area. From these work programs, it was determined that the majority of sites did not contain contaminant sources or evidence of contaminated soil. However, the following sites were identified for further consideration:

- The potential contamination deriving from the Rancheria Dump
- The known contamination at the pit location in sub-area P1
- The known contamination existing at the former powerhouse located in sub-area P3

It is the purpose of this chapter to conduct a preliminary environmental impact assessment for the above noted potential or known contaminated areas.

There are generally two techniques used in such an assessment process, the Numerical Comparison Approach and the Risk Assessment Approach. Each technique will be applied to the evaluation of the three sites identified with known or potential contamination.

4.2 Numerical Comparison Approach

The numerical comparison approach essentially involves comparing the chemical test results of contaminated soil samples with bench marks provided in environmental quality criteria. The criteria applied in this particular study are the Draft Contaminated Sites Regulations (DCSR) which have recently been developed by the Government of Yukon, Renewable Resources, Environmental Protection and Assessment Branch.

For each particular land use, there is a specific criteria that must be extracted from the DCSR and applied in the numerical comparison approach. Although the regulations do not provide a land use designation that directly reflects the Pine Lake Airstrip or Rancheria Dump sites, it was decided to apply the agricultural land use criteria. This would ensure that the most stringent criteria was utilized and that the site would be evaluated according to unrestricted future land use.

For convenience in the numerical comparison process, all chemical test results were taken from the ASL report and summarized in Table Three. The corresponding environmental criteria were then extracted from the DCSR and placed on Table Three adjacent to the test results. It should be noted that the units for all figures in Table Three are parts per million (ppm). Following a review of this summary table, it can be seen that the majority of chemical results are below the corresponding criteria. Exception to this includes the Extractable Petroleum Hydrocarbons results for samples 1,4,7,8, and 10. These samples were contaminated with an oil impurity and occurred at levels in excess of the criteria for an agricultural land use designation.

From this review, it appears that the samples taken from within the Rancheria Dump area do not exceed leachable anions/cations or metals levels which are typical indicators of leachate production. However, the soil in the immediate vicinity of the pit at area P1 and the generating unit at area P3 contaminated with hydrocarbons at levels which require further assessment or remediation considerations.

The numerical comparison approach is useful in determining the relative extent of soil contamination as compared to the environmental criteria of the Draft Contaminated Sites Regulations. Where chemical laboratory test results indicate that the levels are in excess of the applicable criteria, it may be prudent to consider the regulatory requirements imposed by the DCSR once they are proclaimed and become legal. The regulations are typically enacted when a transfer in property ownership occurs or when there is a change in the land use of a particular property. In either circumstance, it is understood that the Minister will make the determination as to whether the site should be classified as a contaminated site. If such a designation is made, a public registry process is initiated whereby the Minister shall provide written notice of the preliminary determination to all interested parties. Subsequent requirements under the Act include the necessity of site investigations and assessments and, if necessary, plans of restoration.

Although soil samples do have impurity at concentrations in excess of the criteria in the DCSR, it is highly unlikely that such a regulatory requirement process would be enacted at any of the subject sites considered in this study. This is due to the very small contaminated soil volumes that had been encountered in the investigative work.

4.3 Risk Assessment Approach

It is instructive to consider the risk assessment approach in addition to the numerical comparison technique described above. This considers the hazards of a particular impurity and the exposure potential of that impurity to affect humans, animals, or the natural environment. Thus, risk is defined as the hazard and the exposure potential for the contaminant.

The hazard refers to the relative toxicity of the impurity to plants, animals, or humans. This is quantified in terms of the concentration of impurity and the quantity of contaminated soil. As well as this, the physical and chemical characteristics are important in defining the hazard of the impurity in the natural environment. This may refer to the degree of recalcitrance in relation to degradation or the opportunity for cumulative or bioaccumulative effects in the environment. The exposure potential refers to the pathways for migration and the possible receptors (plants, animals, humans) which could be adversely affected by the impurity.

Each potential and known contaminated area will be analyzed according to the risk assessment approach separately below.

Rancheria Dump

The contaminant sources at the Rancheria Dump consist primarily of domestic waste such as cans, bottles, and plastic containers. Based on the data searches and field work programs, it does not appear that the dump was used as a significant disposal area for wastes associated with the Alaska Highway construction activities and US Army presence in the early 1940s.

In regards to the types of impurity deriving from the waste material, the chemical sampling program did not uncover excessive levels of metals or anion/cation leachates which are typically used as indicators for leachate production. The garbage encountered was of the solid state and did not contain pure phase liquid impurities which would readily migrate through the soil profile. Therefore, contaminant transport would be commensurate with the potential for leachate production deriving from the waste material. As a solid waste, the potential for degradation and dissolution is low. Further, as a semi arid climate with a mean annual rainfall of just 570 mm, the infiltration rate and movement of water in the unsaturated zone is very low. As a result, the hazard of the waste material

encountered in this dump is considered low due to negligible concentrations of impurity encountered in the subsurface and to the low potential for leachate production.

With respect to the exposure potential, the migration pathways include ground water and surface water. Due to budgetary and scheduling constraints, we were unable to perform a detailed ground water characterization and sampling program. However, as a preliminary assessment, it may suffice to provide general discussions as to the potential impact to ground water resources. As just mentioned, the waste is in a solid form and leachate production potential is considered low. If leachate is produced, its migration through the unsaturated zone will be characteristic of three phase flow with air, water, and contaminated solute occupying the available void space in the soil profile. The depth to the water table, the intrinsic permeability of the soil profile, and the potential for adsorption and decay are among the more important factors relating to the possible impact on the ground water resource. Although the permeability of the sand material is considered high, the low potential for leachate production and the low transport potential in the unsaturated zone would clearly be the limiting factors for contaminant migration to the ground water. The depth to the ground water table should be determined to verify that impacts from leachate production do not exist.

Receptors of ground water contamination include the Rancheria Lodge and Restaurant. This facility obtains its water from a shallow well that most likely taps into the same regional aquifer that is below the dump. From the Reger, 1983 report, there have been water quality problems arising from hydrocarbon odours at the Lodge in the past. With the dump located hydraulically upgradient from this well, it may have been the source for the impurity. However, the more likely scenario is that the underground storage tanks from the gas station located adjacent to the lodge is the source of the hydrocarbon impurities. In order to confirm that the existing dump is not adversely affecting the ground water resource of the Rancheria Lodge, a ground water characterization and baseline water quality sampling should be conducted.

The migration potential to surface water is considered relatively high due to the relatively close proximity of the Rancheria River. With an estimated ground water vector following a south-east bearing, the dump is approximately 700 m from the Rancheria River. More extensive ground water characterization is necessary to offer further discussion on the impact to the Rancheria River.

Potential receptors include aquatic life in the Rancheria River, and in turn humans who harvest these fish.

As a summary, the relative hazard of the potential contaminants in the Rancheria Dump are considered low due to the relatively benign solid waste occurring at the dump and the low potential for leachate production. However, the exposure potential is considered relatively high due to the close proximity and potential impact to the Rancheria Restaurant and the Rancheria River.

Pit Location, Sub-area P1 at Site 4

The contamination at this site is due to an oil based petroleum product deriving from small releases in the pit. The oil is not considered a hazard due to the low concentrations and the very small soil volume that it had affected. Exposure pathways for the oil are considered low. Vapour migration is not probable as this petroleum product does not readily partition to the vapour phase. Migration potential to the ground water resource is considered low due to the high viscosity of the oil and the relatively slow rate of movement in the unsaturated zone. Further, with a very low solubility, the oil would not readily migrate in solution to the ground water table.

Receptors may include plant uptake and subsequent consumption by roaming herbivores such as moose or caribou. However, the limited soil volume and the lack of vegetation due to the disturbance caused by the test pit program makes this potential very low.

In summary, due to the relatively low concentrations and very small contaminated soil volume, there is considered to be little or no impact deriving from this contaminant zone.

Previous Generator Location, Sub-area P3 at Site 4

The contamination in this particular area appears to consist of an oil product deriving from the previous generator unit. The probable impact from this contaminant zone is similar to that previously described for the pit location at P1. Although the concentrations of the impurity are relatively high, the hazard is considered low due to the very small quantity of contaminated soil. As with the discussion provided for the pit location, the exposure pathways and receptors are considered low.

4.4 Summary

The above numerical comparison and risk assessment approaches were successful in interpreting the results of the field and laboratory work programs. In general, there appears to be little environmental risk associated with any of the three known or potential contaminant zones described above.

In specific reference to the Rancheria Dump, the waste encountered in the test pit excavations does not appear to be an existing source for contamination. However, there are significant uncertainties associated with this site. Firstly, although we had attempted to perform sufficient test pit excavations to gain a representation of the waste source at this site, there may be hazardous materials located at this dump which were not encountered during the test program. The other uncertainty is the characteristics of the groundwater and the potential for the waste material at the dump to affect this resource. That the Rancheria Lodge is hydraulically downgradient from the dump and that the facility relies on this ground water resource, it may be prudent to perform the necessary field work, hydrogeologic characterization, and baseline water quality testing in order to determine if the dump is currently affecting the ground water resource and to establish the necessary infrastructure for future monitoring. In regards to the pit area at P1 and the area of the previous generator at P3 at the Pine Lake Airstrip, there does not appear to be sufficient quantities of contaminated soil to adversely affect the natural environment and present or future users.

5.0 CONCLUSIONS

The following conclusions can be made in regards to this study:

1. The Phase I aspect of the work program was instrumental in determining the past uses of each particular subject area. The Rancheria Dump appears to have been developed by a past owner of the Rancheria Lodge and there does not appear to be waste material deriving from the Alaska Highway construction and US Army presence in the early 1940s. The garbage disposed of there contained domestic waste from the normal operations of the Rancheria Lodge and Restaurant. In regards to the Pine Lake Airstrip site, there were several different areas developed as determined from the air photo and records review. The Camp 10.5E area was utilized strictly during the construction of the Alaska Highway with no indication of subsequent users after this time. The original information regarding the Swift River Bridge study area was anecdotal and no further information was obtained from the data searches to indicate the presence of a disposal site in this area.
2. Contaminant sources identified from the Phase I component of the work program included domestic waste at the Rancheria Dump and diesel or motor oil at the area of the generating unit at the Pine Lake Airstrip. The electrical generating facilities at an emergency airstrip like the Pine Lake Airstrip were considered minimal compared to the larger operations such as the Snag or Watson Lake Airports. As such, the generator at the Pine Lake Airstrip most likely did not contain PCB oils but rather operated on a low voltage 'air blast' system. There were no significant contaminant sources identified from the Phase I results either at the Camp 10.5E Site or the Swift River Site.
3. The environmental survey was successful in verifying potential contaminated areas based on site features encountered during the site reconnaissance trip. Typical site features included existing pits and waste piles containing remnants from previous camps or structures.
4. The detailed geophysical program performed by AMCL was an efficient and thorough technique in locating a number of magnetic and electromagnetic anomalies that were attributed to the presence of buried metals. The general conclusion from this study was that the anomalies encountered at all seven test sites were relatively weak, suggesting that only a small quantity of buried metal exists at these areas.

5. The test pit program was an effective and cost efficient investigative technique for verifying the presence of buried metallic objects, for determining if soil contamination had occurred, and for obtaining soil samples for laboratory testing.
6. From the test pit program, the waste at the Rancheria dump was found to be located primarily at the north periphery of the clearing and to have an average thickness of 1.0 m. The waste consisted of domestic garbage with no visual sign of impurity located below garbage fill.
7. Of the several test pit excavations performed at the Pine Lake Airstrip study area, contamination was encountered in two locations. An old pit at sub-area P1 appears to have a small amount of oil impurity in the soil. This oil most likely derived from old drums which were disposed of in this pit. By employing an inside-out excavation technique, the maximum contaminated soil volume was estimated to be 1.0 - 2.0 m³. The second contaminant zone occurred at the former generating unit located near the beacon tower at sub-area P3. The soil was contaminated with an oil impurity at relatively high concentrations, however, the total contaminated soil volume was just 2.0 - 3.0 m³.
8. There was no contaminant source, presence of impurity within the soil profile, or an indication of disturbed soil in any of the test pit excavations at Site 5, Camp 10.5E.
9. The results of the Phase I and subsequent geophysical survey excluded the Swift River Bridge site from further investigative work or environmental assessment considerations.
10. Only the three known or potential contaminant zones identified as the Rancheria Dump, and the pit at sub-area P1, and the former generator location at sub-area P3, at the Pine Lake Airstrip, necessitated environmental impact assessment considerations. Based on a numerical comparison approach utilizing the Draft Contaminated Sites Regulations (YTG, 1996), the Rancheria Dump was not classified as a contaminated site. The two areas encountered at the Pine Lake Airstrip site did have contaminant concentrations which were above the applicable criteria, however, it is not envisioned that these areas would be designated as a contaminated site under the regulations due to the small volumes of contaminated soil. Alternately, the results of the risk assessment approach indicate that each known contaminant zone at the Pine Lake study area had little to no risk associated with the contaminated soil.

In regards to the Rancheria Dump Site, the results of the risk assessment indicated that some risk does exist due to the uncertainties associated with the potential impact to the ground water resource.

6.0 RECOMMENDATIONS

The following recommendations are provided in relation to this study:

1. In order to reduce the uncertainty as to whether the Rancheria dump has in the past or may in the future adversely affect the water quality of the Rancheria Lodge, it is advised to proceed with a drilling program to further characterize the soil and ground water in the area surrounding the dump. The first objective would be to characterize the hydrogeologic conditions by determining the ground water vector, hydraulic conductivity, and hydraulic gradient of the study area. This would be accomplished by installing ground water monitoring wells at strategic locations throughout the study area and performing the necessary surveying and hydraulic testing programs. The second objective of the drilling program would be to obtain water samples for baseline water quality data. Permanent ground water monitoring wells should be constructed with a suitable ground water testing and scheduling protocol devised to satisfy the monitoring objectives. This information may be invaluable in repudiating possible future claims that contamination encountered at the Rancheria Lodge water source had derived from this site.
2. In regards to the Pine Lake Airstrip, the two areas where soil contamination was encountered do not currently require remediation considerations. However, with this area under land claims selection, it may be prudent to engage in an excavation and disposal program in order to remove the small amount of contaminated soil in an expeditious and cost effective manner. At this time, further restoration work should be done to remove the miscellaneous garbage debris which was encountered during this study in the various areas at the Pine Lake Airstrip Site.
3. The excavation and removal program described above will necessitate some planning and consultation activities prior to implementation. This work, along with monitoring services during remediation activities, should be performed by a qualified Environmental Engineer to ensure compliance and closure with the applicable regulatory agencies.
4. The Camp 10.5E and Swift River Bridge sites do not require any further investigation work or monitoring activities for environmental considerations.

7.0 CLOSURE


This report has been prepared for the exclusive and confidential use of Indian and Northern Affairs, Arctic Environmental Strategy, Action on Waste Program and applies only to the Preliminary Environmental Investigations performed at the sites of the Rancheria Dump, Pine Lake Airstrip, Swift River Bridge, and Camp 10.5E located in south east Yukon.

The subsurface soil and ground water conditions are known at the test pit locations only. Further, contaminant presence is known only in those test pit locations where qualitative observations have been made and where chemical laboratory verification has been conducted. Due to geologic and contaminant transport randomness, interpolations between test pit locations have not been made or implied.

The recommendations provided herein are based on the results of the environmental and geophysical surveys, the subsurface soil conditions encountered during the field work programs, current investigative techniques, and generally accepted engineering practices. Recommendations for remediation are based, in part, on environmental criteria and regulations which may change in time. Should further information pertinent to this study become available, the recommendations may be altered or modified in writing by the undersigned.

Yours truly,
J.R. PAINE & ASSOCIATES LTD.

Michael E. Billowits, P.Eng.
Project Engineer



Wilbur C. Kofoed, P.Eng.
Office Manager

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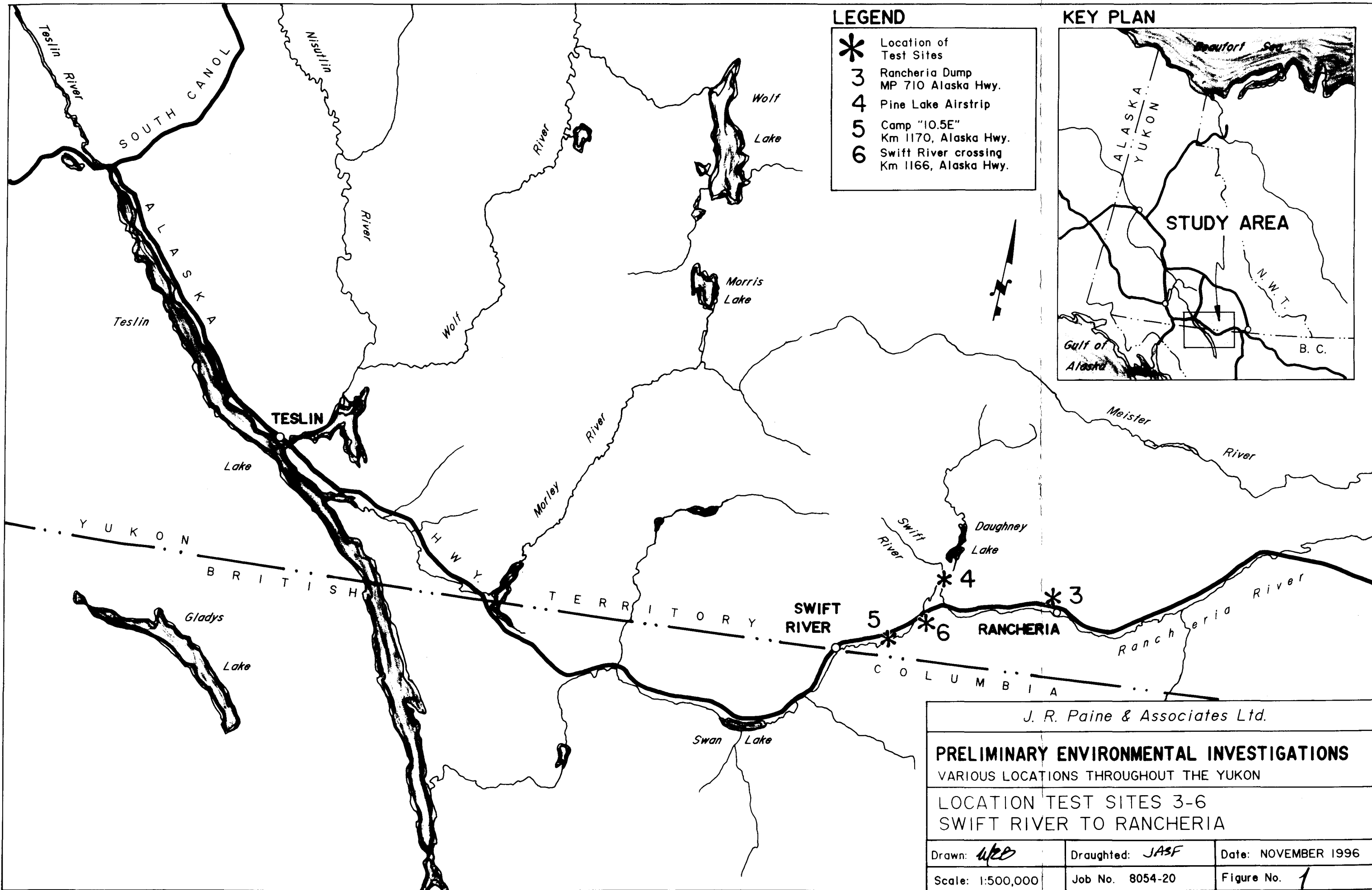
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FIGURES

- Figure 1: Location Test Sites 3 to 6 - Swift River to Rancheria
- Figure 2: Site 3 - Location of Rancheria Dump, MP 710 Alaska Highway
- Figure 3: Site 3 - Rancheria Dump
- Figure 4: Site 4 - Pine Lake Airstrip Site Plan, Sub-Areas 'P1' to 'P5'
- Figure 5: Sub-Area 'P1' at Site 4, Pine Lake Airstrip
- Figure 6: Sub-Area 'P2' at Site 4, Pine Lake Airstrip
- Figure 7: Sub-Area 'P3' at Site 4, Pine Lake Airstrip
- Figure 8: Sub-Area 'P4' at Site 4, Pine Lake Airstrip
- Figure 9: Sub-Area 'P5' at Site 4, Pine Lake Airstrip
- Figure 10: Site 5 - Camp 10.5 E, Km 1170 Alaska Highway
- Figure 11: Site 6 - Swift River Crossing, Km 1166, Alaska Highway
- Figure 12: Photographic Documentation (5pages)







LEGEND




- * Location of Test Sites
- 3 Rancheria Dump
MP 710 Alaska Hwy.
- 4 Pine Lake Airstrip
- 5 Camp "10.5E"
Km 1170, Alaska Hwy.
- 6 Swift River crossing
Km 1166, Alaska Hwy.

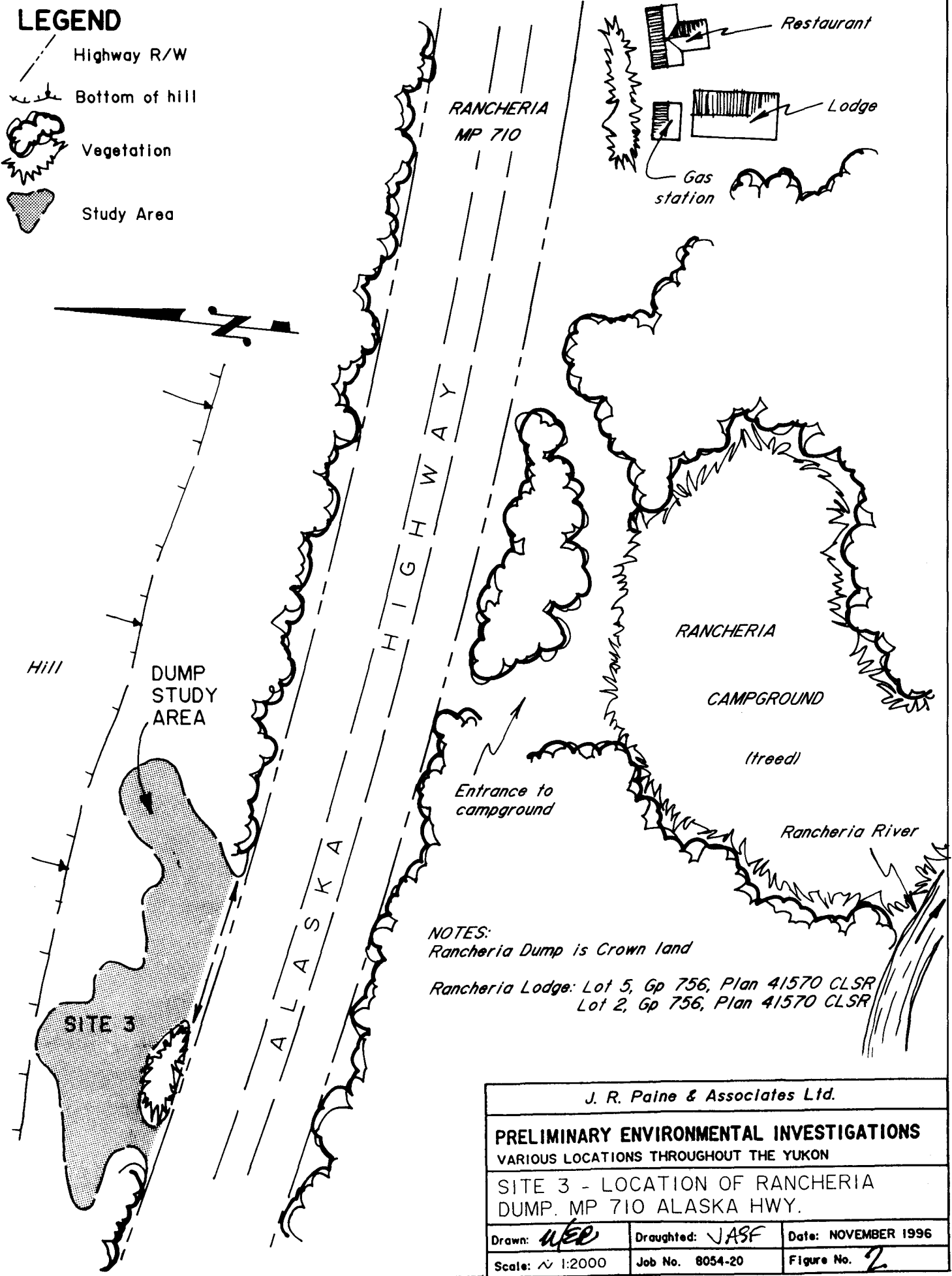


J. R. Paine & Associates Ltd.		
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS		
VARIOUS LOCATIONS THROUGHOUT THE YUKON		
LOCATION TEST SITES 3-6		
SWIFT RIVER TO RANCHERIA		
Drawn: <i>WEP</i>	Draughted: <i>JASF</i>	Date: NOVEMBER 1996
Scale: 1:500,000	Job No. 8054-20	Figure No. 1

LEGEND

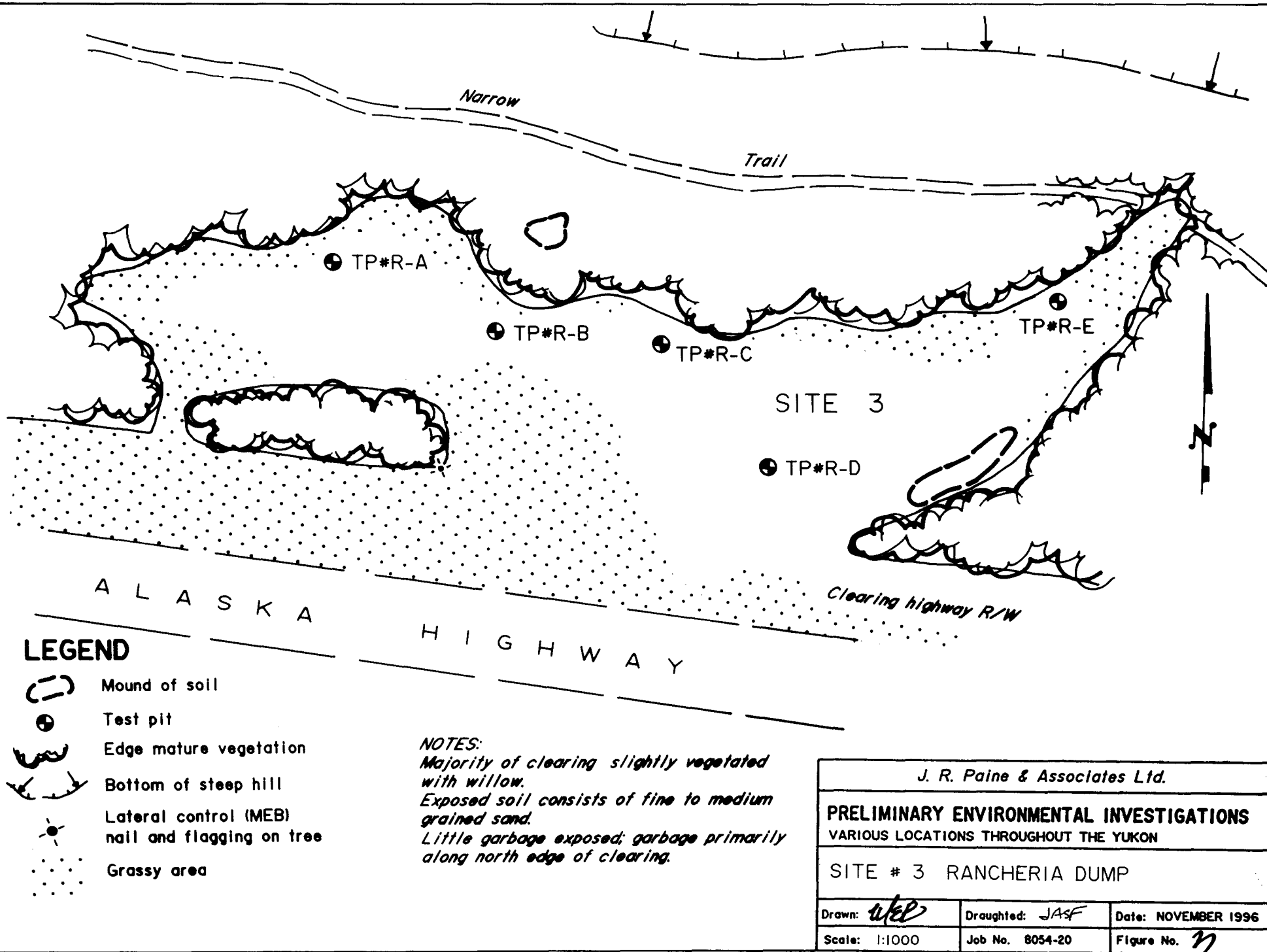
-  Highway R/W
-  Bottom of hill
-  Vegetation
-  Study Area

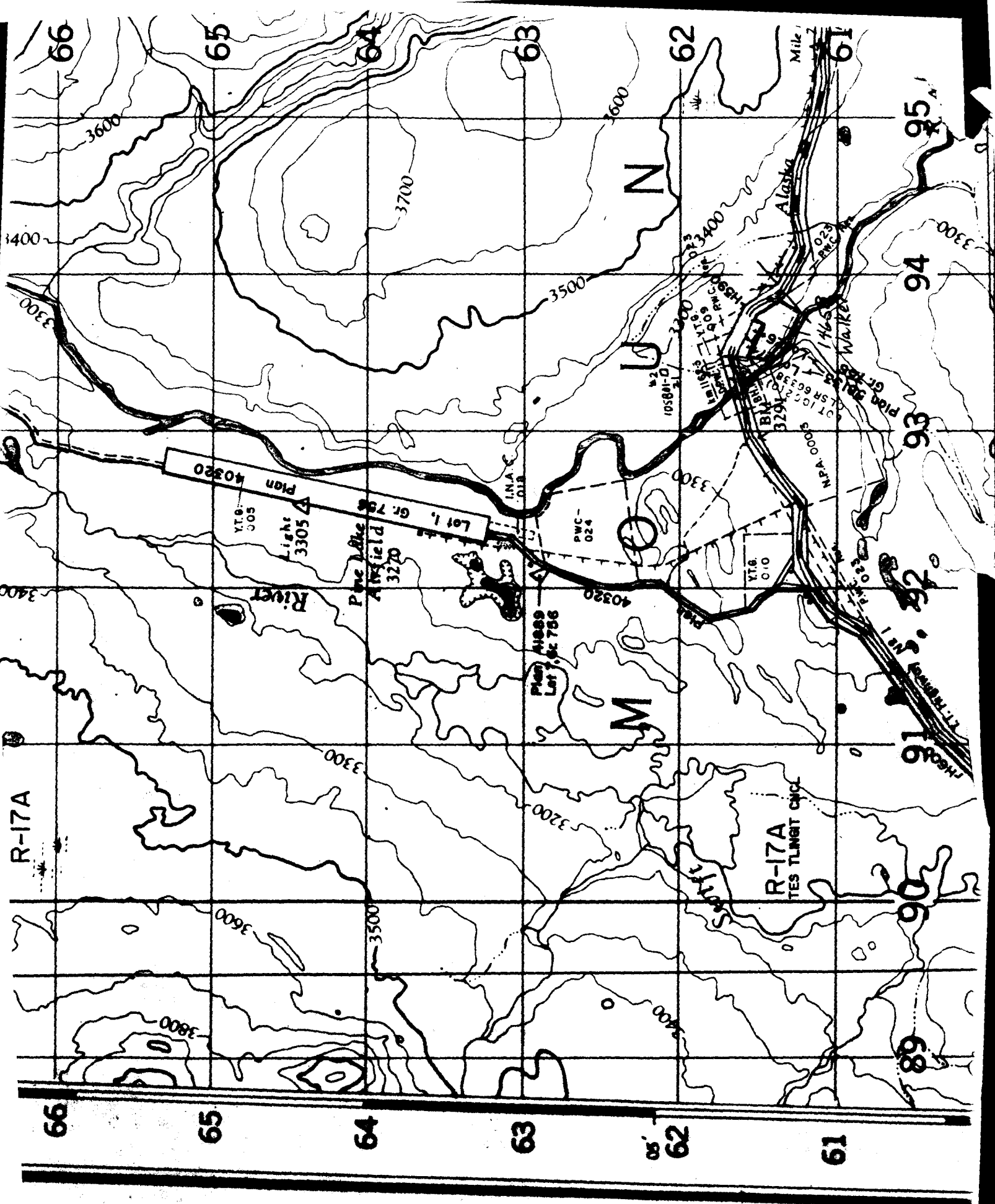
-  Restaurant
-  Lodge
-  Gas station



NOTES:
 Rancheria Dump is Crown land
 Rancheria Lodge: Lot 5, Gp 756, Plan 41570 CLSR
 Lot 2, Gp 756, Plan 41570 CLSR

J. R. Paine & Associates Ltd.		
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS VARIOUS LOCATIONS THROUGHOUT THE YUKON		
SITE 3 - LOCATION OF RANCHERIA DUMP. MP 710 ALASKA HWY.		
Drawn: <i>WEE</i>	Draughted: <i>JASF</i>	Date: NOVEMBER 1996
Scale: ~ 1:2000	Job No. 8054-20	Figure No. <i>2</i>





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R-17A
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Mile

Alaska

River

S

Pign 40320

V.T.B. 005

Light 3305

Pine Lake
Amsfield
3270

Plan 41889
Lot 1, GR. 786

PWC-024

40320

V.T.B. 010

Plan 41889
Lot 1, GR. 786

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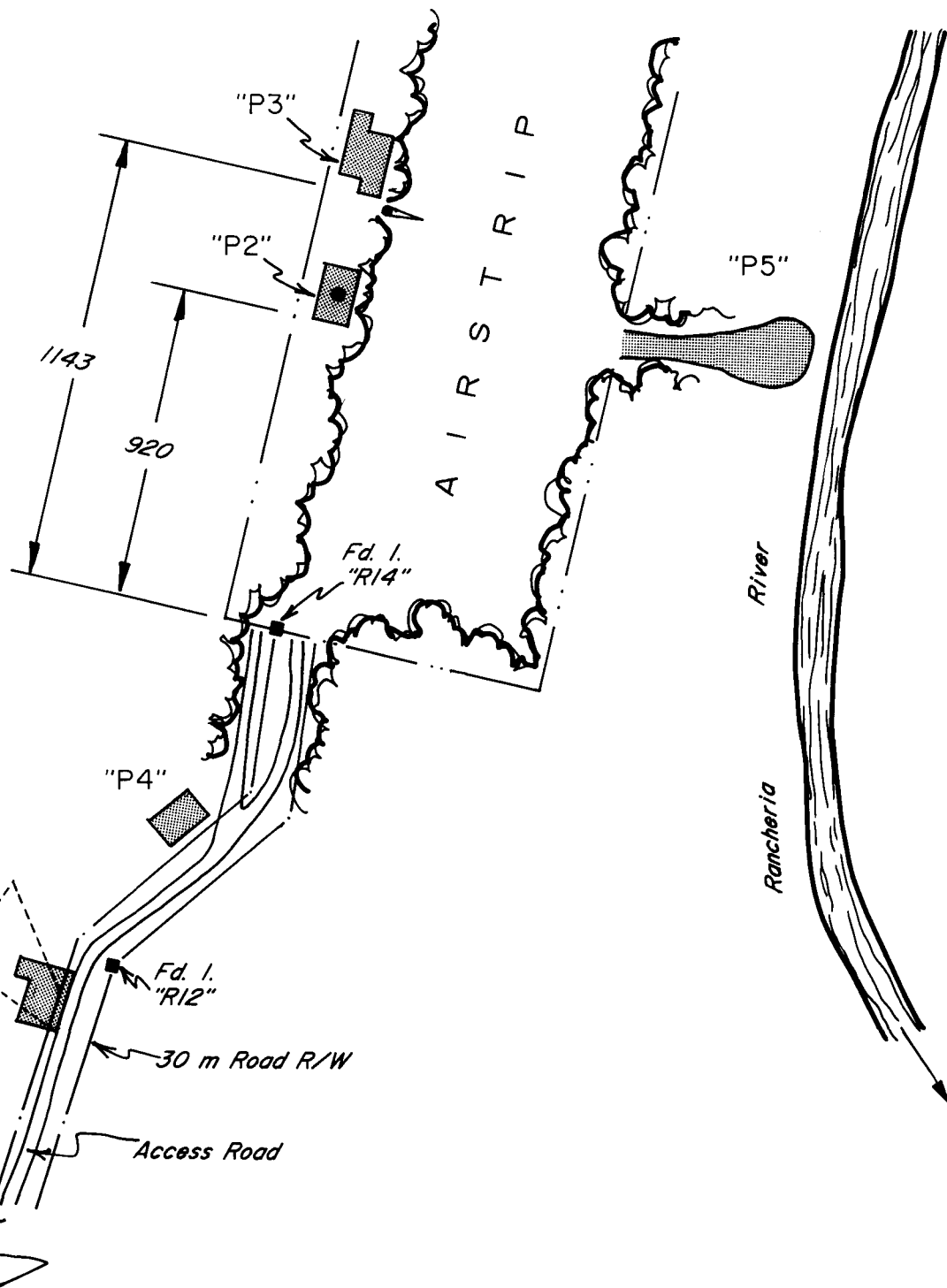
Plan 41889
Lot 1, GR. 786

Plan 41889
Lot 1, GR. 786

LEGEND

-  Test site location
- "P2" Sub-area number
- Surveyed boundary 1945
- Iron posts shown thus
- Fd. 1. Found iron post
- "R14" Post markings run from old Alaska Hwy. (1945)
-  Vegetation edge
-  New windsock
- Old windsock
- * Cans (garbage)

All distances in metres



Approx. surveyed boundary

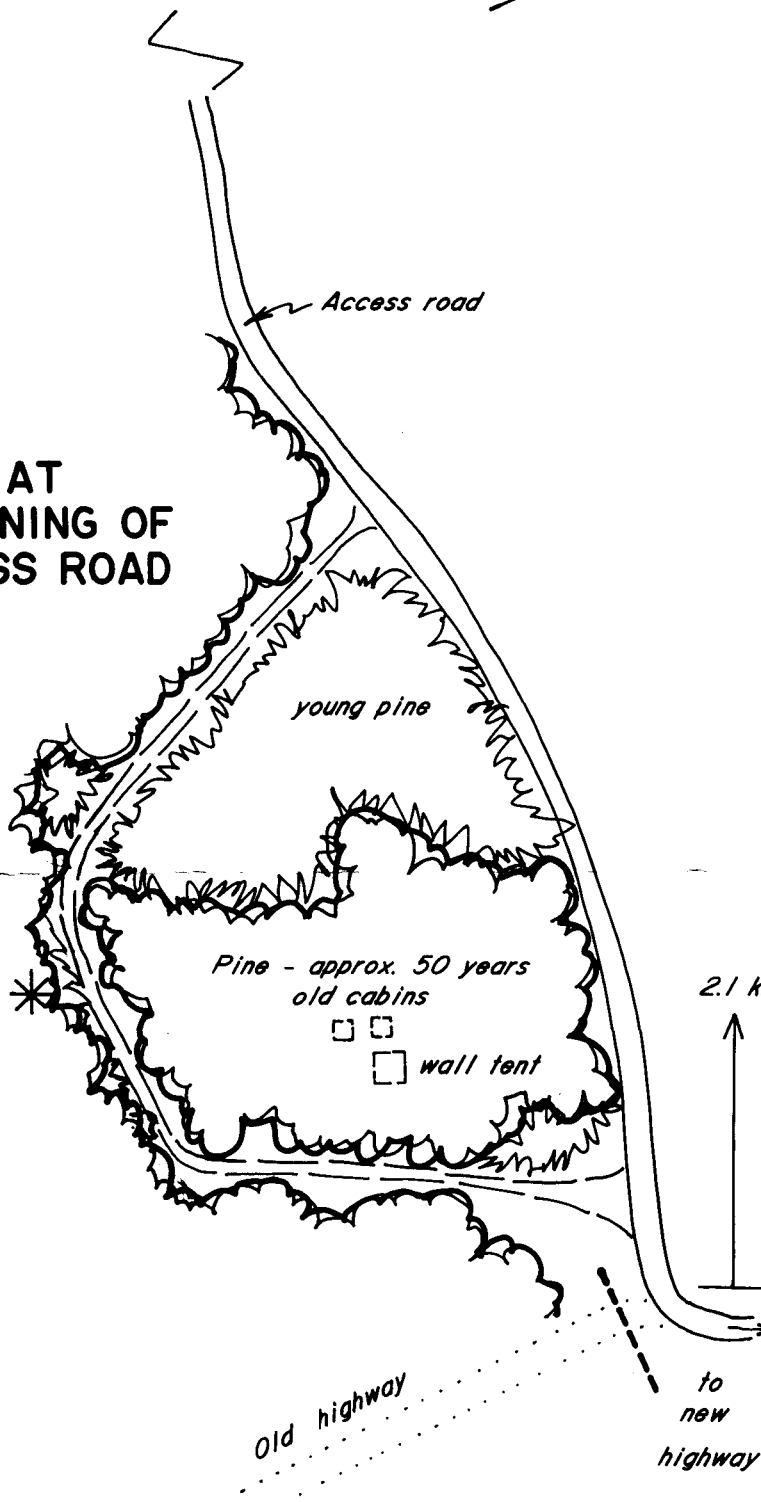
"P1"

Access Road

30 m Road R/W

Fd. 1. "R12"

AREA AT BEGINNING OF ACCESS ROAD



young pine

Pine - approx. 50 years old cabins

wall tent

Old highway

to new highway

2.1 km to start of runway

NOTES:

Boundary of Pine Lake Airstrip, Road R/W, Posts and post markings are from Sheet 22 of Plan of Pine Lake Flight Strip # 5, Lot 1 Group 756, Plan 40320 CLSR by K.F. McCusker, D.L.S. Dated March 31, 1945

Airfield and Access Road - Lot 1 Group 756, Plan 40320 CLSR

Camp area - Lot 7 Group 756, Plan 41889 CLSR

Remainder is Crown land

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PRELIMINARY ENVIRONMENTAL INVESTIGATIONS

VARIOUS LOCATIONS THROUGHOUT THE YUKON

PINE LAKE AIRSTRIP SITE PLAN

SUB-AREAS "P1" TO "P5" AND AREA AT BEGINNING OF ACCESS ROAD

Drawn: *JPB*

Draughted: *JASF*

Date: NOVEMBER 1996

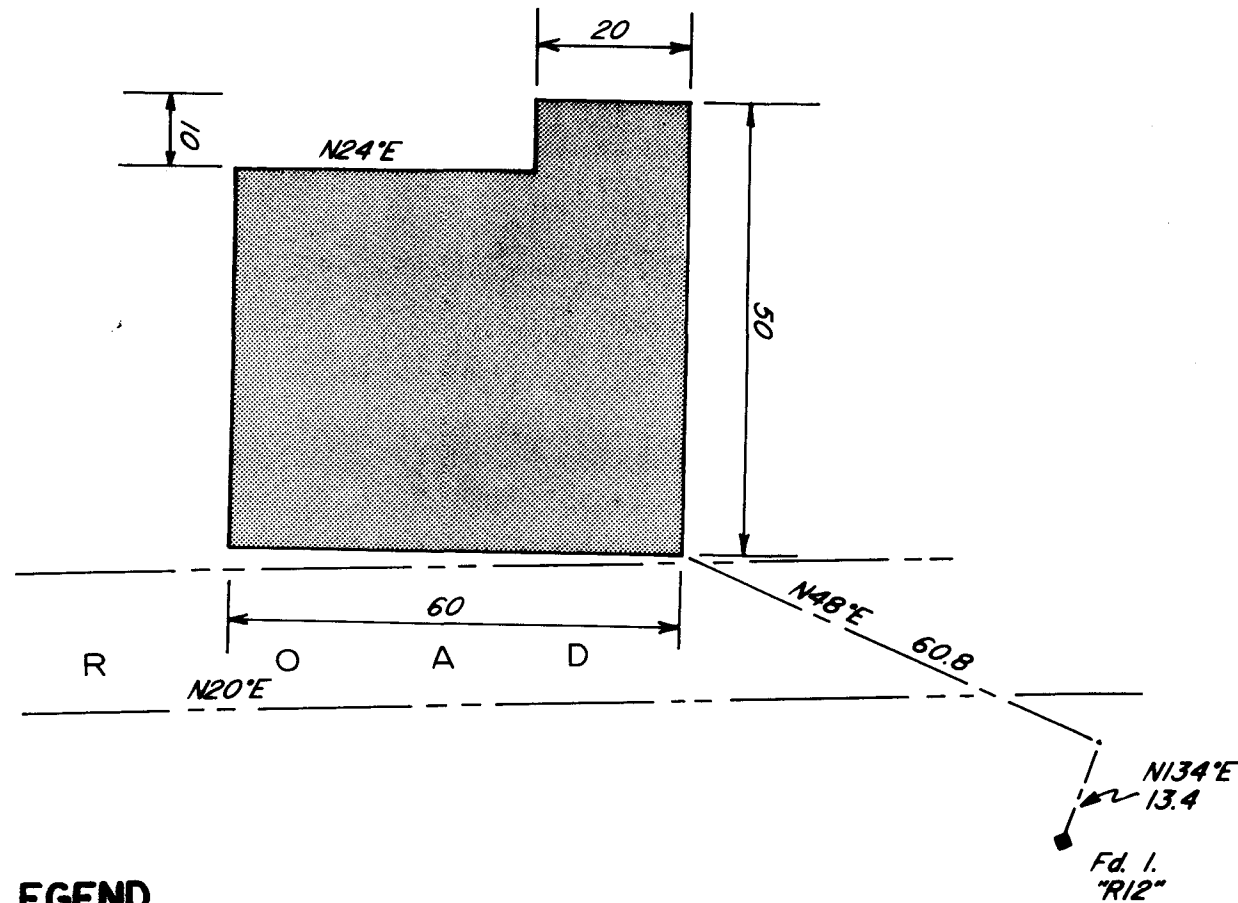
Scale: NTS

Job No. 8054-20

Figure No. **4**

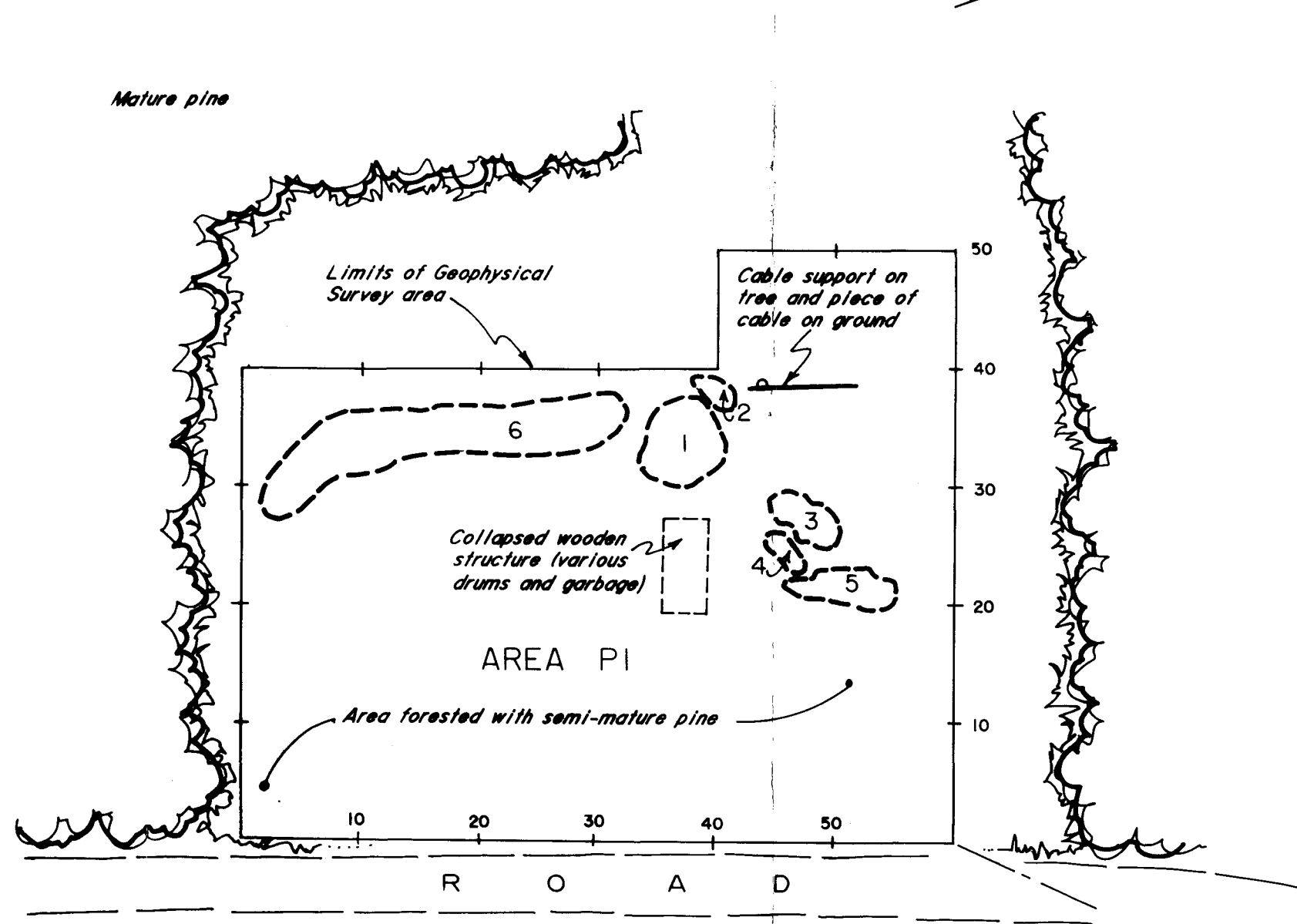
OVERALL PLAN OF AREA "PI"

SCALE 1:1000



DETAILS AREA "PI"

SCALE 1:500



LEGEND

- Test site location
- Various piles (1-6) with hts. 0.5-2.0 m
- Pile number
- Geophysical survey boundary
- Traverse line from "R12"
- Road edge
- Limit mature vegetation
- Vegetation 1943 or younger
- Iron post shown thus

NOTE:

Test pit excavation "PIA" encompassed entire area of wood structure shown above and pile 1.

All distances in metres unless shown otherwise.

Piles appear to consist of organics and soil deriving from clearing activities. No contaminant sources identified from surface.

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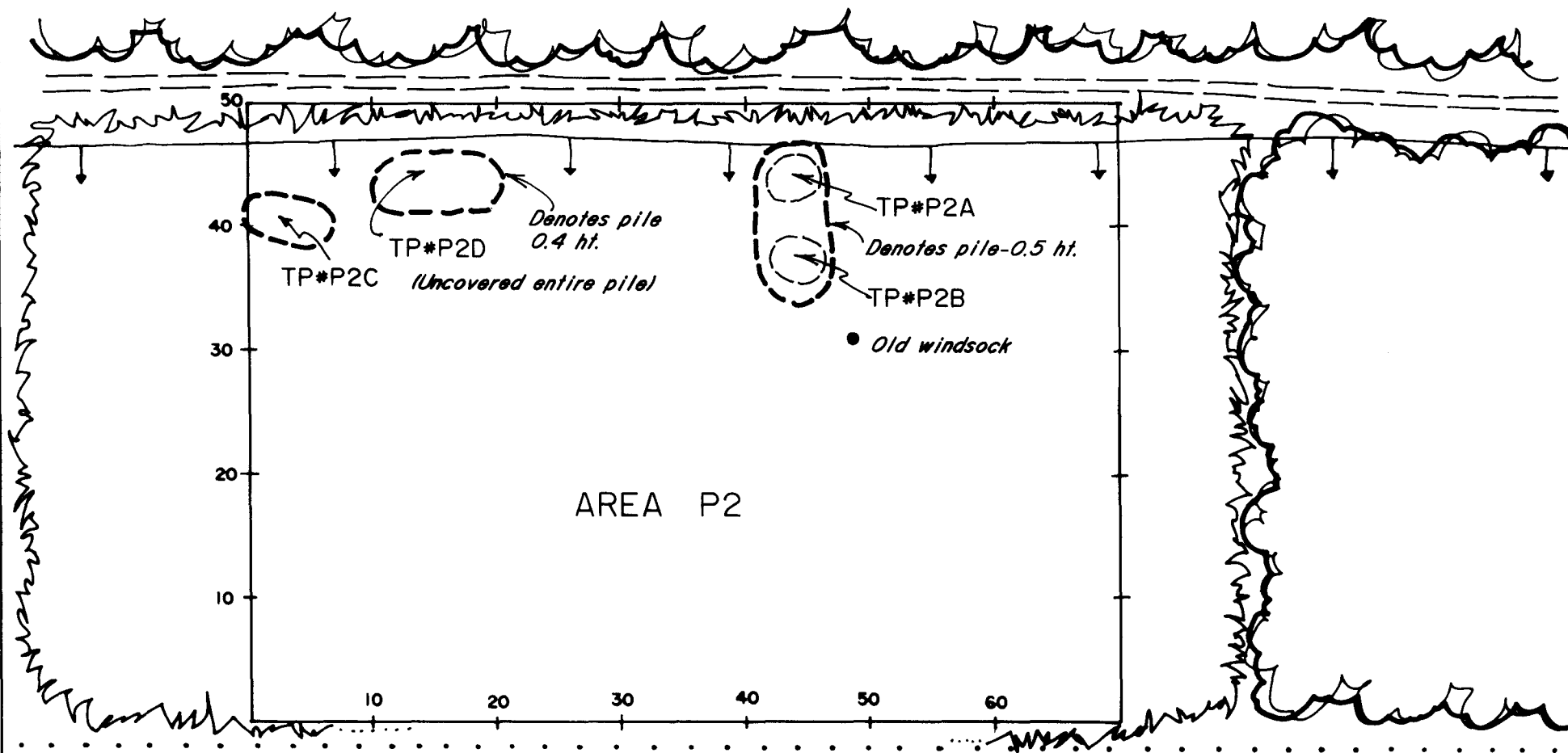
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS







VARIOUS LOCATIONS THROUGHOUT THE YUKON

SUB-AREA "PI" AT SITE NO. 4
PINE LAKE AIRSTRIP

Drawn: <i>WLB</i>	Draughted: <i>JAF</i>	Date: NOVEMBER 1996
Scale: AS SHOWN	Job No. 8054-20	Figure No. <i>5</i>

Mature pine forest



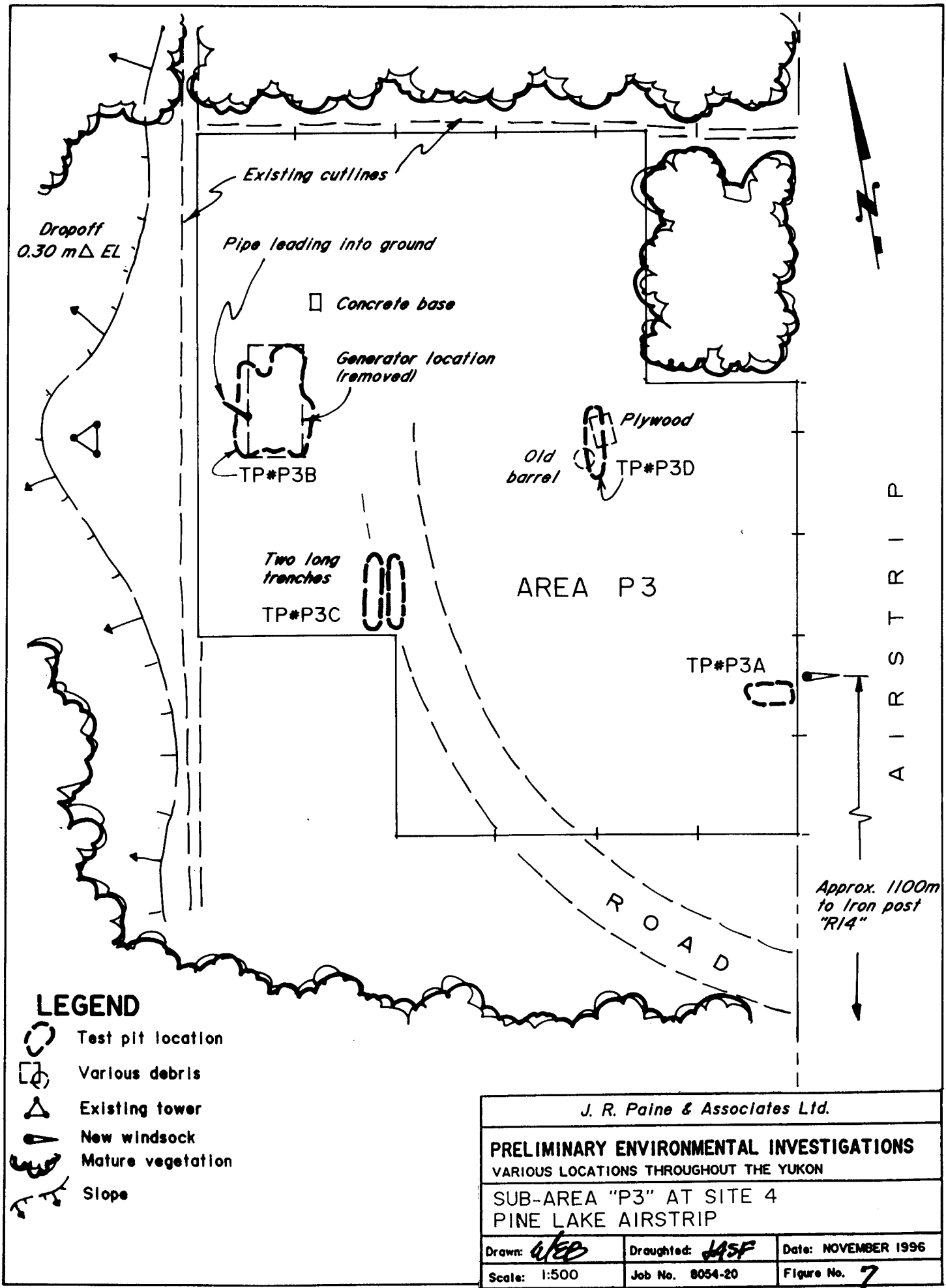
-  Edge of pile
-  Testpit within pile
-  Edge of airstrip
-  Edge of bank (I.O.ΔEL approx)
-  Edge mature vegetation
-  Vegetation 1943 or younger

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PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
VARIOUS LOCATIONS THROUGHOUT THE YUKON

SUB-AREA "P2" AT SITE 4
PINE LAKE AIRSTRIP

Drawn: <i>JRP</i>	Draughted: <i>JRP</i>	Date: NOVEMBER 1996
Scale: 1:500	Job No. 8054-20	Figure No. 6



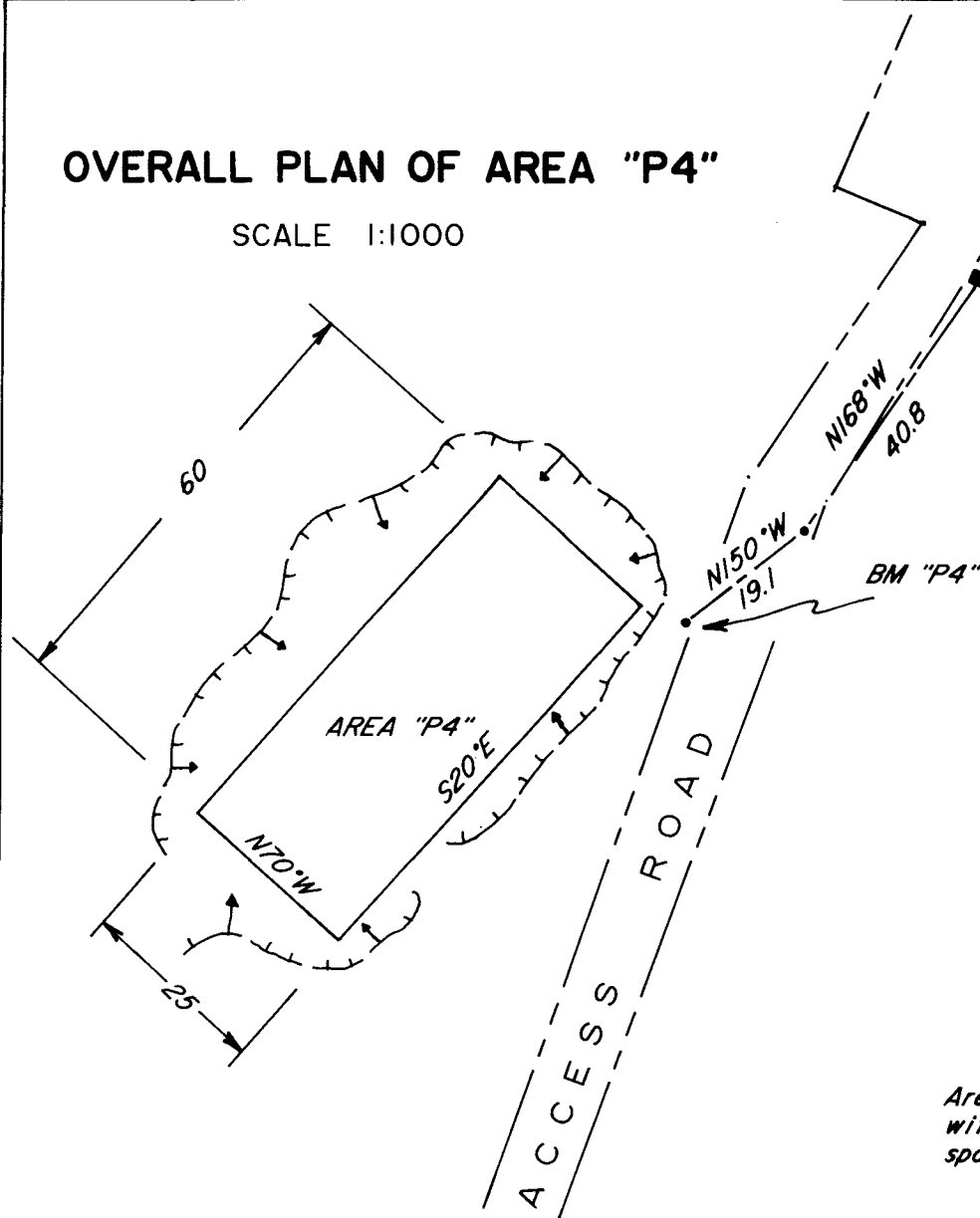
LEGEND

- Test pit location
- Various debris
- Existing tower
- New windsock
- Mature vegetation
- Slope

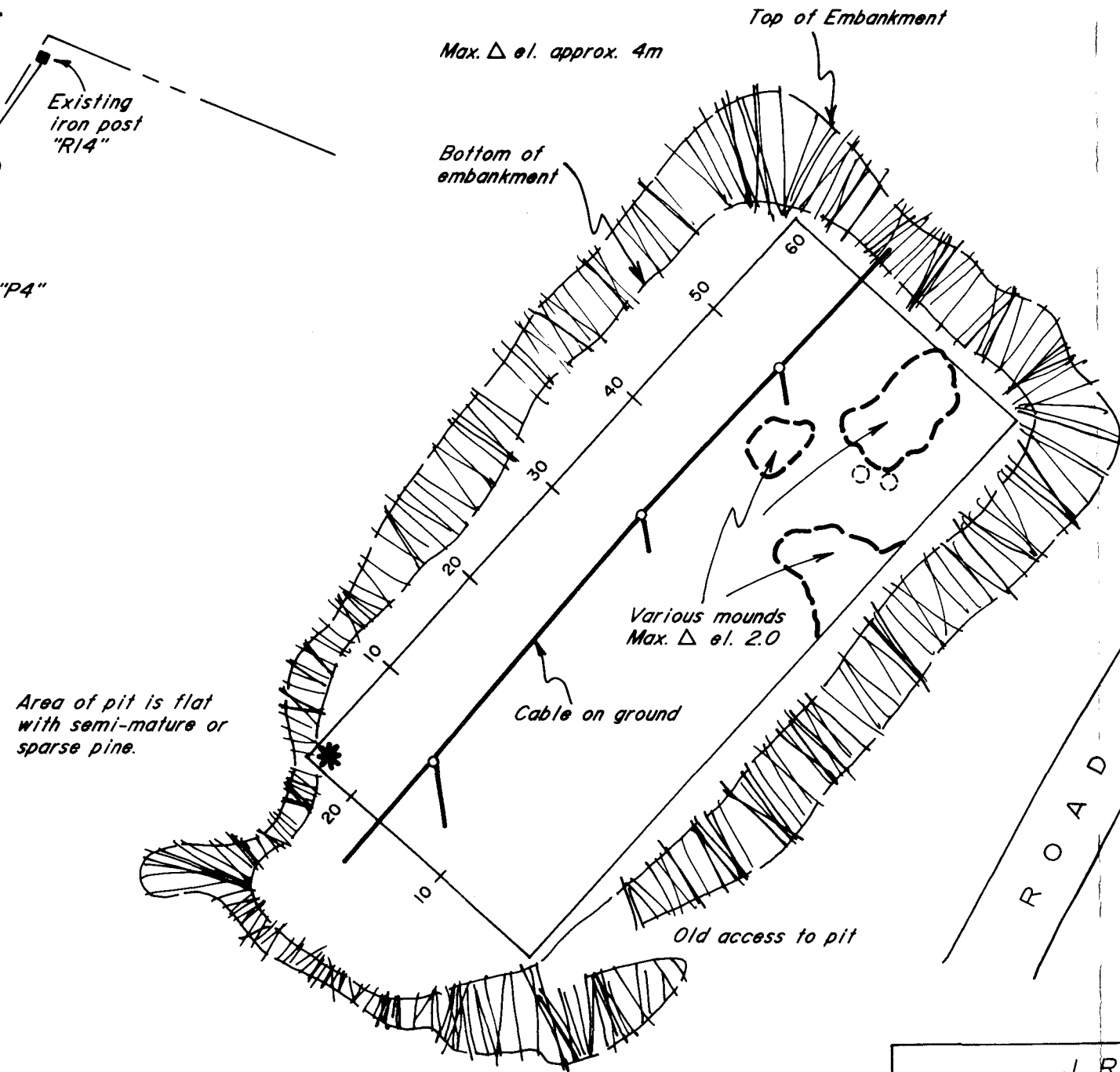
J. R. Paine & Associates Ltd.		
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS VARIOUS LOCATIONS THROUGHOUT THE YUKON		
SUB-AREA "P3" AT SITE 4 PINE LAKE AIRSTRIP		
Drawn: <i>WEP</i>	Draughted: <i>JASF</i>	Date: NOVEMBER 1996
Scale: 1:500	Job No. 8054-20	Figure No. 7

OVERALL PLAN OF AREA "P4"

SCALE 1:1000



AIRSTRIP



DETAILS AREA "P4"

SCALE 1:500

NOTE: All distances are in metres.

LEGEND

- Mounds in pit
- Small drums
- Vehicle door
- Access road R/W
- Found iron post (1946)
- MEB traverse
- Embankment

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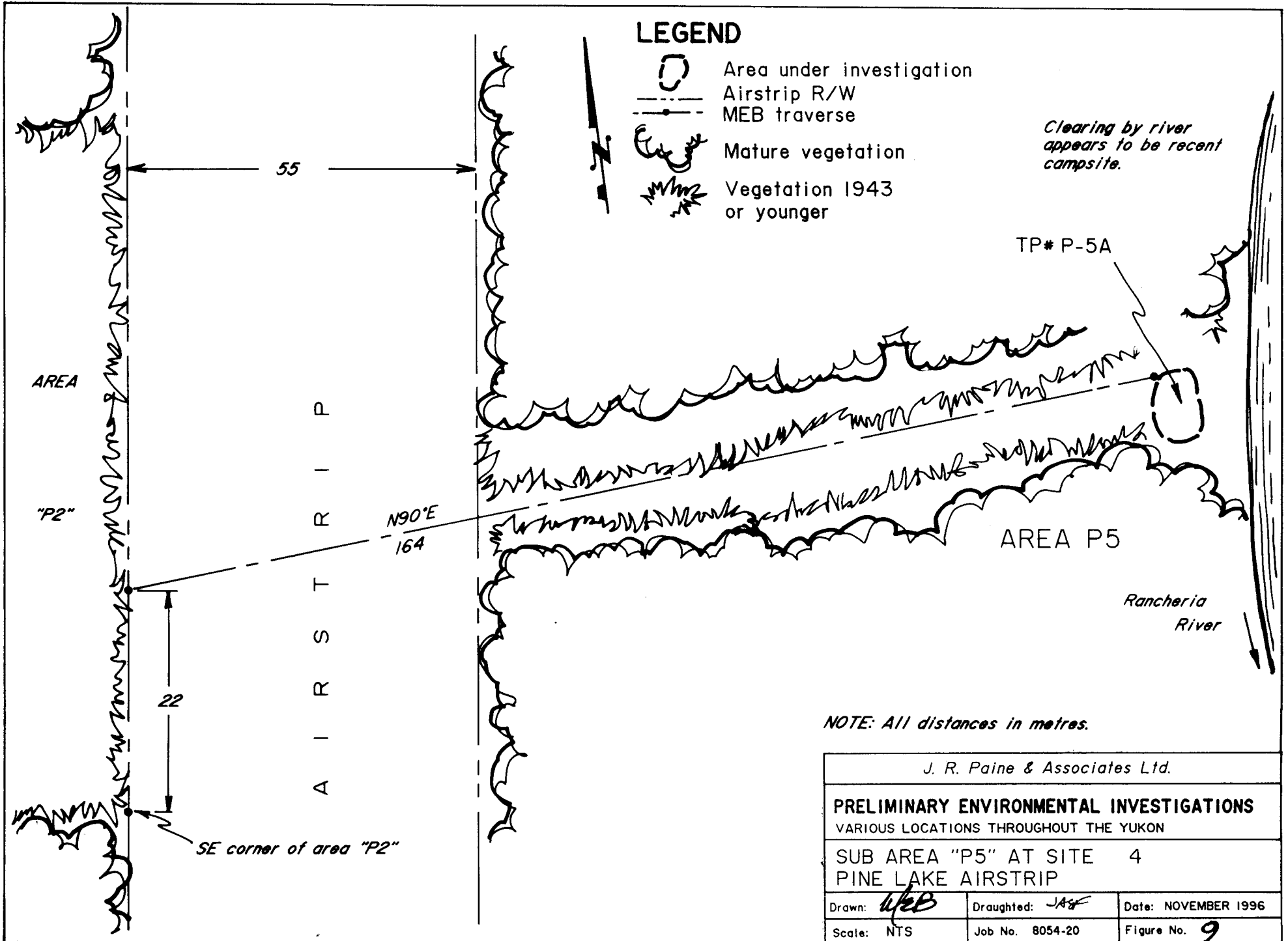
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS

VARIOUS LOCATIONS THROUGHOUT THE YUKON

SUB-AREA "P4" AT SITE # 4

PINE LAKE AIRSTRIP

Drawn: <i>WEP</i>	Draughted: <i>LASF</i>	Date: NOVEMBER 1996
Scale: AS SHOWN	Job No. 8054-20	Figure No. <i>8</i>



LEGEND

- Area under investigation
- Airstrip R/W
- MEB traverse
- Mature vegetation
- Vegetation 1943 or younger

Clearing by river appears to be recent campsite.

TP# P-5A

AREA P5

Rancheria River

NOTE: All distances in metres.

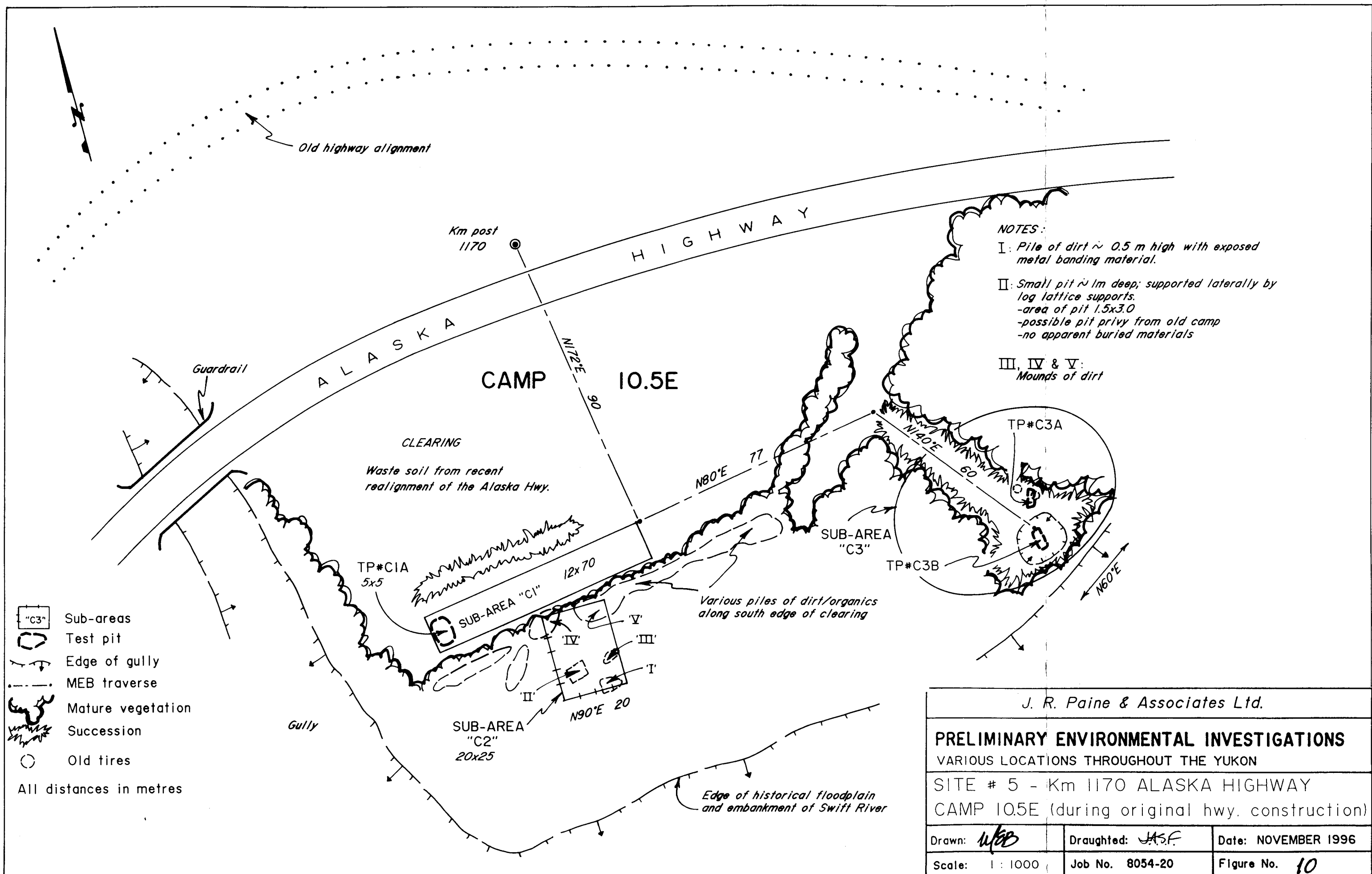
J. R. Paine & Associates Ltd.

PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
VARIOUS LOCATIONS THROUGHOUT THE YUKON

SUB AREA "P5" AT SITE 4
PINE LAKE AIRSTRIP

Drawn: *WEB* Draughted: *JAS* Date: NOVEMBER 1996

Scale: NTS Job No. 8054-20 Figure No. 9



LEGEND



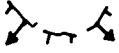
Rusted cable



Grass

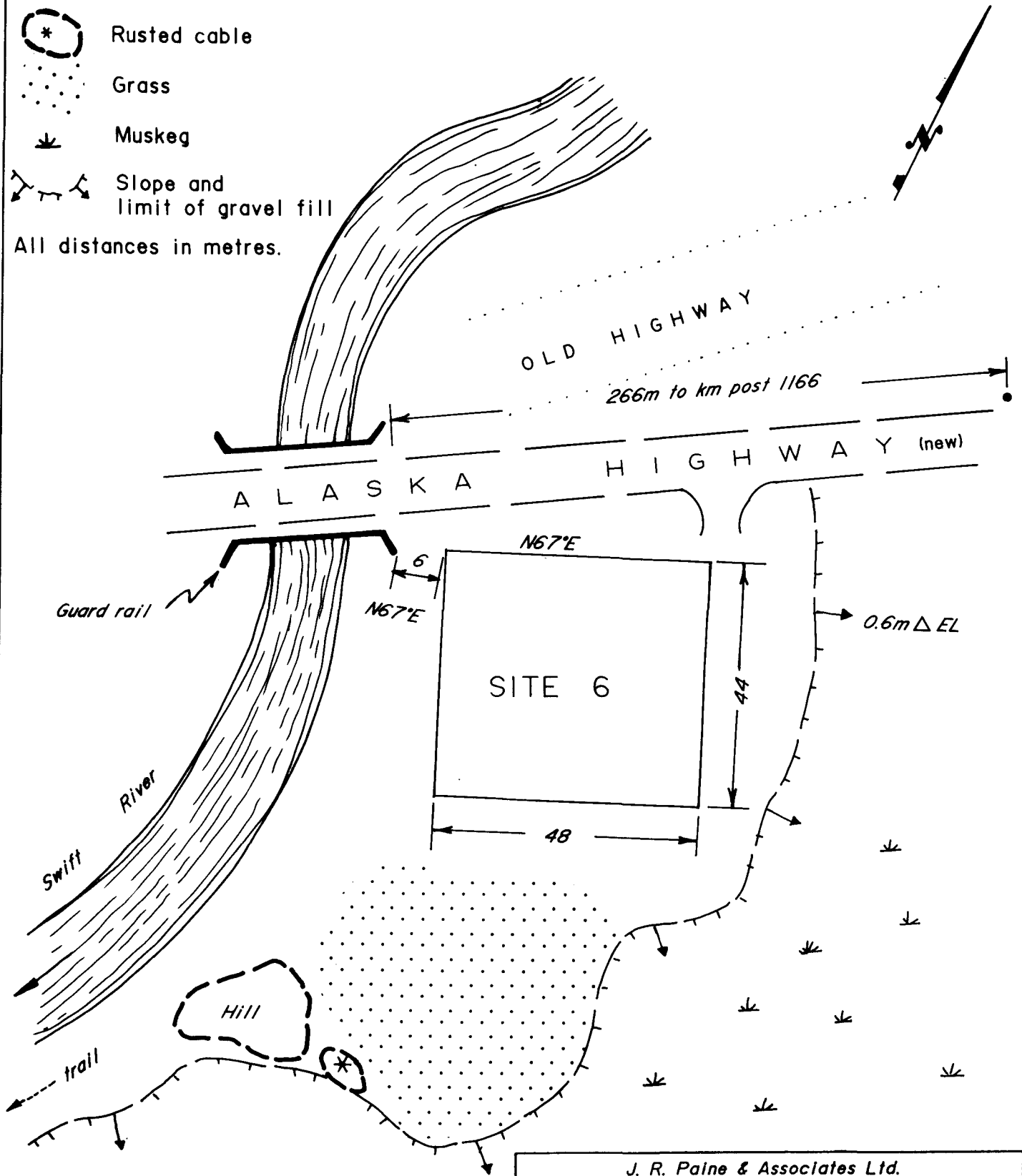


Muskeg



Slope and limit of gravel fill

All distances in metres.



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PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
VARIOUS LOCATIONS THROUGHOUT THE YUKON

SITE 6 - SWIFT RIVER CROSSING
Km 1166 ALASKA HWY.

Drawn: <i>WEB</i>	Draughted: <i>JASF</i>	Date: NOVEMBER 1996
Scale: 1:1000	Job No. 8054-20	Figure No. 11

FIGURE 12: PHOTOGRAPHIC DOCUMENTATION

PHOTO NO.	DESCRIPTION
1	-Site #3, Rancheria Dump -looking east from west edge of dump; note steep hill bordering dump to the north; note pine and poplar regeneration within clearing area
2	-Site #3, Rancheria Dump -looking east along north edge of dump; note approximately 1.0 m of garbage fill material above natural ground level; typical near surface garbage includes tires and tubes
3	-Site #4, Pine Lake Airstrip -looking north at wall tent and old cabin located on "loop road" at beginning of access road to airstrip
4	-Site #4, Pine Lake Airstrip, Sub-area P2 -looking north along clearing at old windsock and previous cabin location; note younger regenerated pine trees near windsock pole as opposed to mature pine forest to the west (left side of photo)
5	-Site #3, Rancheria Dump -looking south at excavation of TP#R-b; note various metal debris
6	-Site #3, Rancheria Dump -looking north-west at excavation of TP#R-a; note various tin, glass, and other domestic waste intermixed with sand soil
7	-Site #3, Rancheria Dump -looking west at dump floor in general area of TP#R-c; note fine grained sand as native soil, cash register most likely deriving from Rancheria Lodge
8	-Site #4, Pine Lake Airstrip, Sub-area P1 -looking at excavation for TP#P1-a located at existing pit structure; note log cribbing at edge of pit wall (top left of photo) and various disposal items
9	-Site #4, Pine Lake Airstrip, Sub-area P4 -looking south-west from top of embankment at north east corner of P4 -note depression due to gravel borrow source activity; note slight regeneration of pine trees
10	-Site #4, Pine Lake Airstrip, Sub-area P2 -looking north west at excavation of TP#P2-d; note various wood and metal debris within pile
11	-Site #4, Pine Lake Airstrip, Sub-area P3 -looking east at area of former generating unit; note metal pipe leading into ground
12	-Site #4, Pine Lake Airstrip, Sub-area P3 -looking south at area of former generating unit; note concrete base for pole or tower
13	-Site #5, Camp 10.5 E -looking west from Alaska Hwy at clearing where former Camp 10.5 E was situated; note young grass vegetation recently seeded
14	-Site #5, Camp 10.5E, Sub-area C3 -looking south-east at depression where TP#C3-b was excavated
15	-Site #5, Camp 10.5E, Sub area C3 -looking south-west at small clearing where old tires located
16	-Site #6, Swift River Crossing -looking west at area of clearing adjacent to Swift River and Alaska Hwy



PHOTO 2



PHOTO 4



PHOTO 3



PHOTO 1



PHOTO 5



PHOTO 6



PHOTO 7



PHOTO 8



PHOTO 10



PHOTO 12



PHOTO 9



PHOTO 11

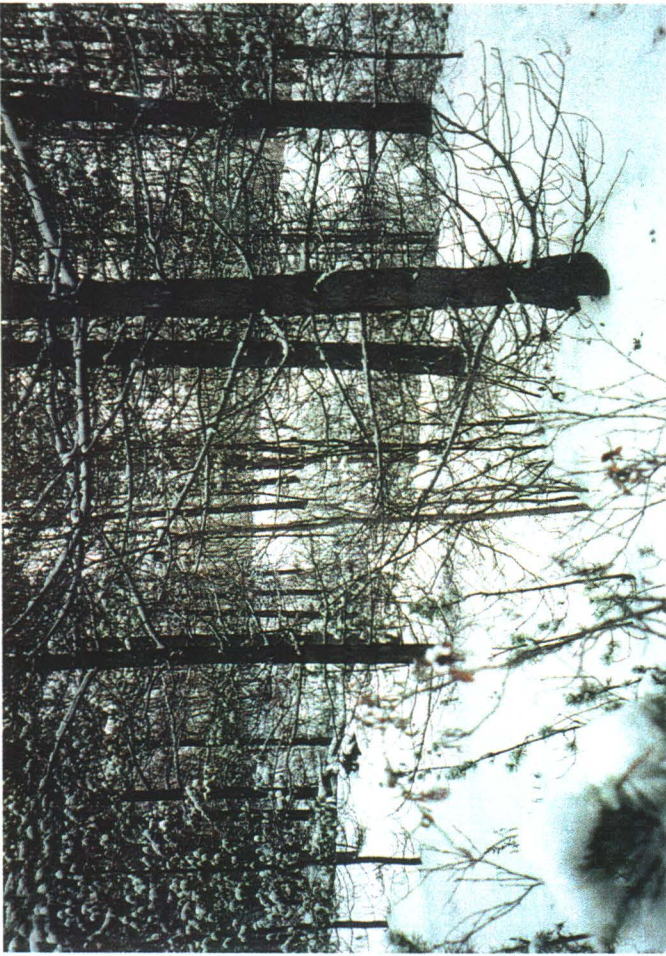


PHOTO 14



PHOTO 16



PHOTO 13

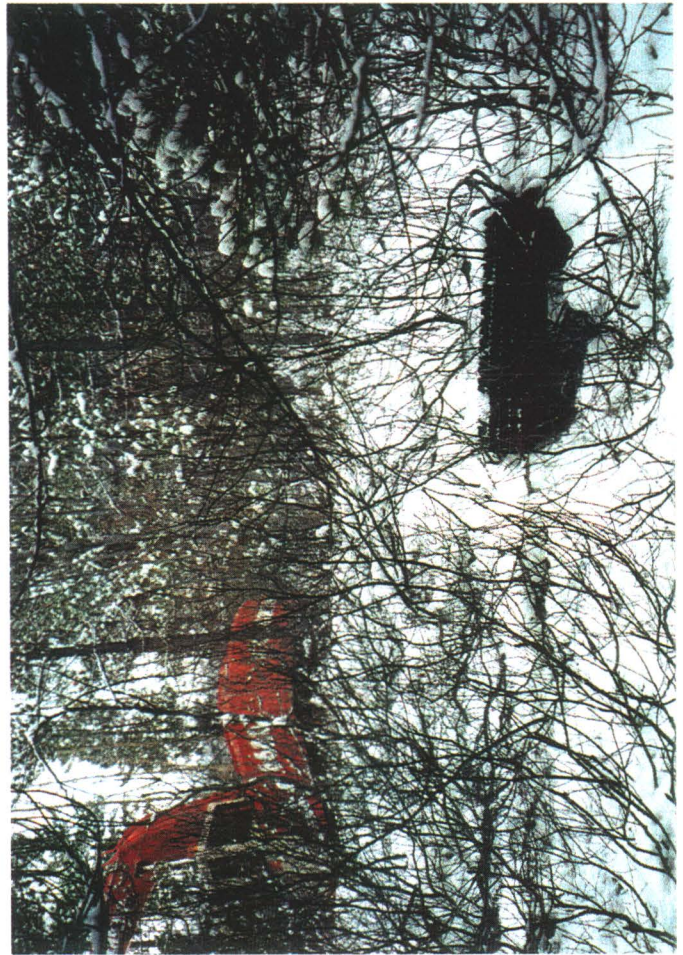


PHOTO 15

TABLES

Table One: Air Photo Review for Land Use Changes

Table Two: Results of Interview Program

Table Three: Numerical Comparison of Chemical Laboratory Results
with Environmental Quality Criteria

TABLE ONE: Air Photo Review for Land Use Changes

SITE #	PHOTO #	DATE	SCALE	DESCRIPTION
3 Rancheria Dump	A11412-199	Jun, 1948	1: 40 000	-may be a very small clearing (in area of northeast corner of existing dump) -large clearing where former US Army camp was
	A17431-37	Aug, 1961	1: 60 000	-no discernible clearing with homogenous vegetation throughout existing dump area
	A27874-125	Sep, 1992	1: 15 000	-clearing for dump identical in shape to existing shape
4 Pine Lake Airstrip	A11412-193	Jun, 1948	1: 40 000	-several clearings associated with airstrip -small loops along east edge of airstrip -entire area of Lot 1, Group 756 is cleared (7000 ft by 550 ft) as a result sites P2 and P3 are clear of vegetation (primarily) -sites P1, P4, and P5 cleared of vegetation -"loop road" at beginning of access road is not present -small clearing just to north of Alaska Hwy appears to be where the old cabins are on the loop road -no apparent structures
	A17431-41	Aug, 1961	1: 16 000	-original clearing for airstrip still intact however regeneration occurring along east and west edges of strip -no apparent structures -clearing for P1, P4, and P5 remain although regeneration apparent -alignment changes at beginning of access road and "loop road" appears (linking up access road to clearing where old cabins situated) -clearing at north portion of "loop road" appears
	A27521-94	Aug, 1989	1: 40 000	-regeneration along east and west edges of runway; total width decreases to 250 ft. -regeneration at sites P1, P2, P3 -no apparent structures or activity present
	A27871-253	Sep, 1992	1: 15 000	-similar to 1989 description -large clearing appears for gravel pit located east of access road near P1 sub-area

TABLE ONE: Air Photo Review for Land Use Changes

SITE #	PHOTO #	DATE	SCALE	DESCRIPTION
5 Camp 10.5E	A27871-246	Jun, 1948	1: 40 000	-rectangular clearing (camp area) approx. 200 m by 100m -one building present at east-central of clearing -small clearing present at south edge of camp area -road leading to clearing at south-east corner of camp area
	A17431-79	Aug, 1961	1: 60 000	-clearing for camp remains -some regeneration in area of pit and area C3
	A27871-246	Sep, 1992	1: 15 000	-partial regeneration of camp area -clearing for right of way for new alignment of highway appears and seems to encroach on northern edge of former camp area -regeneration of C3 area and C2 area
6 Swift River Bridge	A11412-270	Jun, 1948	1:40 000	-clearing and trail located south east side of road at bridge -clearing located north side of Hwy approx. 100 m east of Swift R. bridge
	A17431-79	Aug, 1961	1: 60 000	-scale too small to delineate clearings
	A27871-250	Sep, 1992	1: 15 000	-clearings remain north and south of hwy; new highway alignment cleared and covers some of clearing to the south

TABLE TWO: RESULTS OF INTERVIEW PROGRAM

INTERVIEWEE	RELATIONSHIP TO STUDY	QUESTION	RESPONSE
1. Greg Belisle YTG, C&TS, Transportation Eng.	Info on Alaska Hwy	A. Where did realignment of highway occur at Swift River Crossing and at Camp 10.5E?	A. Only slight realignment at each location. [Plan and profile as-built drawings provided to J.R. Paine]
		B. Were any dumps or other waste items noted at either site?	B. Nothing was reported as such; for specific site conditions you should ask Eric Biensch, on site supervisor during construction.
2. Eric Biensch, YTG, C&TS, T.E.	Info on Alaska Hwy.	A. What were the site conditions at the Swift R. Crossing and Camp 10.5E?	A. Nothing comes to mind at Swift River, just that pull out adjacent to road which currently remains; no garbage or dumps encountered during construction activities. At km 1170 (Camp 10.5E) there was a clearing at the side of the Highway which was used to dump waste soil [silt and clay not used for road construction]. Nothing at clearing besides young willow vegetation - no foundations, wood or concrete debris, no barrels or anything else noticed. Approx. 2 metres of waste soil placed throughout clearing area and seeded.
3. Jerry Coon, Transport Canada	Airport Info	A. What do you know about Pine Lake Airstrip?	A. Based on a flight supplemental Transport Canada has, it has been an emergency air strip since about 1970, under YTG control. Referred to Aviation Branch.
4. Bill Blahitka, YTG, Aviation Branch	Airport Info	A. What do you know about Pine Lake Airstrip?	A. Built in 1946. Transferred in 1975 from Department of Transport to Yukon Government. Used as an emergency landing strip only and there is not regular service there. Maintained by YTG since 1975 consisting of resurfacing and summer maintenance only.
		B. Any beacons or other equipment at airport?	B. No beacons, lighting, or other equipment to his knowledge. Referred to some historical information he had on file which he faxed to J.R. Paine
5. Bruce Barret, Heritage Branch	Highway, Airport Information	A. Do you have any historical information on the Pine Lake Airstrip or the other sites on the Alaska Highway?	A. No information on the Airstrip. As-built drawings provided of the Alaska Highway (same as received from Jim Coxford of YTG, Transportation Engineering). All aspects of the Highway under U.S Army jurisdiction until 1946 when Canadian Military took over. He remarked that U.S. Army most likely will not provide historical information (based on previous attempts by Heritage Branch).

TABLE TWO: RESULTS OF INTERVIEW PROGRAM

INTERVIEWEE	RELATIONSHIP TO STUDY	QUESTION	RESPONSE
6. Mary Reger	Authored previous study on waste sites in Yukon	A. Where exactly is the Swift River waste site located? B. Do you remember if the site was an active or former dump?	A. Study was performed 12 years ago, can't remember. The purpose of the study was to observe and record any waste area along Alaska Highway. From notes on the Swift River Crossing site in report, this particular area had poles lying around, may have equated this with transformers and PCBs, however, no such items noted, therefore most likely not present. Not sure exactly where it was located relative to Swift River and old or new Highway. B. No recollection. If no note of it on report sheet, most likely not.
7. Jeff Sheldon, Trapper	Old resident of Study area	A. How long have you lived in this area? B. What do you remember of the Airstrip? Were there buildings, lights? Was it actively used? C. Do you recall the U.S. Army having a camp there? D. What did the camp consist of? E. Do you know of any dump sites in connection with any past users, army or HBMC? F. Do you recall of any spraying or use of chemicals for pest control or to keep vegetation down?	A. Born in 1918 and grew up in Carcross-Tagish area. In 1948 he got the trap line which is in the Pine Lake, Daughney Lake area. B. There were a couple of prefab buildings by the tower. There was a generator with lights along the airstrip but only for a short while. Doesn't recall seeing a plane there ever or hearing of one landing. C. No. Don't remember seeing such a camp but the Hudson's Bay Mining Co. Ltd. had a camp along the road there in late 1940's. [note: I described the location of Lot 7, Group 756 and he confirmed this is where the HBMC camp was] D. Temporary residence for exploration camp that was working west of Pine Lake Airstrip - consisted of wall tents only, no permanent structures, clearing left over from camp there during construction of the airstrip. E. No. Doesn't know of any dump sites. F. No. Doesn't recall. Not likely because the area was hardly used
8. Joe Suffix, YECL	Generator Info	A. What sort of generator would have operated at the Pine L. Airstrip?	A. Probably a 240V unit; Low voltage system compared to what is used now, but would have been enough for some lights, etc..

TABLE TWO: RESULTS OF INTERVIEW PROGRAM

INTERVIEWEE	RELATIONSHIP TO STUDY	QUESTION	RESPONSE
8. continued..		B. Would there be PCB's used in such a system?	B. No. PCB oils are the medium in which the contacts sit - the oil helps extinguish the arc that occurs between the contacts [due to lack of oxygen necessary for combustion]. The old 240V systems would have been an air breaker or 'air blast' system where a blast of air is used to disturb the arc - no PCB oil used in such a system.
		C. What other contaminant sources may have been present at this facility in connection with a diesel generating unit like this?	C. Definitely diesel fuel and motor oil. May have been varasol or other solvents used for cleaning purposes.
9. Vern Finster, Former YECL Employee	Generator Info, Historical Info	A. How are you familiar with study area?	A. Previously employed for YECL as Maintenance person for south-east Yukon. Has been here since 1940' s working throughout Yukon in electrical supply business.
		B. Describe the type of system used for the electrical needs of the Pine Lake Airstrip.	B. The Pine Lake Airstrip was more like a '3rd class' airstrip and was not used much. Probably just a little 15 Kilowatt generator used to supply direct 220-110V power for lights. There may have been some transformers necessary because such a low voltage would not carry the power too far.
		B. What do you mean by '3rd Class airstrip?	B. The primary airports would be something like Whitehorse or Watson Lake airports that were well equipped. Secondary airports were ones like Snag, Aishihik, Teslin, Swift River, and Beaton River which were well enough equipped to have lights on all the time and run all year long. The smaller, emergency airstrips like Pine Lake were never developed much but were just put in place for emergency purposes, lights were used infrequently and there wasn't service in the winter - no permanent structures or personnel.
		C. How different was this then a secondary airport like Snag?	C. Snag was a much bigger operation. Assembled a work crew to fix some electrical equipment in 1948. They had 5, 100 kilowatt generators with a fully equipped power house supplying energy for whole station.

TABLE TWO: RESULTS OF INTERVIEW PROGRAM

INTERVIEWEE	RELATIONSHIP TO STUDY	QUESTION	RESPONSE
10. Art Semler, Owner of Rancharia Lodge.	Info on Rancharia Dump Site	A. What do you know about the Dump across the road? B. Do you know if it was developed or used by the Army or others in connection with large Highway camp at Rancharia? C. Who was the previous owner of the lodge?	A. The dump was there when he bought the lodge 15 years ago. Never used it for dumping their waste. B. No idea if U.S. army used it. He has seen some old equipment in the bush all up and down the highway in this area. C. Bud Simpson, Currently lives in Kelowna, B.C.
11. Bud Simpson, Previous owner of Rancharia Lodge	Info on Rancharia Dump Site	A. How long did you own the Rancharia Lodge? B. What do you know about the dump across the road? Was it there in 1946 when you bought it? C. Do you know if the Army or others in connection with the previous camp used the area to dispose of any type of waste? If not, where did they dispose of waste?	A. Bought it in 1946 from White Pass, sold it in 1974 to current owners. B. No, it wasn't there in 1946. They made it for domestic waste deriving from the lodge. Used it for a few years and then started using the one down the highway when the government made one. C. No, military or others associated with highway did not dump things there - it was just bush. He didn't know of any waste dumps in connection with the old camp there.
12. Jan Fozard	Info on Swift River Crossing Site	A. What do you know of the Swift River Crossing?	B. Worked on the "Research of Former Military Sites & Activities in the Yukon" (K.Bisset, 1995) study. Does not recall anything specific about the Swift River crossing area, however, they found in study that pretty much every river crossing had some sort of a small camp due to the construction of a bridge.

Table 3: NUMERICAL COMPARISON OF CHEMICAL LABORATORY RESULTS WITH ENVIRONMENTAL QUALITY CRITERIA

CONTAMINANT	DRAFT CONTAMINATED SITES REGULATIONS (YTG)			CHEMICAL LABORATORY TEST RESULTS								
	SCHED 1 ²	SCHED.2 ³	SCHED3 ⁴	1	2	4	7	8	10	15	20	23
Total Metals												
Antimony	20										<20	<20
Arsenic											5.35	4
Barium	750										99	72
Beryllium	4										0.7	<0.5
Cadmium											<2	<2
Chromium	750										20	17
Cobalt	40										7	5
Copper ⁷		15									15	11
Lead											0.015	0.008
Molybdenum	5										<4	<4
Nickel	150										17	14
Selenium	2										<0.1	<0.1
Silver	20										<2	<2
Tin	5										<30	<30
Vanadium	200										29	23
Zinc											78	43
Leachable Anions & Cations												
Bromide											<5	<5
Chloride			250								13	<5
Fluoride			1								0.6	0.8
Nitrate Nitrogen			10								<1	<1
Nitrite Nitrogen			3.2								<1	<1
Sulphate			500								21	<10
Water Soluble Volatiles												
Ethylene Glycol				<100		<100						

Table 3: NUMERICAL COMPARISON OF CHEMICAL LABORATORY RESULTS WITH ENVIRONMENTAL QUALITY CRITERIA

CONTAMINANT	DRAFT CONTAMINATED SITES REGULATIONS (YTG)			CHEMICAL LABORATORY TEST RESULTS								
	SCHED. 1	SCHED.2	SCHED 3	1	2	4	7	8	10	15	20	23
Chlorinated Hydrocarbons												
1,2- Dichlorobenzene	0.1			<0.010								
1,3-Dichlorobenzene	0.1			<0.010								
1,4-Dichlorobenzene	0.1			<0.010								
Hexachlorobenzene	0.05			<0.010								
Hexachlorobutadiene				<0.010								
Hexachlorobutadiene				<0.010								
Hexachloroethane				<0.010								
Pentachlorobenzene	0.05			<0.010								
1,2,3,4-tetrachlorobenzene	0.05			<0.010								
1,2,3,5-Tetrachlorobenzene	0.05			<0.010								
1,2,3-Trichlorobenzene	0.05			<0.010								
1,2,4-Trichlorobenzene	0.05			<0.010								
Polychlorinated Biphenyls												
Total Polychlorinated Biphenyls		0.5				<0.05	<0.05	<0.05	<0.1			
Extractables												
EPH (C ₁₀ -C ₁₈) ⁵	1000			2630	<250	350	<250	<250	444	<250	<250	
EPH (C ₁₉ -C ₃₁) ⁶	1000			2660	<250	6410	7450	10100	20200	<250	<250	

- NOTES: ¹ Government of Yukon, Draft Contaminated Sites Regulations (1996)
² Generic Numerical Soil Standards, Agricultural land use
³ Matrix Numerical Soil Standards, Agricultural land use, environmental prot.
⁴ Generic Numerical Water Standards

- ⁵ LEPH test without correction for PAH
⁶ HEPH test without correction for PAH
⁷ Criteria taken for human health protection

J.R. Paine & Associates Ltd.

APPENDIX A

Results of Geophysical Surveys - AMCL Report

**PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
CONTRACT 96-6134**

Submitted to:
J.R. Paine & Associates Ltd.
Whitehorse, YT

Submitted by:
Associated Mining Consultants Ltd.

AMCL Associated
Mining Consultants Ltd.



1401, 910 - 7 Avenue S.W.: Calgary, Alberta, Canada T2P 3N8
Tel: (403) 264-9496 Fax: (403) 269-7640

File: PG92
October 22, 1996

J.R. PAINE & ASSOCIATES LTD.
14 Burns Road
Whitehorse, YT
Y1A 4Q9

Attention: Mr. Michael Billowits, P.Eng.

Dear Michael

Associated Mining Consultants Ltd. (AMCL) is pleased to submit the following final report entitled:

Preliminary Environmental Investigations
Contract 96-6134
Geophysical Surveys

We would like to express our thanks to J.R. Paine & Associates Ltd. for the opportunity to provide our services in relation to this project.

Yours truly
ASSOCIATED MINING CONSULTANTS LTD.

A handwritten signature in black ink, appearing to read 'Mark Bowman'. The signature is fluid and cursive, with a large initial 'M' and 'B'.

Mark Bowman, P.Geoph.
Senior Geophysicist

MB/mlh

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Letter of Transmittal
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1.0 INTRODUCTION

This report presents the results of magnetic and electromagnetic surveys undertaken for J. R. Paine & Associates Ltd. in the Swift River and Pine Lake regions of Yukon Territory on October 3 and 4, 1996. The geophysical surveys were a component of the preliminary environmental investigations of abandoned Alaska Highway construction sites (Figure 1).

The objective of the surveys was to map variations in magnetic response and/or ground conductivity to determine the presence of buried metal.

The geophysical surveys were carried out in accordance with Associated Mining Consultants Ltd.'s (AMCL's) proposal AMP 784 dated August 26, 1996.

2.0 METHOD

The time domain electromagnetic method is generally the preferred geophysical technique for the delineation of subsurface metals. However, relatively dense vegetation growth at many of the survey regions precluded its use. At those sites where use of electromagnetic instrumentation was not feasible, the magnetic method was employed.

2.1 Electromagnetic Method

A time-varying electromagnetic (EM) field produced at surface, results in currents flowing within subsurface conductors in configurations defined by the laws of electromagnetic induction. Resulting secondary EM fields distort the primary field. The resultant field, measurable at any point on the surface of the ground, differs from the primary field in intensity, phase and direction to an extent dependant on the magnitude and geometry of the subsurface conductor(s).

The Geonics Limited EM61 is a high powered time domain EM metal detector. The decay of secondary currents produced by a pulsed primary field is measured a relatively long time after the primary pulse is terminated. This technique results in a method where results are essentially independent of ground conductivity.

The use of two vertically displaced receiver coils enables a filtering, of sorts, of near surface anomalies.

The EM61 survey data were collected at approximately 0.2 metre intervals along survey lines spaced 1 and 2 metres apart.

2.2 Total Field Magnetic Method

Magnetometers measure the intensity of the geomagnetic field. The geomagnetic field is comprised of two main parts:

- The earth's magnetic field. The origin of this field is apparently a system of electric currents originating in the earth's fluid conductive core. The resulting magnetic field resembles that of a large bar magnet.
- Local magnetic anomalies in the relatively near surface. These consist of variations caused by geological features such as magnetic rocks and by man-made magnetic objects.

Over relatively small areas, magnetic geological features contribute minimally to the geomagnetic field and local magnetic anomalies are generally entirely due to above surface magnetic/electromagnetic sources and to buried metallic objects.

At those sites requiring the use of magnetic methods, a 5 metre by 5 metre survey grid was established by J. R. Paine & Associates Ltd. personnel. Total field magnetic measurements were subsequently recorded on a 2.5 metre by 2.5 metre interval grid.

The magnetic response at base stations, located adjacent to each survey grid, were repeatedly measured and recorded at small time intervals (less than 90 minutes) to compensate for diurnal variations in the earth's magnetic field.

3.0 RESULTS

Results of the EM61 surveys are presented as coloured contour maps illustrating lateral variations in electromagnetic response (mV) at each site area. The lower coil response (Channel 2) identifies all buried and surficial metal within the sphere of effect of that coil. The differential channel is the algebraic difference of the upper coil responses, resulting in a partial filtering of near surface sources. In general, upper coil response (Channel 1) is biased towards metallic objects occurring at shallow depth.

Results of the corrected total field magnetometer surveys are presented as coloured contour maps illustrating lateral variations in magnetic intensity. Background magnetic intensity was subtracted from the field measurements, as indicated within each figure, to further clarify the presentation of the data.

3.1 Pine Lake Site P1

The relative location of Site P1 is illustrated in Figure 2a. Dense vegetation within the perimeter of the site precluded the use of the EM61 instrumentation.

Results of the total field magnetometer survey at Site P1 identify two main regions of anomalous magnetic response as labelled in Figure 2b. Interpretation is as follows:

- P1a** Occurring within the vicinity of two partially buried metal drums within the perimeter of a wooden building foundation (25W, 22S), the magnitude of the anomalous response suggests that additional buried metal occurs within this vicinity.
- P1b** A relatively broad and weak negative anomaly likely due to buried metal occurring at, or immediately east of 0W, 50S. As the anomalous response was not readily evident during data collection, the survey was not expanded to encompass the full lateral extent of the anomaly.
- P1c** This region depicts a relatively wide extent of slightly depressed magnetic intensity. It is unlikely that this anomalous region is the result of significant, or indeed any, quantities of buried metal.

3.2 Pine Lake Site P2

Conditions at Site P2, located immediately adjacent to the existing airstrip (Figure 2a), prevented the use of EM61 survey equipment. Instead, a total field magnetometer survey was conducted, identifying five distinct regions of anomalous response (Figure 2c). Interpretation is as follows:

- P2a, P2b** Increased magnetic response, indicative of buried metal, coincident with a rock pile of approximately 1 metre height (6E, 42N and 15E, 40N). Some evidence of metal at surface.
- P2c** Relatively low (negative) magnetic response indicative of buried metal at, or immediately adjacent to, 5E, 30N.
- P2d** High magnetic response at 11E, 15N coincident with rock pile; indicative of buried metal. Some scrap metal evident on surface.
- P2 e** Relatively strong magnetic response of very limited lateral extent indicative of buried metal at shallow depth (10E, 2N).

In addition to those anomalies identified in Figure 2c, increased magnetic response occurs along survey line 50E, within a small mound occurring immediately adjacent to the airfield to the east. This suggests the occurrence of metallic objects distributed within the mound.

3.3 Pine Lake Site P3

Located north of Site P2 (Figure 2a), similar vegetation conditions occur at Site P3. It was therefore not possible to perform EM61 surveys within this region. Instead, a total field magnetometer survey has identified three main anomalies (Figure 2d) described as follows:

- P3a** A strong, laterally extensive magnetic anomaly occurring within the southeast region of the survey area attributed exclusively to the effects of the metal windsock pole and scrap metal apparent on ground surface (wire, metal trim, etc.).
- P3b** Attributed exclusively to coincident metal pipe extending approximately one metre above ground surface at 2.5E, 22.5N.
- P3c** Relatively strong magnetic response at 20E, 3N. Although survey grid was extended in this region, the anomaly was found to be of limited lateral extent. Interpreted as a relatively small, shallow occurring metallic object.

Other, somewhat weaker anomalous responses are evident within the survey grid occurring coincident with scrap surface metal (e.g. 40E, 5N).

3.4 Pine Lake Site P4

The relative location of Site P4 is illustrated by Figure 2a. Topographical constraints, in addition to regions of dense vegetation, precluded the use of the EM61 survey instrumentation.

The only anomalous magnetic response occurs coincident with scrap metal visible on surface (4E,4N) as shown in Figure 2b. No evidence of buried metal within the survey area is apparent.

3.5 Swift River Site

The Swift Site is located within an open region adjacent to Swift River (Figure 3a), approximately 250 metres west of kilometre milepost 1166 of the Alaska Highway. Site conditions enabled the EM61 survey method to be used.

As illustrated by Figure 3b, no evidence of significant buried metal is apparent within the EM61 Channel 2 survey results. Slight increases in electromagnetic response may be attributed to very small metallic articles distributed on surface (ie. small pieces of wire, beverage cans, etc.).

Measurements were monitored, but not recorded, in the region immediately to the south and west of the surveyed area in a random fashion to detect anomalous response indicative of buried metal. No such indicators were evident.

3.6 Camp Site

Two regions were surveyed at the Camp Site (Figure 4a). Camp Site C1 were situated within a relatively large open area adjacent to kilometre milepost 1170 of the Alaska Highway. Site conditions enabled use of the EM61 survey instrumentation.

Further to the south of Camp Site C1, at Camp Site C2, a magnetometer survey was performed to further investigate existing earth mounds and building foundations.

3.6.1 Camp Site C1

Two regions of anomalous response are apparent within the EM61 Channel 2 survey data (Figure 4b) at 39E,3N and 4E,5N. Upon review of the EM61 Differential Channel data (Figure 4c), it is apparent that Anomaly **C1a** may be attributed to buried metal immediately below ground surface, likely within the upper one-half metre. Anomaly **C1b** is a response to deeper occurring metal.

To determine the western extent of Anomaly **C1a**, EM61 conductivity measurements were monitored immediately to the west of the limits of the survey grid. Anomaly **C1a** did not extend beyond those boundaries defined in Figures 4b and 4c.

3.6.2 Camp Site C2

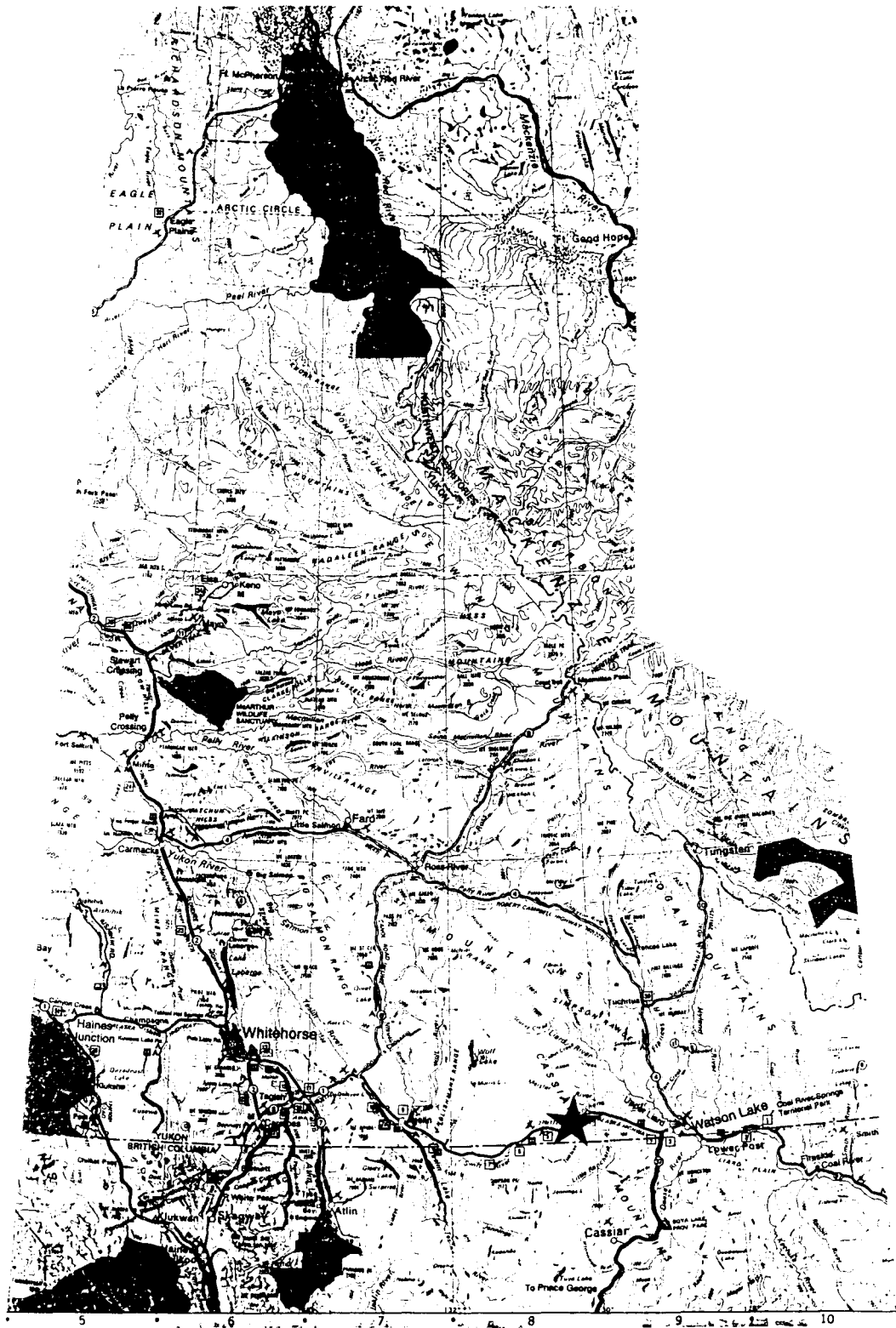
Results of the total field magnetometer survey performed at Camp Site C2 reveals anomalous response at 3E,2N, coincident with surficial scrap metal (Figure 4c). No evidence of buried metal is apparent within the Camp Site C2 survey area.

Random magnetic field measurements were obtained within a region of what appeared to be stressed vegetation located southeast of Camp Site P2. Magnetic response in this area was in the order of background response.

4.0 RECOMMENDATIONS

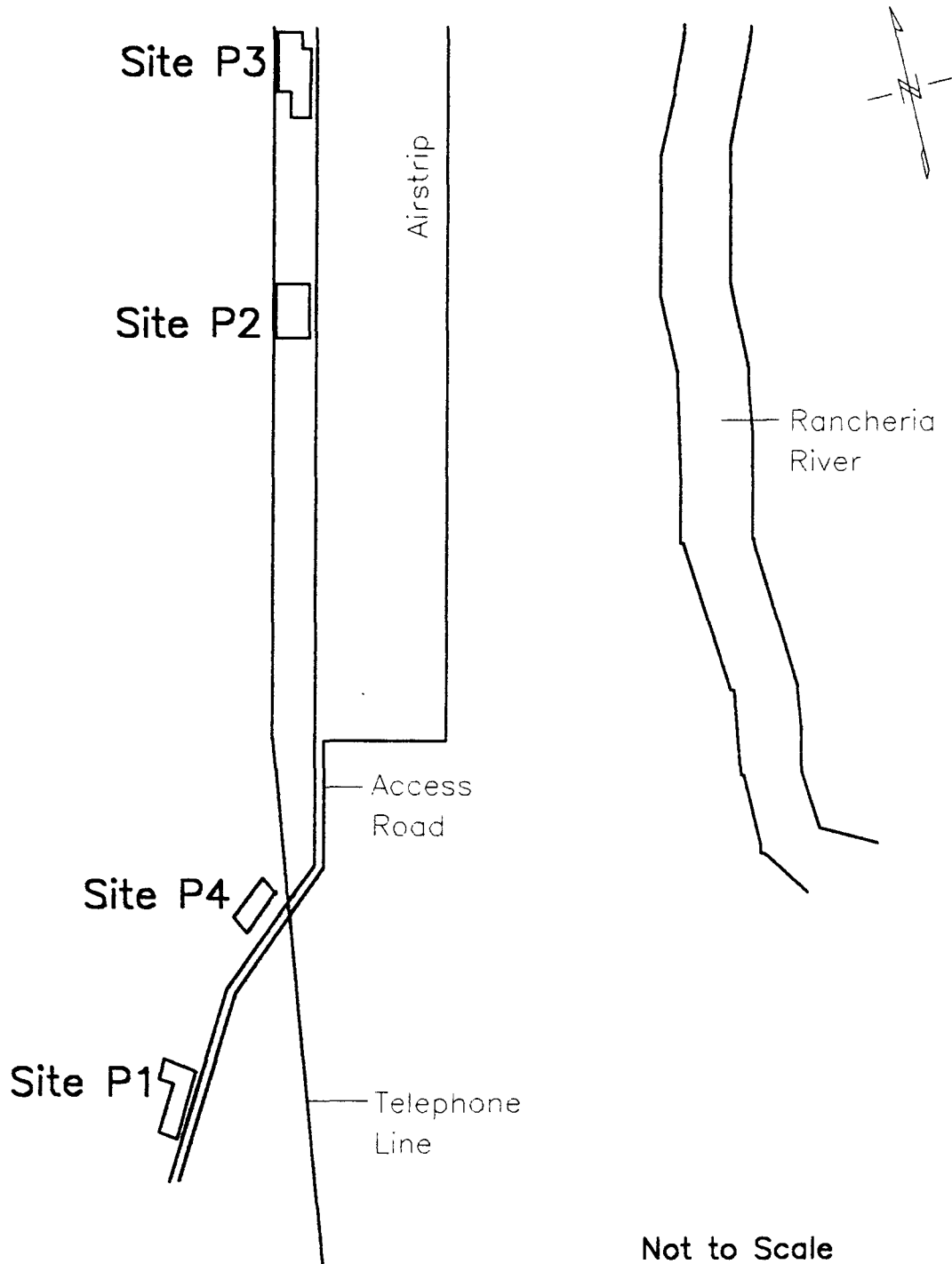
A number of magnetic and electromagnetic anomalies have been identified at the Pine Lake and Swift River sites that are attributed to the presence of metals. With the exception of Anomaly **P3a** at Pine Lake Site P3, which may be attributed to above ground features, magnetic and electromagnetic anomalies are relatively weak and of limited lateral extent. This suggests that only a small quantity of buried metal exists at those sites surveyed.

Snow cover during the time of the geophysical surveys prevented a detailed visual inspection of the ground surface. Therefore, prior to subsequent invasive investigations of the identified anomalies, it is recommended that ground surface be inspected further to ensure that the anomalous responses are not due to surficial metal.



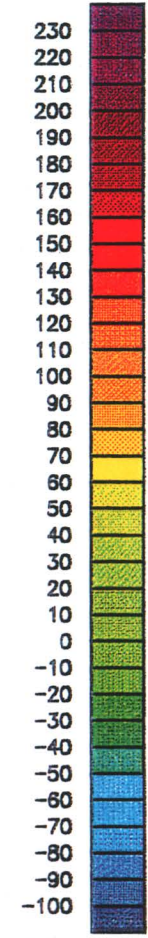
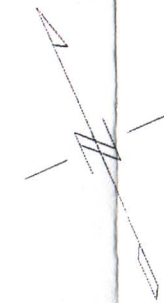
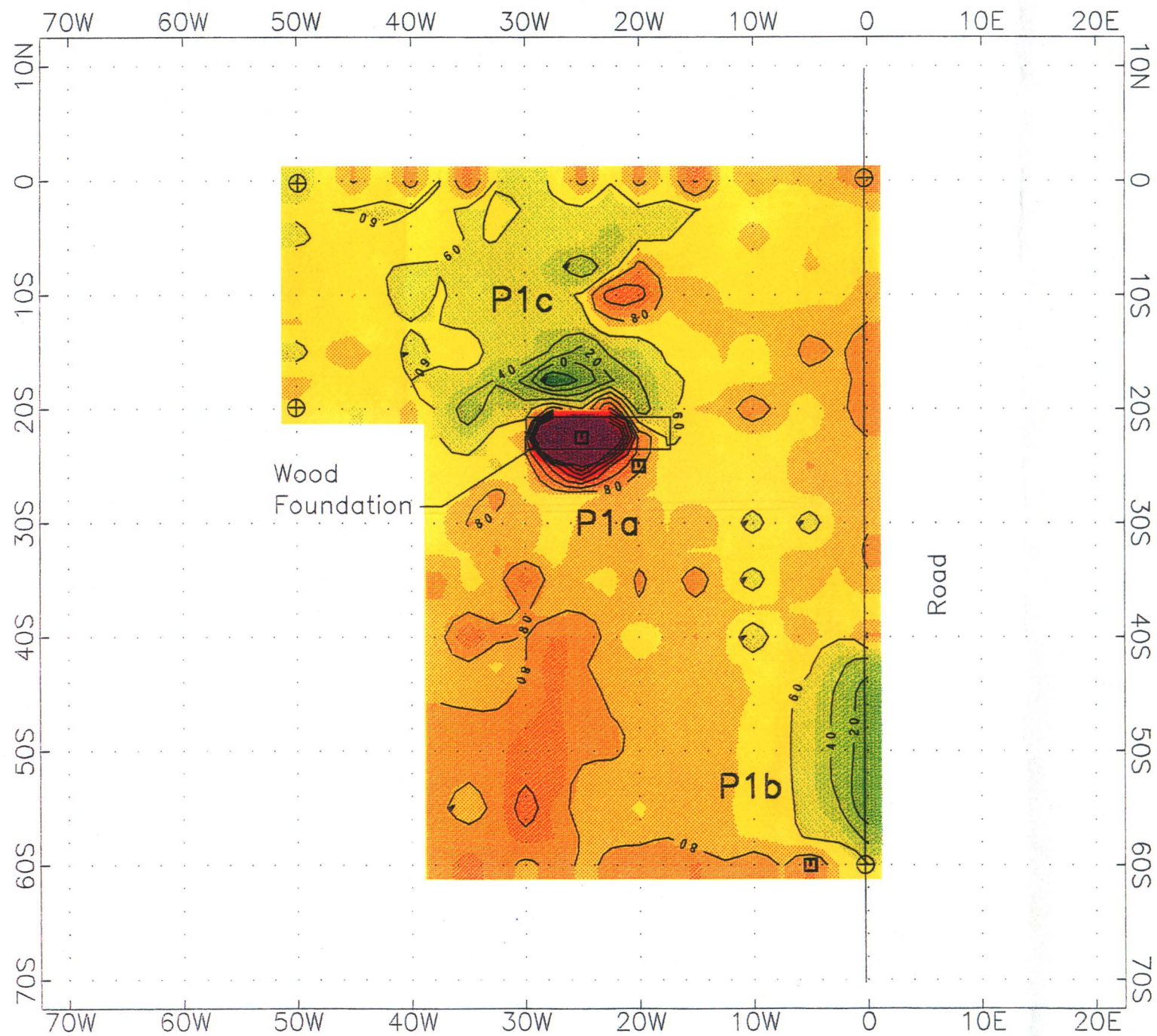
★ Site Location

<p>J R PAINE & ASSOCIATES LTD PRELIMINARY ENVIRONMENTAL INVESTIGATIONS CONTRACT 96-6134 SITE LOCATION</p>
<p>October, 1996 - Figure 1</p>
<p>ASSOCIATED MINING CONSULTANTS LTD PG92</p>



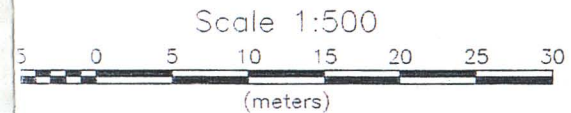
Not to Scale

J R PAINE & ASSOCIATES LTD
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
CONTRACT 96-6134
PINE LAKE SITE MAP
October, 1996 - Figure 2a
ASSOCIATED MINING CONSULTANTS LTD PG92

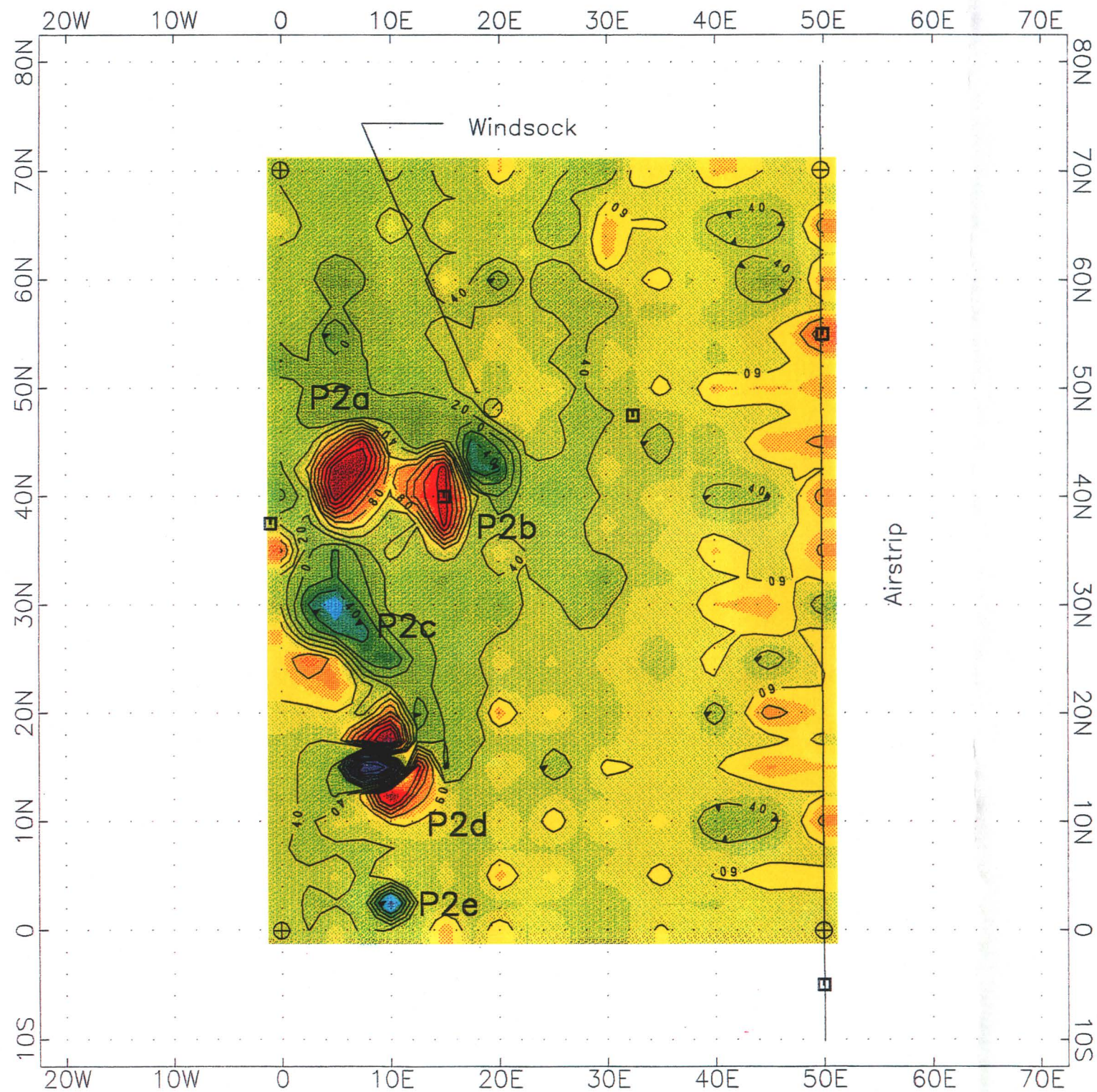


MAGNETIC INTENSITY
(nT) (57800 nT subtracted)

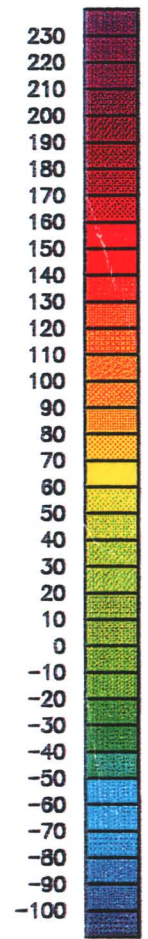
- P1a Magnetic Anomaly
- ▣ Surface Metals
- ⊕ Survey Grid Markers



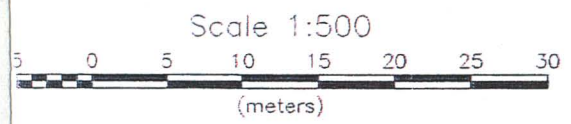
J R PAINE & ASSOCIATES LTD	
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS	
CONTRACT 96-6134	
PINE LAKE SITE P1	
TOTAL FIELD MAGNETOMETER SURVEY	
October 1996 - Figure 2b	
ASSOCIATED MINING	CONSULTANTS LTD. - PG92



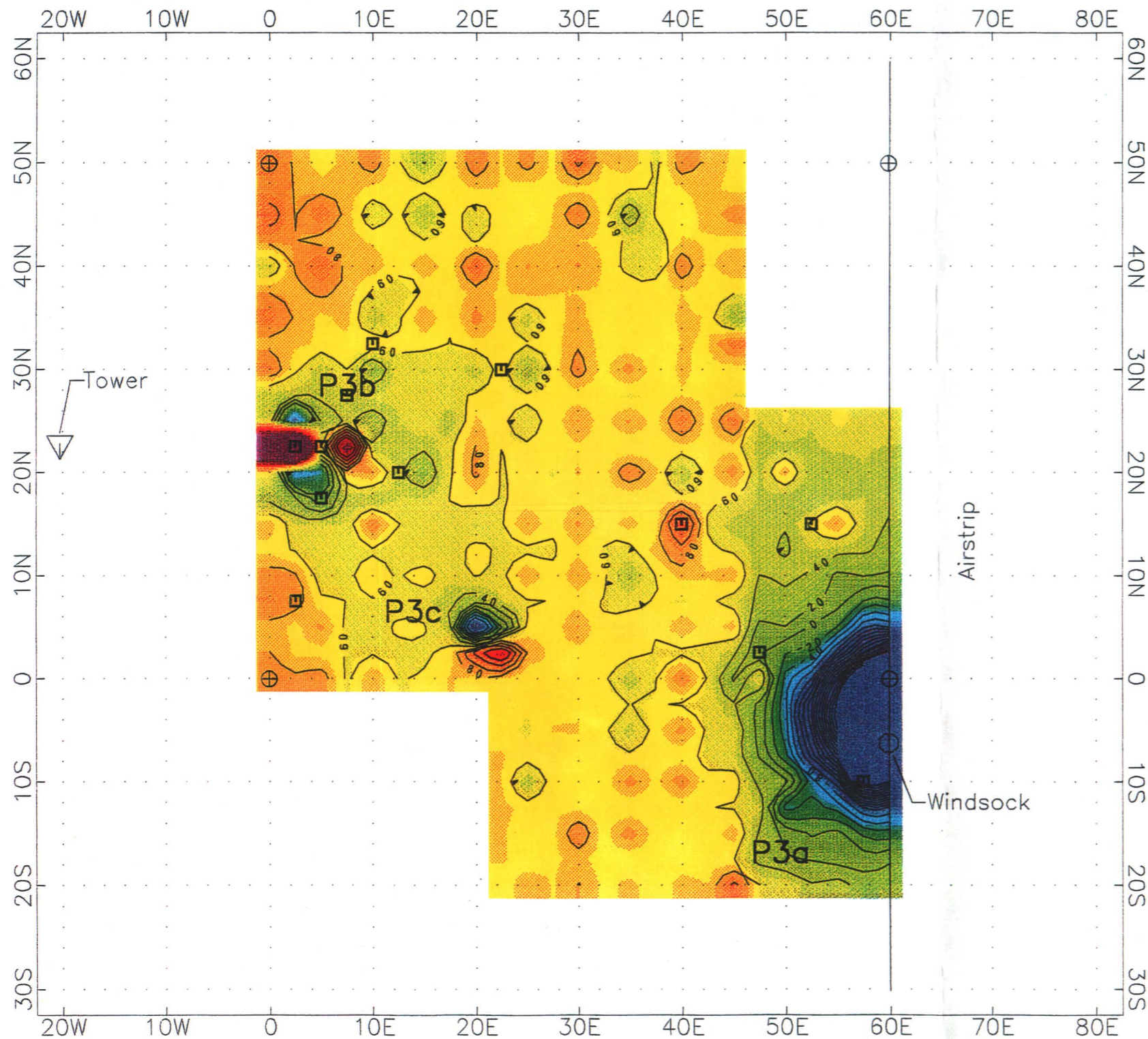
- P2a Magnetic Anomaly
- Surface Metals
- ⊕ Survey Grid Markers



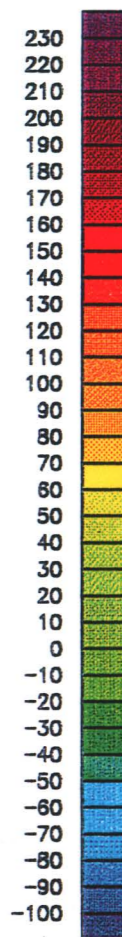
MAGNETIC INTENSITY (nT) (57800nT subtracted)



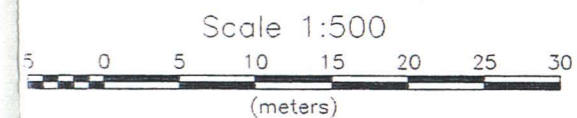
J R PAINE & ASSOCIATES LTD
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS CONTRACT 96-6134 PINE LAKE SITE P2
TOTAL FIELD MAGNETOMETER SURVEY October, 1996 - Figure 2c
ASSOCIATED MINING CONSULTANTS LTD. - PG92



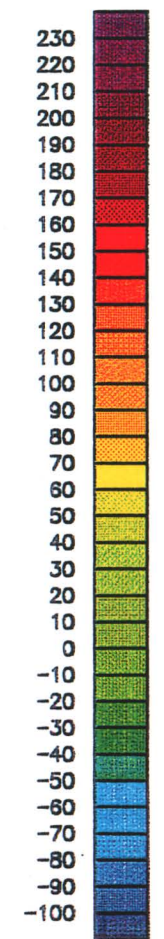
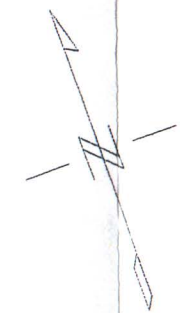
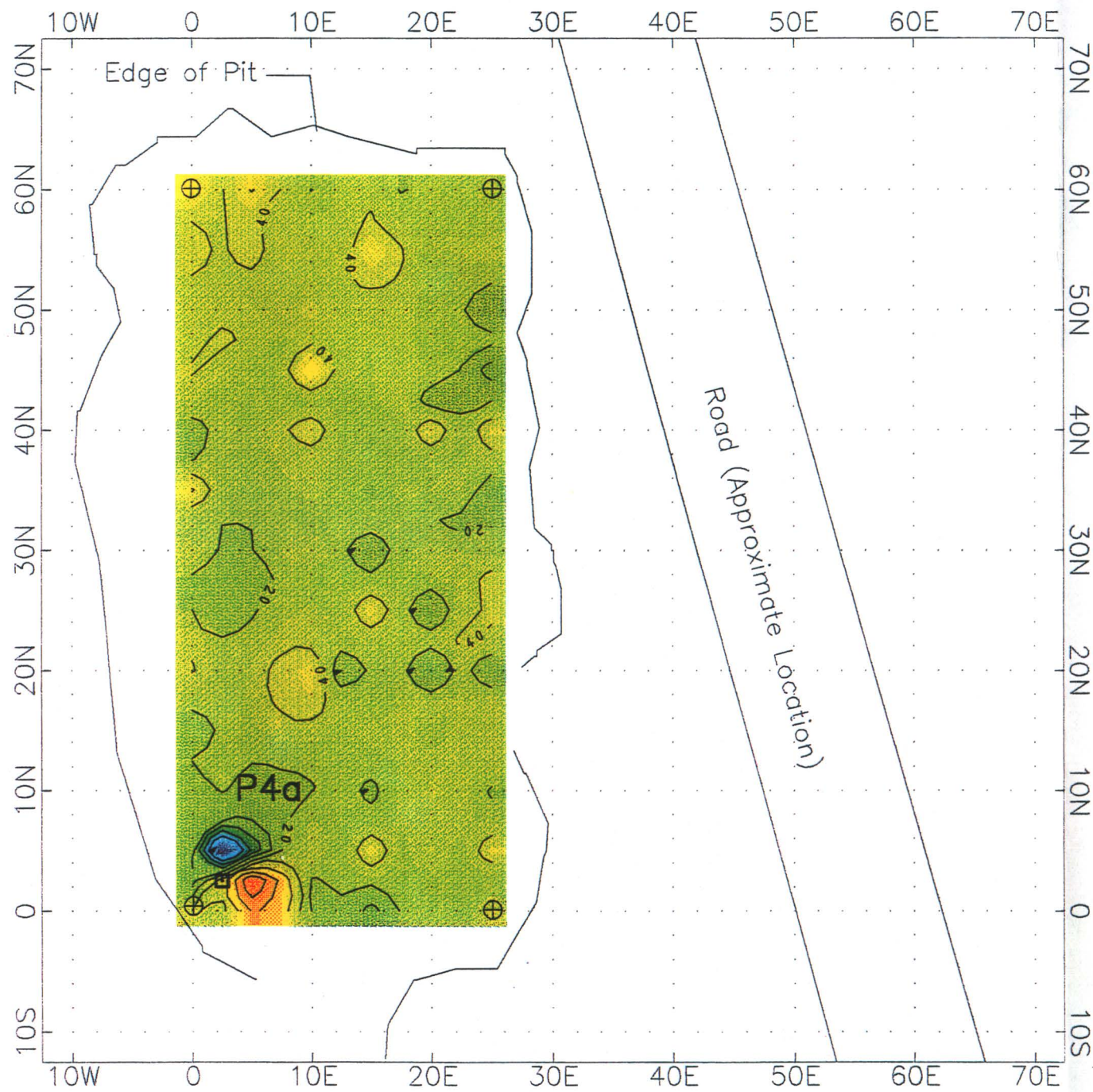
- P3a** Magnetic Anomaly
- Surface Metals
- ⊕ Survey Grid Markers



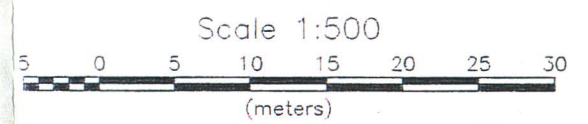
MAGNETIC INTENSITY
(nT) (57800nT subtracted)



J R PAINE & ASSOCIATES LTD
 PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
 CONTRACT 96-6134
 PINE LAKE SITE P3
 TOTAL FIELD MAGNETOMETER SURVEY
 October, 1996 - Figure 2d
 ASSOCIATED MINING CONSULTANTS LTD. - PG92



- P4a Magnetic Anomaly
- Surface Metals
- ⊕ Survey Grid Markers



J R PAINE & ASSOCIATES LTD
 PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
 CONTRACT 96-6134
 PINE LAKE SITE P4
 TOTAL FIELD MAGNETOMETER SURVEY
 October, 1996 - Figure 2e
 ASSOCIATED MINING CONSULTANTS LTD. - PG92

Swift River

266m to Km Post 1166

Alaska Highway

Swift River Site

Limit of Gravel Fill

Grassed Area

Hill

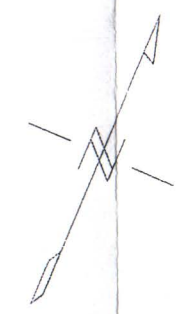
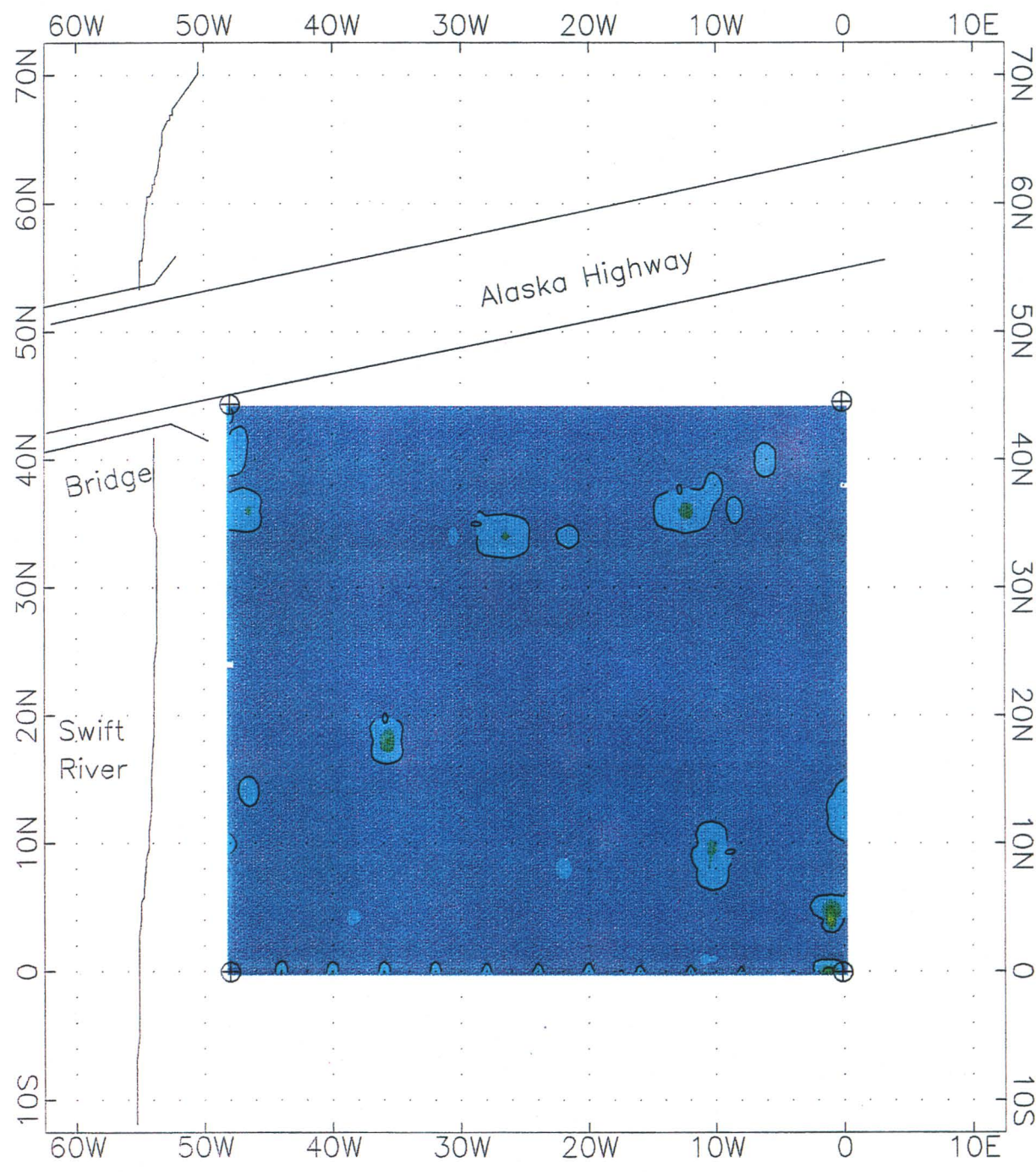
Not to Scale

J R PAINE & ASSOCIATES LTD

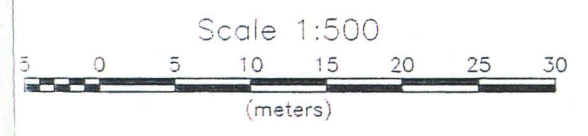
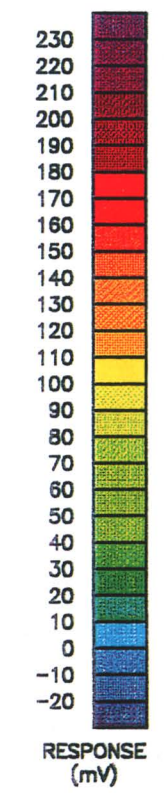
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
CONTRACT 96-6134
SWIFT RIVER SITE

October, 1996 - Figure 3a

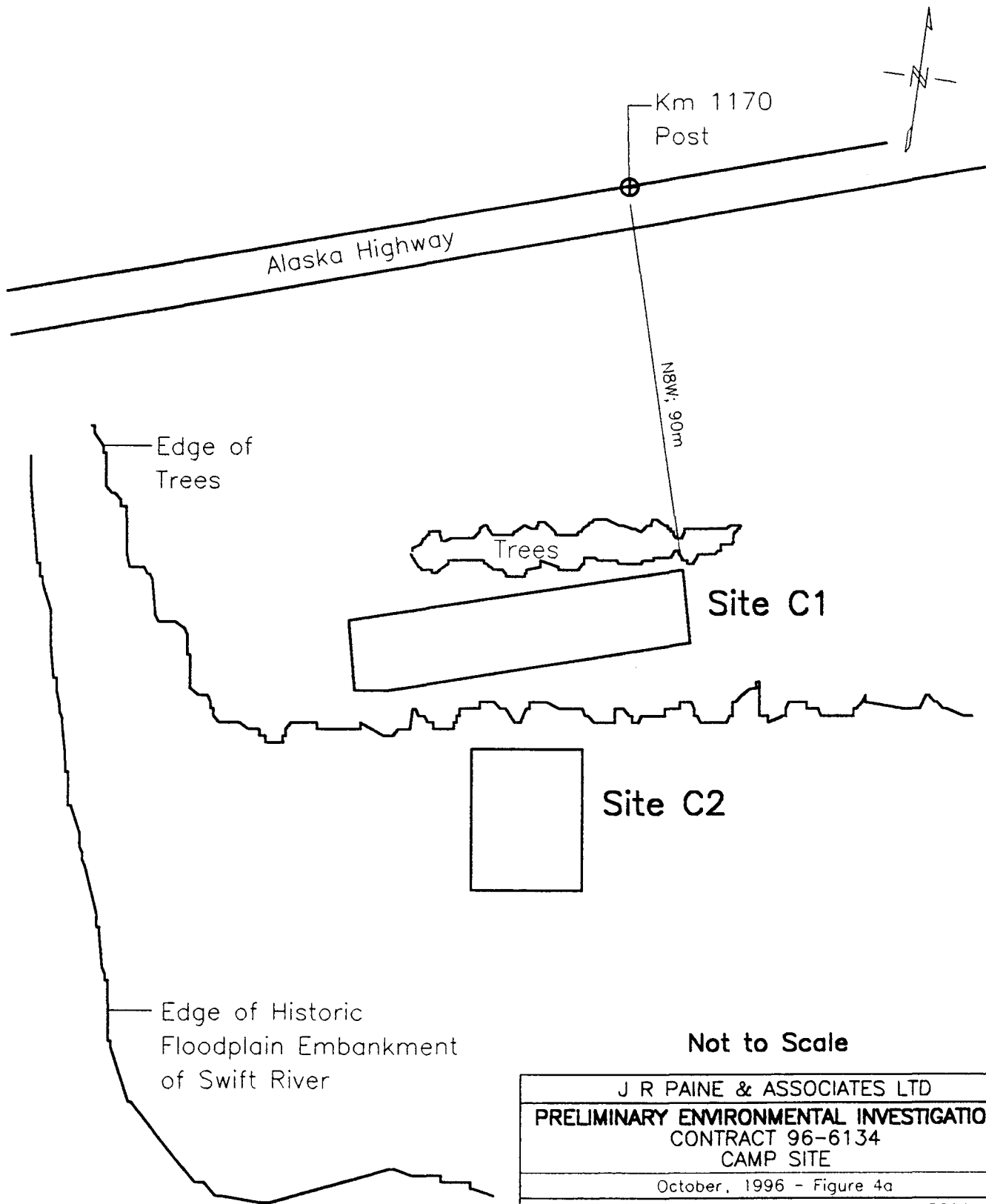
ASSOCIATED MINING CONSULTANTS LTD PG92



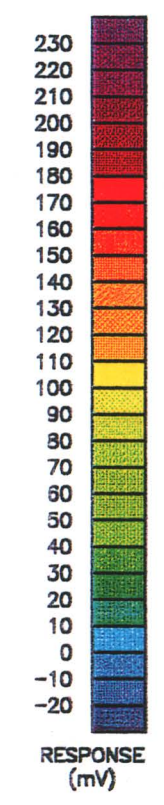
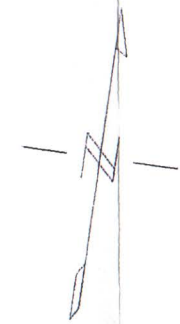
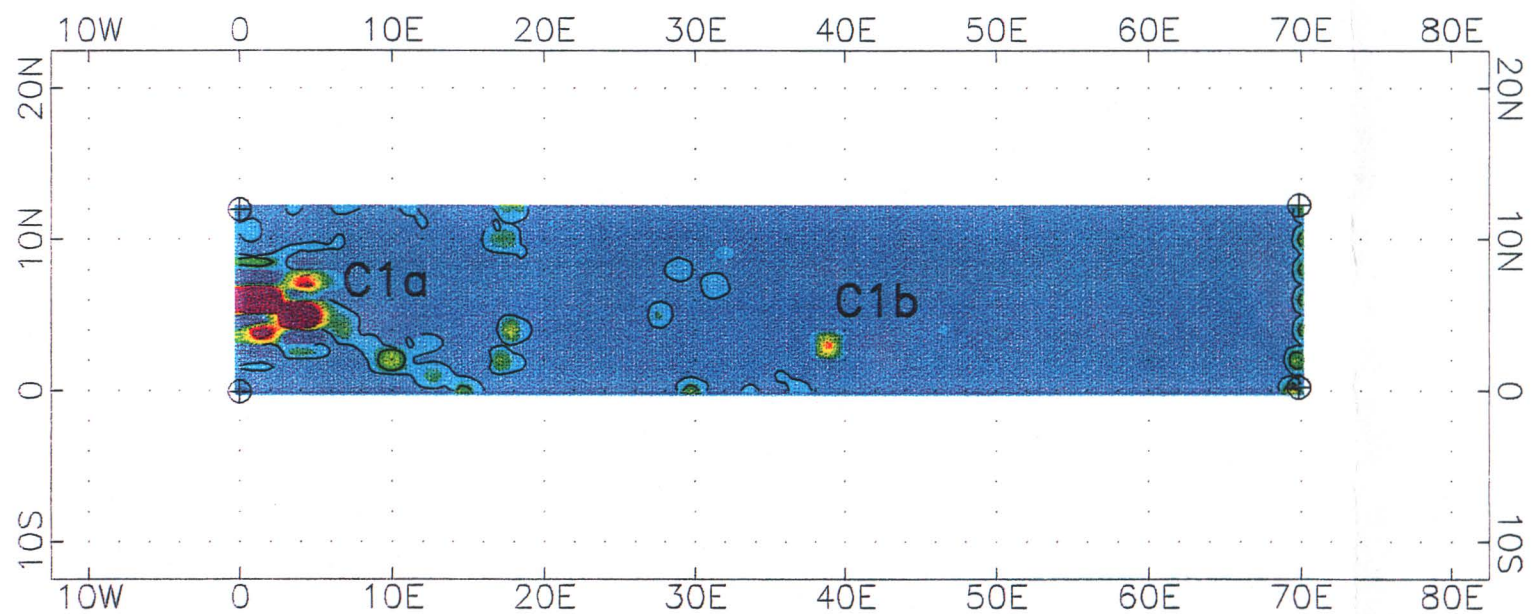
⊕ Survey Grid Markers



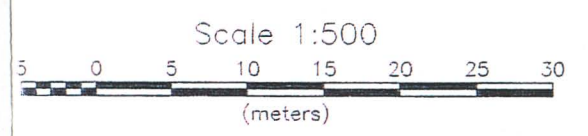
J R PAINE & ASSOCIATES LTD
 PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
 CONTRACT 96-6134
 SWIFT RIVER SITE
 EM61 SURVEY - Channel 2
 October, 1996 - Figure 3b
 ASSOCIATED MINING CONSULTANTS LTD. - PG92



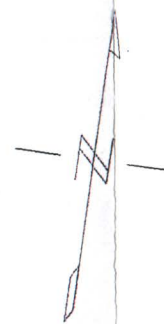
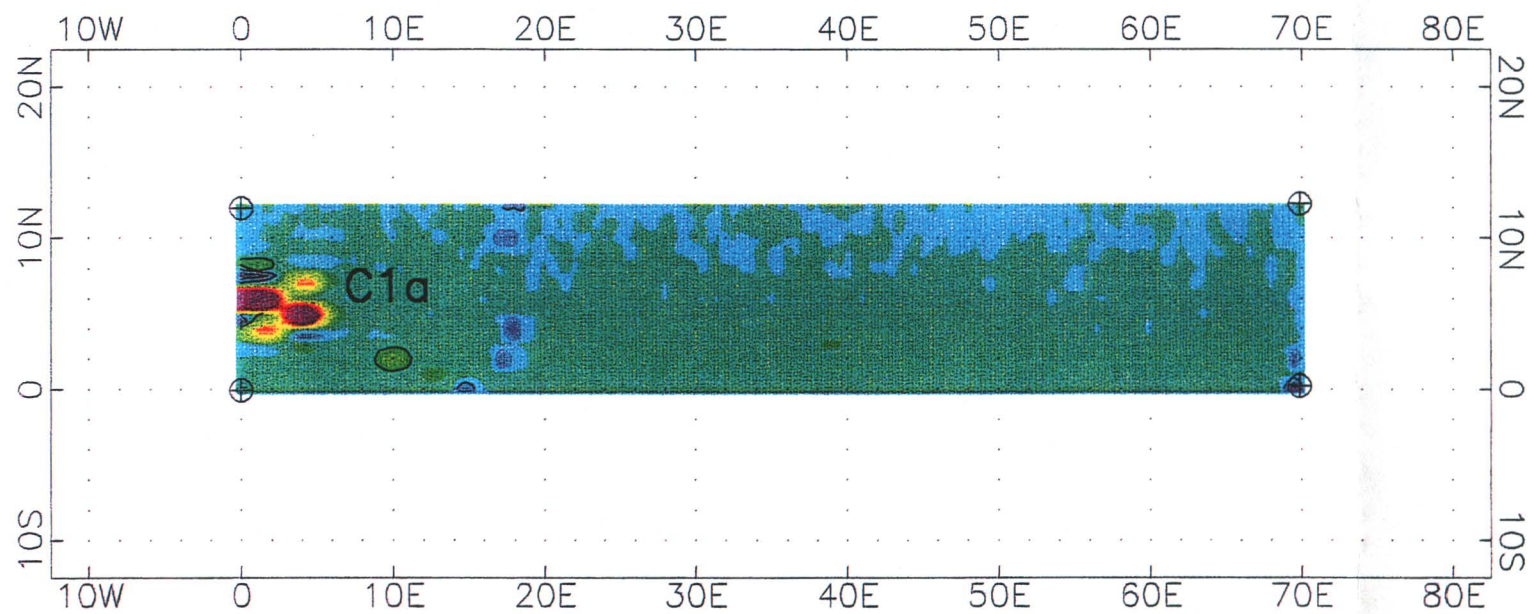
J R PAINE & ASSOCIATES LTD
PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
CONTRACT 96-6134
CAMP SITE
October, 1996 - Figure 4a
ASSOCIATED MINING CONSULTANTS LTD PG92



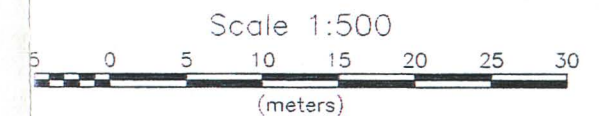
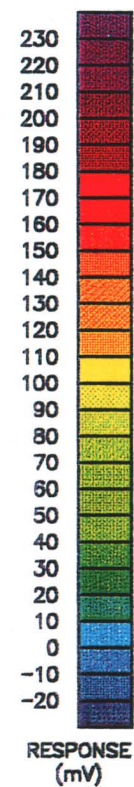
C1a Electromagnetic Anomaly
 ⊕ Survey Grid Markers



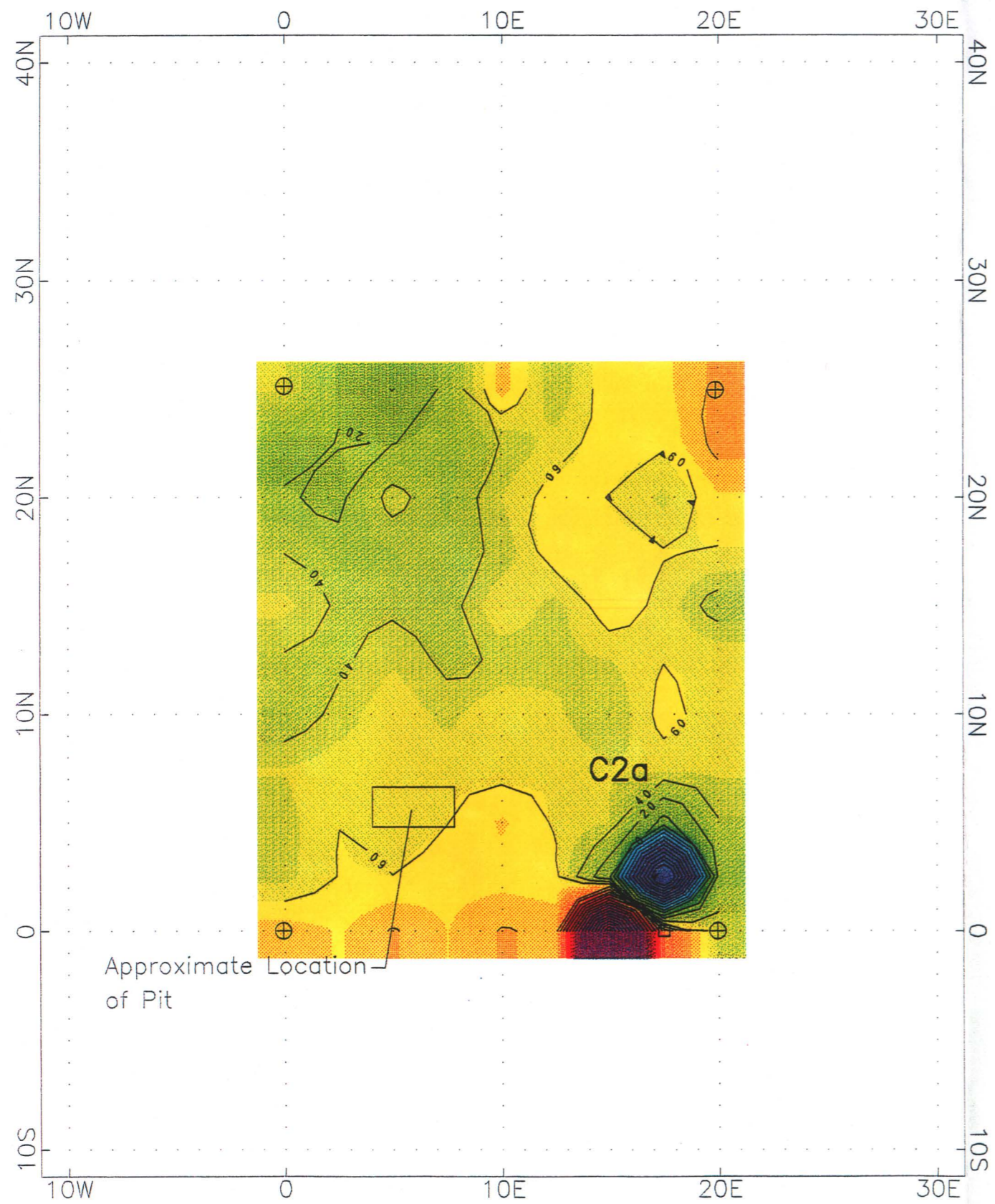
J R PAINE & ASSOCIATES LTD
 PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
 CONTRACT 96-6134
 CAMP SITE C1
 EM61 SURVEY - Channel 2
 October, 1996 - Figure 4b
 ASSOCIATED MINING CONSULTANTS LTD. - PG92



C1a Electromagnetic Anomaly
 ⊕ Survey Grid Markers

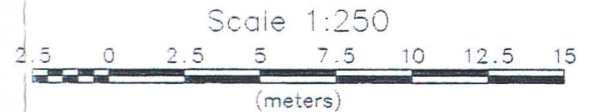
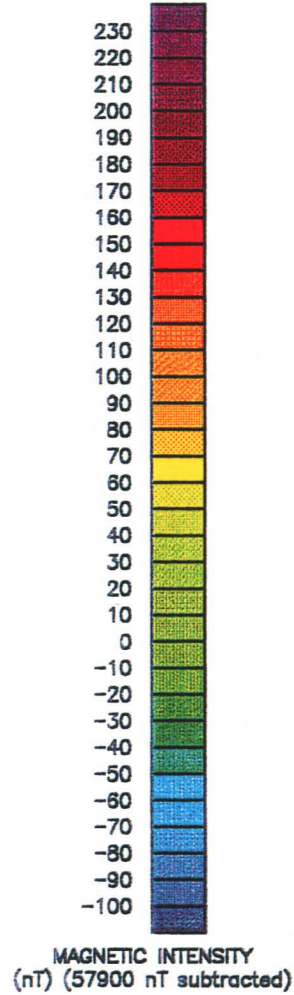


J R PAINE & ASSOCIATES LTD
 PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
 CONTRACT 96-6134
 CAMP SITE C1
 EM61 SURVEY - Differential Channel
 October, 1996 - Figure 4c
 ASSOCIATED MINING CONSULTANTS LTD. - PG92



Approximate Location of Pit

- C2a Magnetic Anomaly
- Surface Metals
- ⊕ Survey Grid Markers



J R PAINE & ASSOCIATES LTD
 PRELIMINARY ENVIRONMENTAL INVESTIGATIONS
 CONTRACT 96-6134
 CAMP SITE C2
 TOTAL FIELD MAGNETOMETER SURVEY
 October, 1996 - Figure 4d
 ASSOCIATED MINING CONSULTANTS LTD. - PG92

APPENDIX B

Test Pit Logs with Physical Lab Results

NOTES ON SOIL CLASSIFICATION

The soil is named after its principal component, and modified by other components as follows:

Presence of Component

greater than 15%
11% to 15%
5% to 10%

Modifier

XXX-ey
some XXX
trace of XXX

Examples

<u>CLAY</u>	<u>SILT</u>	<u>SAND</u>	<u>GRAVEL</u>	
65%	15%	10%	10%	CLAY, some silt, trace of sand, trace of gravel
5%	10%	45%	40%	GRAVELLY SAND, trace of silt, trace of clay
10%	65%	25%	---	SANDY SILT, trace of clay

Also, the USC Classification System is used.

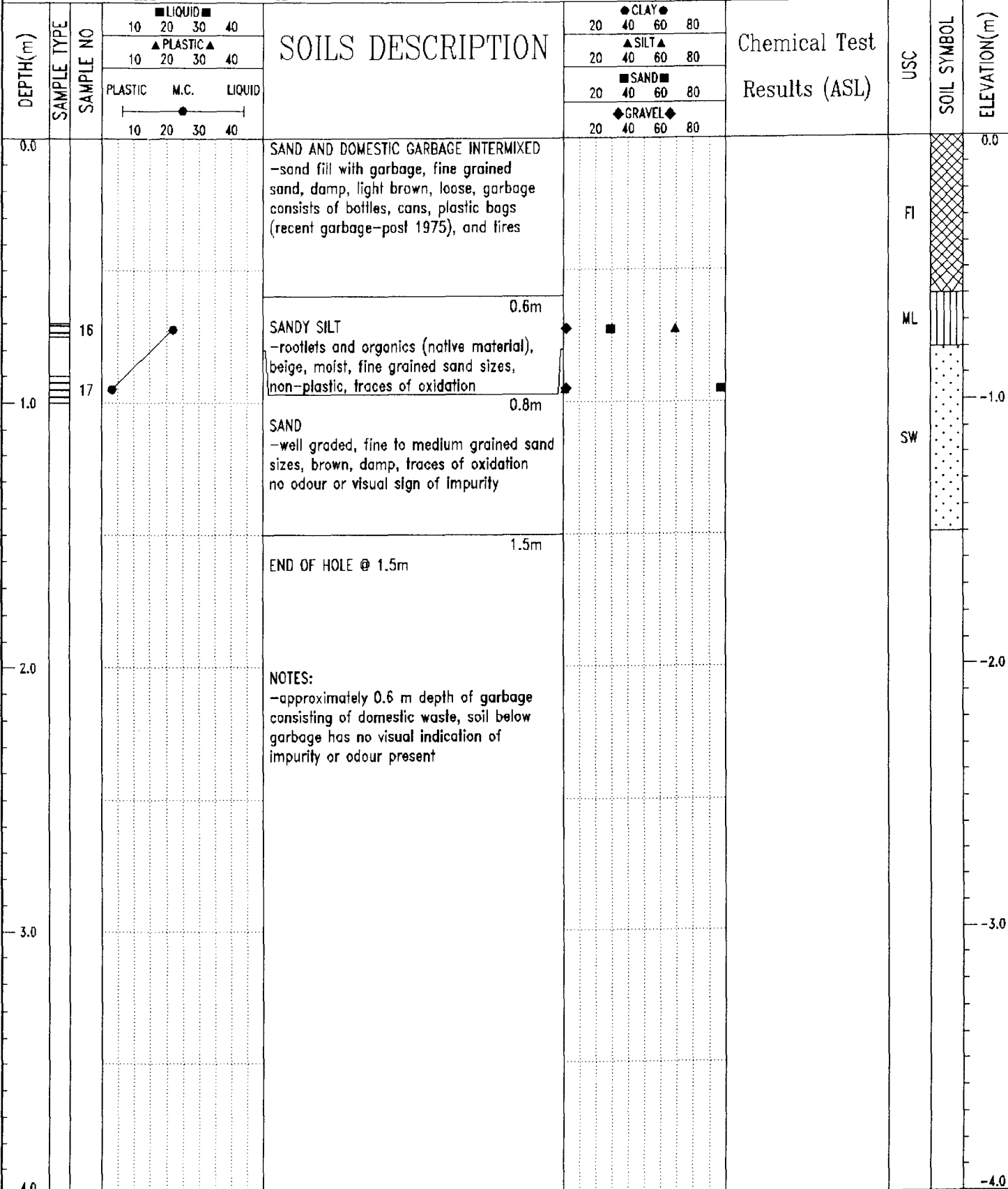
Table 1.1 Unified Soil Classification System (adapted from U.S. Army Corps of Engineers, 1953)

Major division		Group symbol	Typical name	Field identification procedure	Laboratory classification procedure (see Fig. 1.13)				
Coarse-grained soils, more than half of material larger than no. 200 sieve size	Gravels, more than half of coarse fraction larger than no. 4 sieve size	Clean gravels (little or no fines)	GW	Well-graded, gravel-sand mixtures, little or no fines	Wide range in grain sizes and substantial amounts of intermediate particle sizes	Determine percentages of gravel and sand from grain-size curve; depending on percentage of fines (fraction smaller than no. 200 sieve size) coarse-grained soils are classified as follows: Less than 5% = GW, GP, SW, SP More than 12% = GM, GC, SM, SC 5-12% = borderline cases requiring use of dual symbols	$C_u = D_{60}/D_{10} > 4$ $C_c = 1 < D_{30}^2/D_{10} D_{60} < 3$		
		Poorly graded gravels or gravel-sand mixtures, little or no fines	GP	Poorly graded gravels or gravel-sand mixtures, little or no fines	Predominantly one size or a range of sizes with some intermediate sizes missing		Not meeting all gradation requirements for GW		
		Gravels with fines (appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures	Nonplastic fines or fines with low plasticity (for identification procedures see ML)		Atterberg limits below A line or $PI < 4$	Above A line with $4 < PI < 7$ are borderline cases requiring use of dual symbols	
			GC	Clayey gravels, gravel-sand-clay mixtures	Plastic fines (for identification procedures see CL)		Atterberg limits above A line with $PI > 7$		
	Sands, more than half of coarse fraction smaller than no. 4 sieve size	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate particle sizes		$C_u = D_{60}/D_{10} > 6$ $C_c = 1 < D_{30}^2/D_{10} D_{60} < 3$		
			SP	Poorly-graded sands or gravelly sands, little or no fines	Predominantly one size or a range of sizes with some intermediate sizes missing		Not meeting all gradation requirements for SW		
		Sands with fines (appreciable amount of fines)	SM	Silty sands, sand-silt mixtures	Nonplastic fines or fines with low plasticity (for identification procedures see ML)		Atterberg limits below A line or $PI < 4$	Above A line with $4 < PI < 7$ are borderline cases requiring use of dual symbols	
			SC	Clayey sands, sand-clay mixtures	Plastic fines (for identification procedures see CL)		Atterberg limits above A line with $PI > 7$		
							Identification procedures on fraction smaller than no. 40 sieve size		
							Dry strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near PL)
Fine-grained soils, more than half of material smaller than no. 200 sieve size	Sils and clays, liquid limit < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	None to slight	Quick to slow	None			
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium to high	None to very slow	Medium			
		OL	Organic silts and organic silty clays of low plasticity	Slight to medium	Slow	Slight			
	Sils and clays, liquid limit > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Slight to medium	Slow to none	Slight to medium			
		CH	Inorganic clays of high plasticity, fat clays	High to very high	None	None			
		OH	Organic clays of medium to high plasticity, organic silts	Medium to high	None to very slow	Slight to medium			
Highly organic soils	Pt	Peat and other highly organic soils	Readily identified by color, odor, spongy feel, and frequently by fibrous texture						

(see notes on p. 28)

DIAND - ACTION ON WASTE	PRELIM. ENVIRONMENTAL INVESTIGATIONS	TEST PIT NO: R-A
EXCAVATED UTILIZING A KOEHRING 6620	TP#R-a LOCATED AT NORTH EDGE OF LANDFILL	PROJECT NO: 8054-20
BACKHOE FROM DEADMAN CREEK ENT.	SEE SITE SKETCH	ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE



J.R. Paine & Associates Ltd. Whitehorse, Yukon	LOGGED BY: MEB REVIEWED BY: WCK Flg. No:	COMPLETION DEPTH: 1.5 m COMPLETE: 96/10/24
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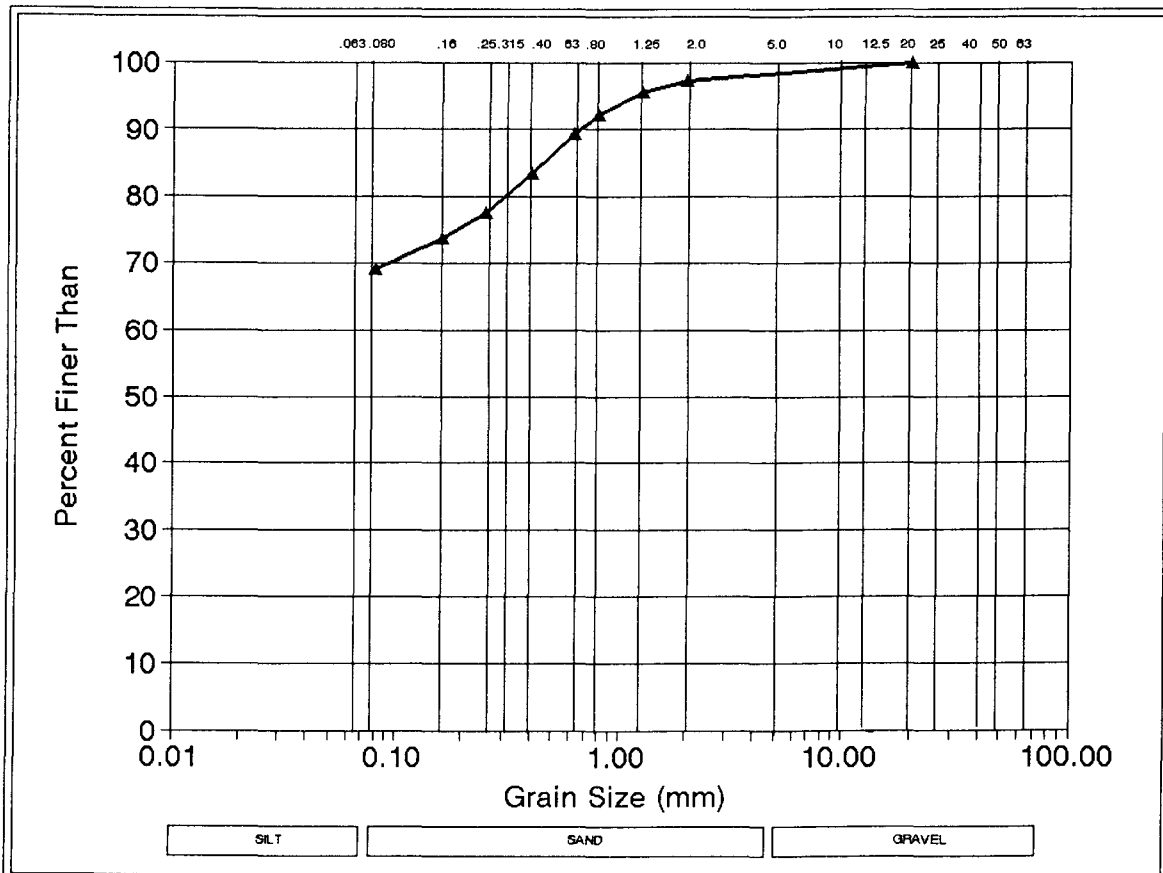
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

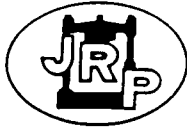
GRAIN SIZE ANALYSIS

SAMPLE: 16	CLIENT: DIAND - ACTION
DEPTH: 0.7-0.8 m	ON WASTE
LOCATION TP#R-a	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>W.P.</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	
20000	20.0	100.0
14000	14.0	98.1
12500	12.5	
10000	10.0	
5000	5.0	98.1
2000	2.0	97.3
1250	1.250	95.5
800	0.800	92.3
630	0.630	89.2
400	0.400	83.2
250	0.250	77.5
160	0.160	73.7
80	0.080	69.0

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 21.9	CRUSH COUNT:
% GRAVEL: 1.9	% FRAC. FACES:
% SAND: 29.1	LIQUID LIMIT:
% SILT: 69.0	PLASTIC LIMIT:
DESCRIPTION OF SAMPLE:	REMARKS:
SANDY SILT, ML	





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

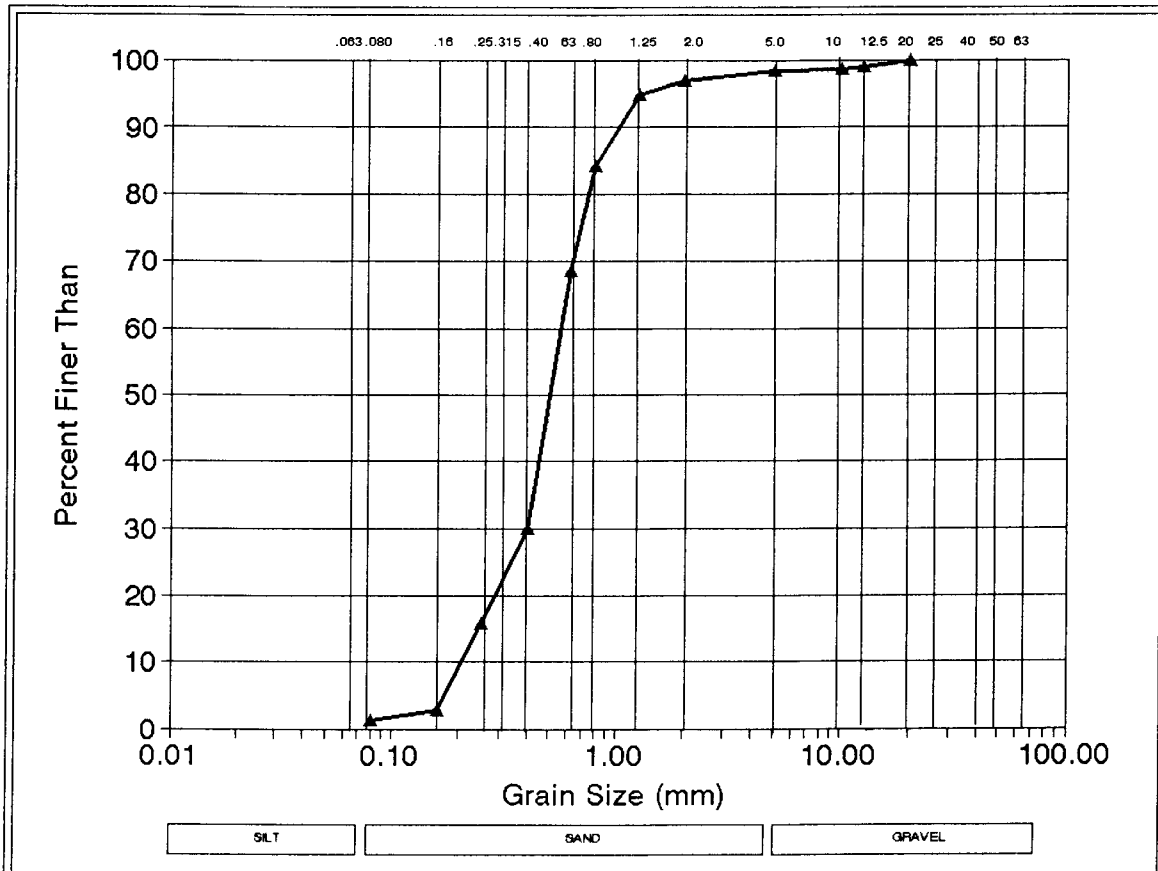
SAMPLE: 17	CLIENT: DIAND - ACTION
DEPTH: 0.9-1.0 m	ON WASTE
LOCATION TP#R-a	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>UP</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	
20000	20.0	100.0
14000	14.0	100.0
12500	12.5	99.0
10000	10.0	98.7
5000	5.0	98.3
2000	2.0	97.0
1250	1.250	94.7
800	0.800	84.1
630	0.630	68.6
400	0.400	29.9
250	0.250	15.7
160	0.160	2.7
80	0.080	1.1

CHARACTERISTICS OF SAMPLE:

MOIST. CONT.: 3.1	CRUSH COUNT:
% GRAVEL: 1.7	% FRAC. FACES:
% SAND: 97.2	LIQUID LIMIT:
% SILT: 1.1	PLASTIC LIMIT:

DESCRIPTION OF SAMPLE:	REMARKS:
SAND, SW	



DIAND - ACTION ON WASTE		PRELIM. ENVIRONMENTAL INVESTIGATIONS		TEST PIT NO: R-B							
EXCAVATED UTILIZING A KOEHRING 6620		TP#R-b LOCATED AT NORTH EDGE OF LANDFILL		PROJECT NO: 8054-20							
BACKHOE FROM DEADMAN CREEK ENT.		SEE SITE SKETCH		ELEVATION:							
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE		SOILS DESCRIPTION		Chemical Test Results (ASL)							
DEPTH(m)	SAMPLE TYPE					SAMPLE NO	<input type="checkbox"/> LIQUID <input type="checkbox"/> PLASTIC <input type="checkbox"/> M.C. <input type="checkbox"/> LIQUID 10 20 30 40	<input type="checkbox"/> CLAY <input type="checkbox"/> SILT <input type="checkbox"/> SAND <input type="checkbox"/> GRAVEL 20 40 60 80	USC	SOIL SYMBOL	ELEVATION(m)
							PLASTIC M.C. LIQUID 10 20 30 40	20 40 60 80			
							20 40 60 80	20 40 60 80			
0.0							0.0				
1.0						SM	-1.0				
2.0						FI	-2.0				
3.0		20 19				SW	-3.0				
4.0							-4.0				

SOILS DESCRIPTION

SILTY SAND FILL
-light brown, dry, roots from poplar trees (trees over test pit were approx. 10-20yrs in age)

GARBAGE AND SAND INTERMIXED 1.2m
-fine grained sand material with some silt, dry, light brown, garbage consists of plastic items, some metallic objects, vehicle parts, possible contaminant sources include an oil-based air filter and a grease can

SAND 2.6m
-well graded, brown, dry, medium dense, fine to medium grained sand sizes, no sign of impurity

END OF HOLE @ 3.0m 3.0m

NOTES:
-garbage encountered within 0.6 to 2.6 m of soil profile, domestic waste primarily

SAMPLE 20:
-EPH(C10-C18)= <250
-EPH(C19-31)= <250
-REFER TO APPENDIX B FOR METALS SCAN AND LEACHABLE ANIONS AND CATIONS SCAN

J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB	COMPLETION DEPTH: 3.0 m
REVIEWED BY: WCK	COMPLETE: 96/10/24
Fig. No:	Page 1 of 1

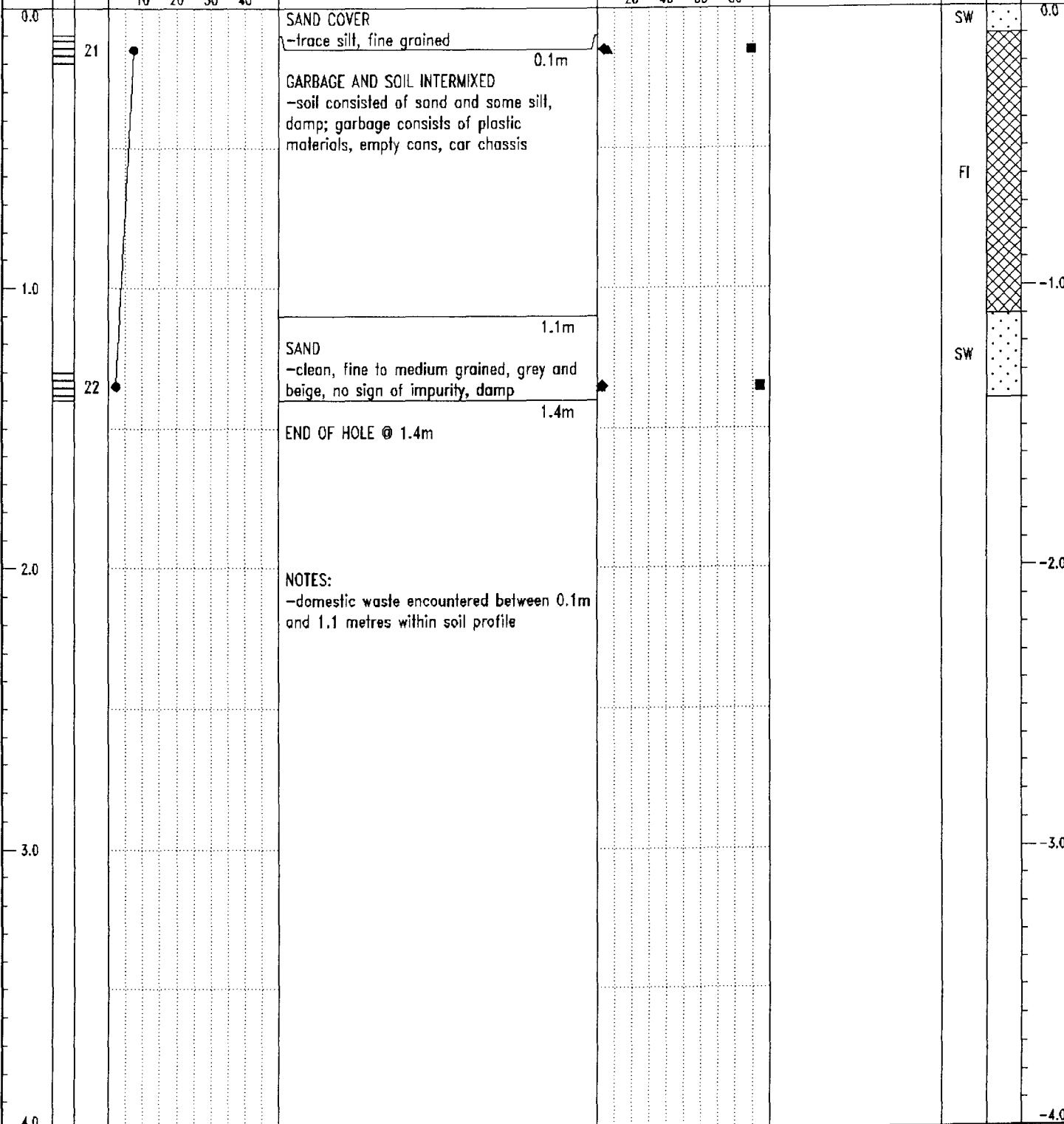
DIAND - ACTION ON WASTE PRELIM. ENVIRONMENTAL INVESTIGATIONS TEST PIT NO: R-C

EXCAVATED UTILIZING A KOEHRING 6620 TP#R-c LOCATED AT NORTH EDGE OF LANDFILL PROJECT NO: 8054-20

BACKHOE FROM DEADMAN CREEK ENT. SEE SITE SKETCH ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE

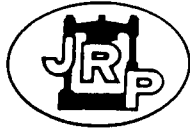
DEPTH(m)	SAMPLE TYPE	SAMPLE NO	LIQUID			SOILS DESCRIPTION	CLAY				Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)		
			10	20	30		40	20	40	60					80	
			PLASTIC				M.C.			SILT						
			10	20	30		40	20	40	60					80	
			PLASTIC M.C. LIQUID			SAND										
						GRAVEL										



NOTES:
-domestic waste encountered between 0.1m and 1.1 metres within soil profile

J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB	COMPLETION DEPTH: 1.4 m
REVIEWED BY: WCK	COMPLETE: 96/10/24
Fig. No:	Page 1 of 1



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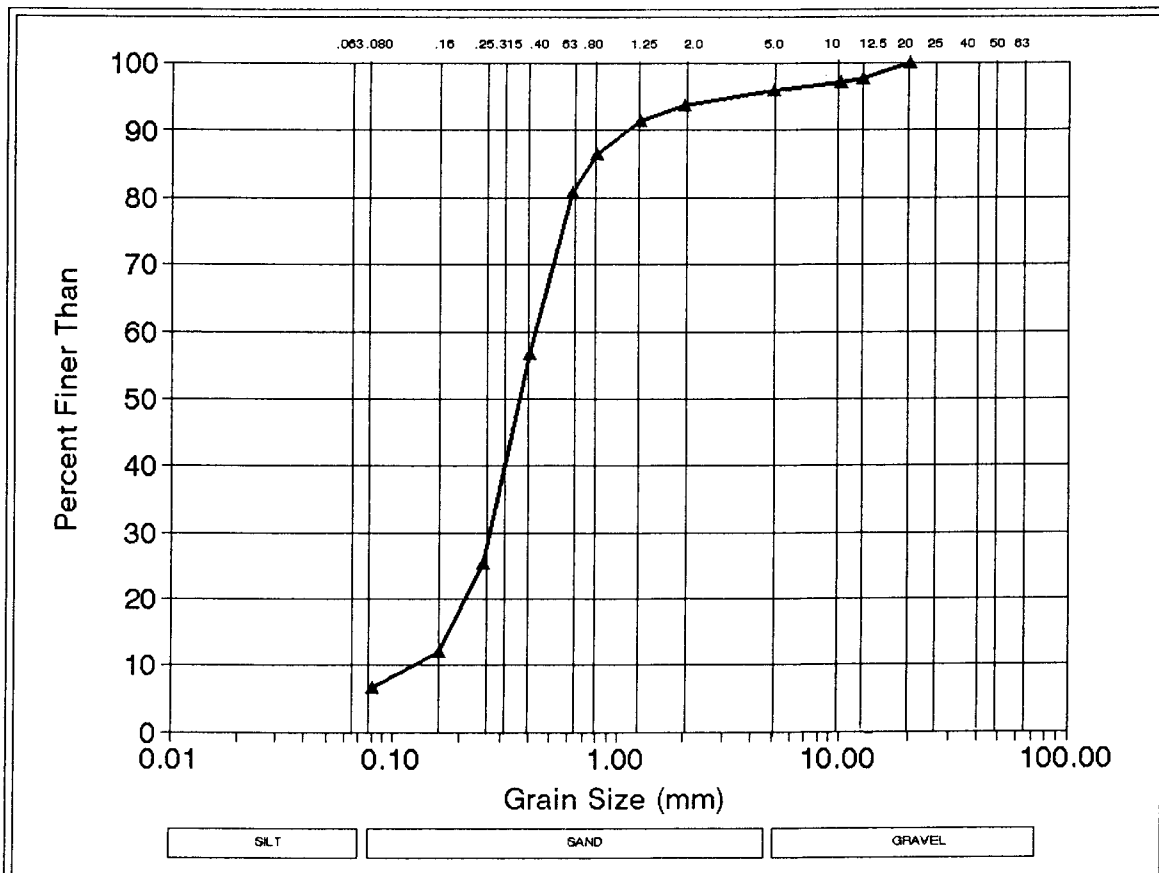
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

SAMPLE: 21	CLIENT: DIAND - ACTION
DEPTH: 0.1-0.15 m	ON WASTE
LOCATION TP#R-c	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>W.P.</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	
20000	20.0	100.0
14000	14.0	97.5
12500	12.5	97.5
10000	10.0	97.1
5000	5.0	95.8
2000	2.0	93.6
1250	1.250	91.2
800	0.800	86.4
630	0.630	80.6
400	0.400	56.5
250	0.250	25.1
160	0.160	11.8
80	0.080	6.5

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 7.4	CRUSH COUNT:
% GRAVEL: 4.2	% FRAC. FACES:
% SAND: 89.3	LIQUID LIMIT:
% SILT: 6.5	PLASTIC LIMIT:
DESCRIPTION OF SAMPLE:	REMARKS:
SAND, trace silt	
SW	





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

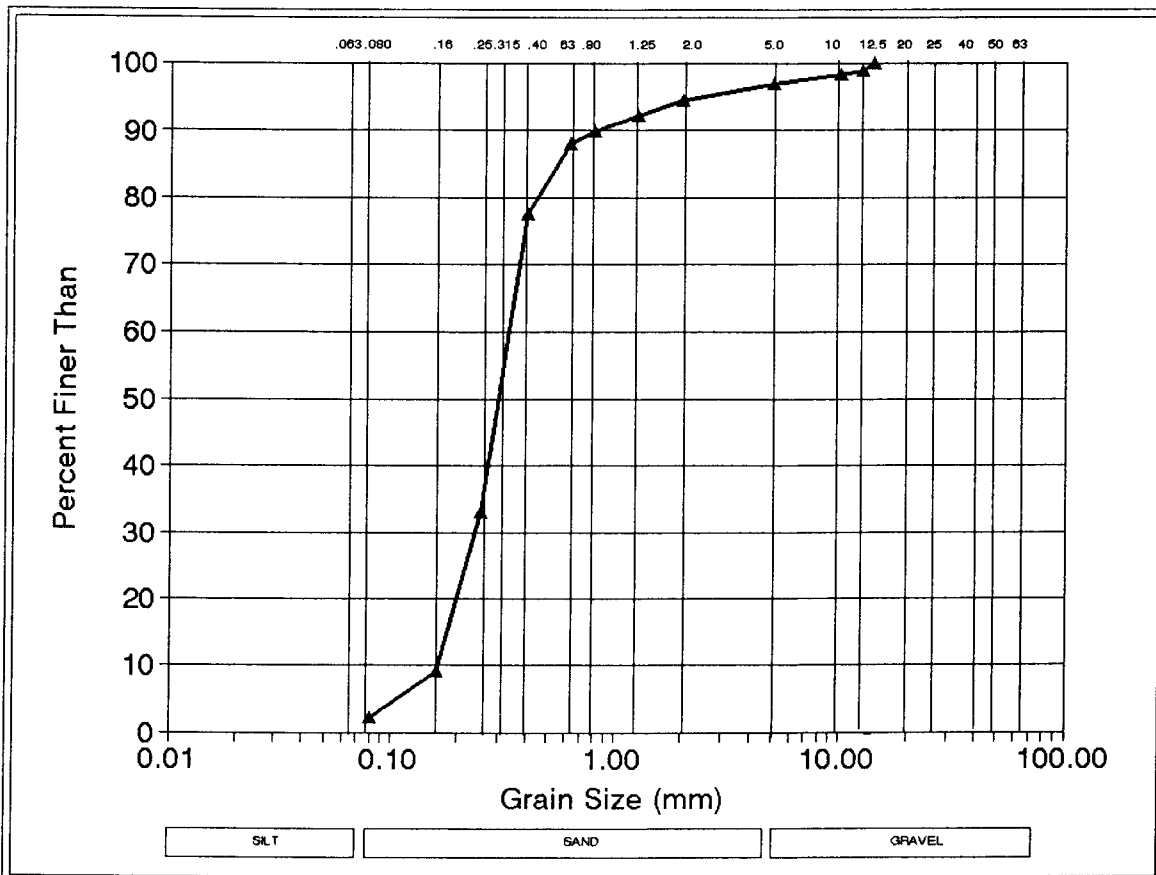
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

SAMPLE: 22	CLIENT: DIAND - ACTION
DEPTH: 1.3-1.4 m	ON WASTE
LOCATION TP#R-c	PROJECT: PRELIM. ENVIRONME
DATE: 98/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>W.P.</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	
20000	20.0	
14000	14.0	100.0
12500	12.5	98.8
10000	10.0	98.1
5000	5.0	96.9
2000	2.0	94.2
1250	1.250	92.1
800	0.800	89.7
630	0.630	87.8
400	0.400	77.5
250	0.250	32.8
160	0.160	9.0
80	0.080	2.3

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 2.1	CRUSH COUNT:
% GRAVEL: 3.1	% FRAC. FACES:
% SAND: 94.6	LIQUID LIMIT:
% SILT: 2.3	PLASTIC LIMIT:
DESCRIPTION OF SAMPLE:	REMARKS:
SAND	
SW	

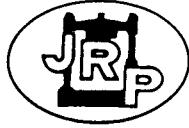


DIAND - ACTION ON WASTE	PRELIM. ENVIRONMENTAL INVESTIGATIONS	TEST PIT NO: R-D
EXCAVATED UTILIZING A KOEHRING 6620	TP#R-d LOCATED AT SOUTH-EAST PORTION OF	PROJECT NO: 8054-20
BACKHOE FROM DEADMAN CREEK ENT.	LANDFILL (SEE SITE SKETCH)	ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	SOILS DESCRIPTION				Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)				
			10	20	30	40					20	40	60	80
			PLASTIC		M.C.						SAND		GRAVEL	
0.0			SILT -dry, light brown, non-plastic, traces of organics (rootlets to 0.1m), medium dense 0.2m SAND -fine grained, dry, loose, brown, well sorted, traces of oxidation, undisturbed soil					ML		0.0				
1.1			END OF HOLE @ 1.1m					SW		1.1				
2.0			NOTES: -no waste material encountered in south area of landfill, appears that waste was end-dumped at north portion of clearing and soil at south portion of clearing was used for cover over the waste							2.0				
3.0										3.0				
4.0										4.0				

J.R. Paine & Associates Ltd. Whitehorse, Yukon	LOGGED BY: MEB REVIEWED BY: WCK Fig. No:	COMPLETION DEPTH: 1.1 m COMPLETE: 96/10/24
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J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

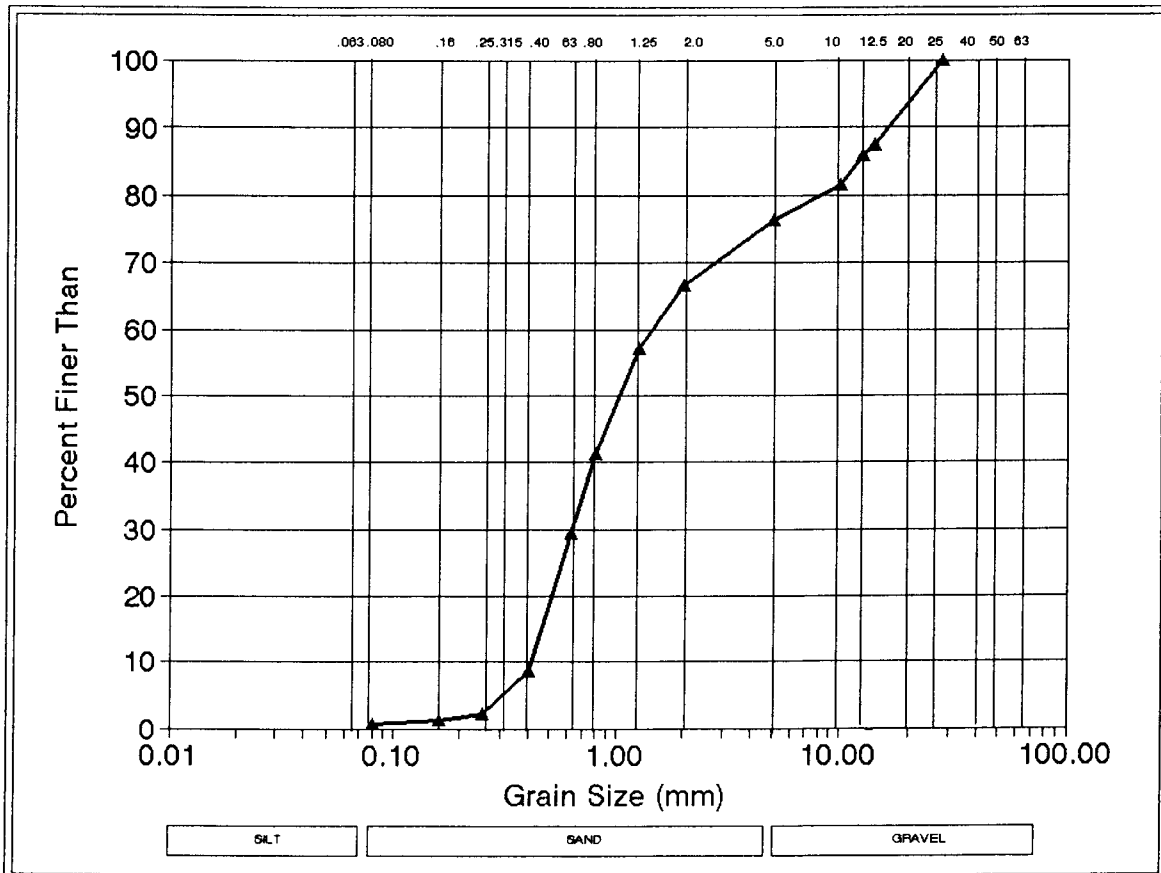
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

SAMPLE: 23	CLIENT: DIAND - ACTION
DEPTH: 1.3-1.4 m	ON WASTE
LOCATION TP#R-e	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>MS</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	100.0
20000	20.0	94.2
14000	14.0	87.3
12500	12.5	85.8
10000	10.0	81.5
5000	5.0	76.3
2000	2.0	66.5
1250	1.250	56.9
800	0.800	41.1
630	0.630	29.2
400	0.400	8.6
250	0.250	2.1
160	0.160	1.2
80	0.080	0.6

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 2.2	CRUSH COUNT:
% GRAVEL: 23.7	% FRAC. FACES:
% SAND: 75.7	LIQUID LIMIT:
% SILT: 0.6	PLASTIC LIMIT:
DESCRIPTION OF SAMPLE:	REMARKS:
GRAVELLY SAND	
SW	



DIAND - ACTION ON WASTE		PRELIM. ENVIRONMENTAL INVESTIGATIONS		TEST PIT NO: P1-A						
EXCAVATED UTILIZING A KOEHRING 6620		TP#P1-a LOCATED IN AREA OF WOOD		PROJECT NO: 8054-20						
BACKHOE FROM DEADMAN CREEK ENT.		STRUCTURE AT SITE P1 NEAR AIR STRIP		ELEVATION:						
SAMPLE TYPE		<input checked="" type="checkbox"/> TUBE	<input type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK	<input type="checkbox"/> SPT	<input type="checkbox"/> CORE			
DEPTH(m)	SAMPLE TYPE	SAMPLE NO	SOILS DESCRIPTION				Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)
			<p> <input type="checkbox"/> LIQUID <input type="checkbox"/> PLASTIC <input type="checkbox"/> M.C. <input type="checkbox"/> LIQUID 10 20 30 40 </p>							
			<p> <input type="checkbox"/> CLAY <input type="checkbox"/> SILT <input type="checkbox"/> SAND <input type="checkbox"/> GRAVEL 20 40 60 80 </p>							
0.0			<p>GARBAGE FILL MATERIAL</p> <p>-existing engineered pit with wood lattice lateral bracing along pit walls; pit filled with various garbage including wood debris, several empty cans of ethylene glycol (U.S. Army Label), glass, empty 10 gal drums, some more recent domestic garbage (plastic bottles)</p>							0.0
1.0		4	<p>SANDY GRAVEL 0.7m</p> <p>-undisturbed native material, rust brown in colour (oxidation throughout), some soil stains on small portion of near surface soil (sample #1 and sample #4) loose, damp, (note sample #1 and #2 taken from east portion of pit, sample #4 taken from west portion of pit)</p>				<p>SAMPLE #2: -EPH(C10-18): <250 ppm EPH(C19-31): <250 ppm</p> <p>SAMPLE #4: -EPH(C10-18): 350 ppm EPH(C19-31): 6410 ppm</p> <p>SAMPLE #1: -EPH(C10-18): 2630 ppm EPH(C19-31): 2660 ppm</p>			-1.0
		1	<p>SANDY GRAVEL 1.3m</p> <p>-grey brown, less oxidation, damp, dense, no sign of impurity within soil profile throughout pit area</p>							
		3	<p>END OF HOLE @ 1.5 m</p>							
2.0			<p>NOTES:</p> <p>-small amount of contamination on soil immediately below fill area, appears to be heavy end hydrocarbon (oil); contaminant does not extend vertically into soil profile beyond 1.3m</p>							
3.0										
4.0										

J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB
REVIEWED BY: WCK
Fig. No:

COMPLETION DEPTH: 1.5 m
COMPLETE: 96/10/23



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CONSULTING AND TESTING ENGINEERS
 EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

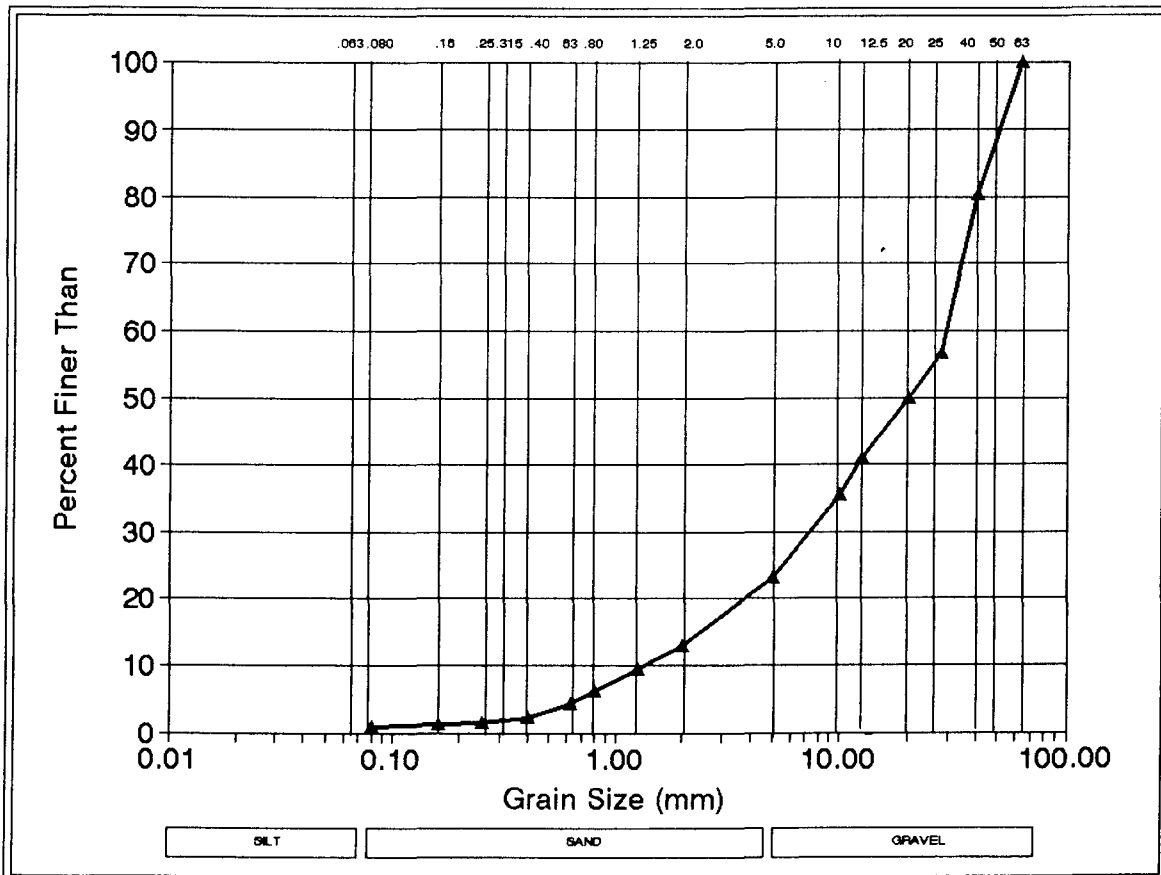
SAMPLE: 1	CLIENT: DIAND - ACTION
DEPTH: 1.1-1.2m	ON WASTE
LOCATION TP#P1-a	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED:

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	100.0
40000	40.0	80.2
28000	28.0	56.6
20000	20.0	49.9
14000	14.0	
12500	12.5	40.9
10000	10.0	35.4
5000	5.0	22.9
2000	2.0	13.0
1250	1.250	9.4
800	0.800	6.2
630	0.630	4.4
400	0.400	2.1
250	0.250	1.4
160	0.160	1.1
80	0.080	0.9

CHARACTERISTICS OF SAMPLE:

MOIST. CONT: 2.8	CRUSH COUNT: _____
% GRAVEL: 77.1	% FRAC. FACES: _____
% SAND: 22.1	LIQUID LIMIT: _____
% SILT: 0.9	PLASTIC LIMIT: _____

DESCRIPTION OF SAMPLE:	REMARKS:
SANDY GRAVEL, GW	

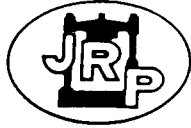


DIAND - ACTION ON WASTE		PRELIM. ENVIRONMENTAL INVESTIGATIONS		TEST PIT NO: P2-A					
EXCAVATED UTILIZING A KOEHRING 6620		TP#P2-a LOCATED 14 m WEST, 6m SOUTH OF		PROJECT NO: 8054-20					
BACKHOE FROM DEADMAN CREEK ENT.		OLD WINDSOCK AT SITE P2 NEAR AIR STRIP		ELEVATION:					
SAMPLE TYPE		<input type="checkbox"/> TUBE	<input type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK				
		<input type="checkbox"/> SPT	<input type="checkbox"/> CORE						
DEPTH(m)	SAMPLE TYPE	SAMPLE NO	SOILS DESCRIPTION			Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)
			■ LIQUID ■ 10 20 30 40 ▲ PLASTIC ▲ 10 20 30 40 PLASTIC M.C. LIQUID 	● CLAY ● 20 40 60 80 ▲ SILT ▲ 20 40 60 80 ■ SAND ■ 20 40 60 80 ◆ GRAVEL ◆ 20 40 60 80					
0.0			GRAVELLY SAND -loose, well graded, brown, dry, disturbed fill material				SW	0.0	
			GARBAGE FILL -various garbage items found intermixed with sandy soil, garbage includes lumber, metal cable approx. 20 m long, sheet metal, no contaminant source throughout fill material	0.2m			FI		
		14	SAND -well graded, brown, oxidation, loose, odd cobble	0.6m			SW		
1.0			SANDY GRAVEL -odd cobble, boulders present to 10 % by volume, coarse material, damp,	0.8m			GW	-1.0	
			END OF HOLE @ 1.5m	1.5m					
2.0			NOTES: -some garbage items encountered, no contaminant source or sign of impurity within soil profile					-2.0	
3.0								-3.0	
4.0								-4.0	

J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB
REVIEWED BY: WCK
Fig. No:

COMPLETION DEPTH: 1.5 m
COMPLETE: 96/10/23



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CONSULTING AND TESTING ENGINEERS

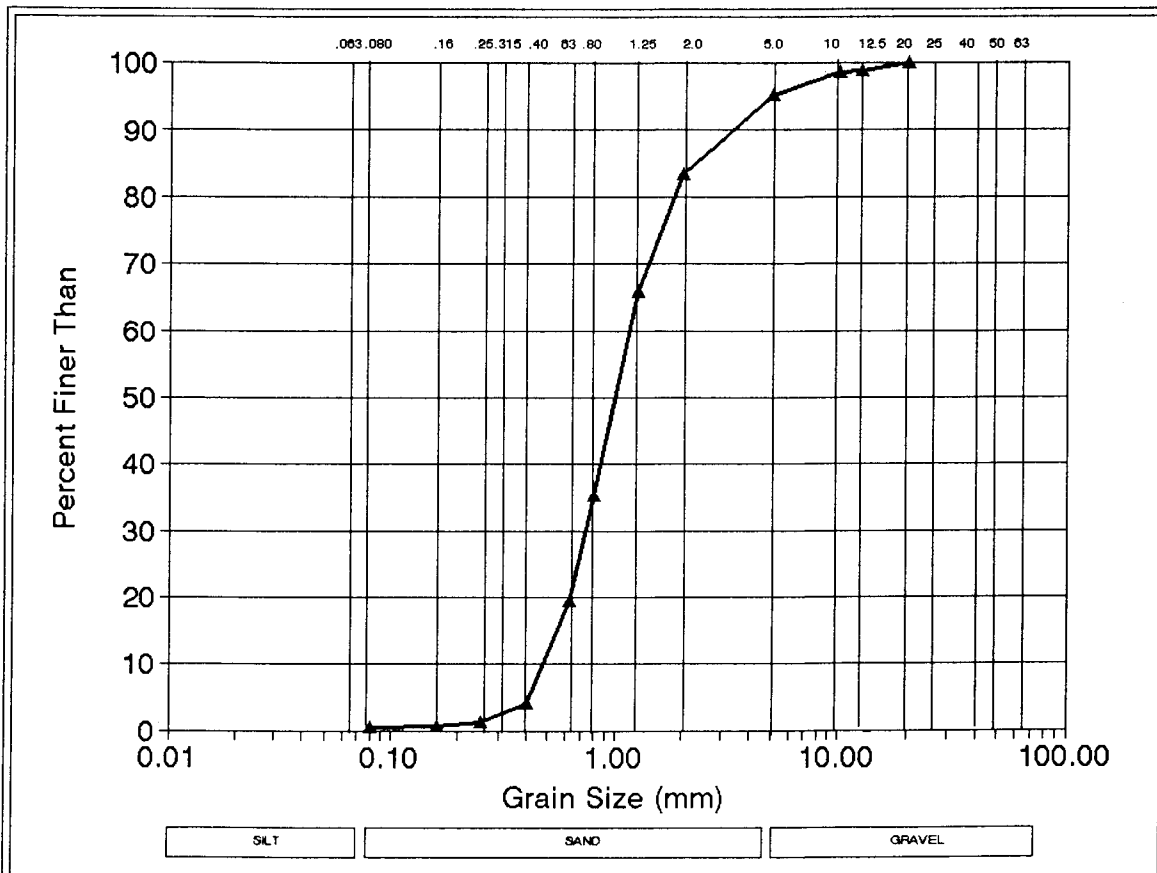
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

SAMPLE: 14	CLIENT: DIAND - ACTION
DEPTH: 0.7-0.8 m	ON WASTE
LOCATION TP#P2-a	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>WJP</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	
20000	20.0	100.0
14000	14.0	99.4
12500	12.5	98.9
10000	10.0	98.6
5000	5.0	95.1
2000	2.0	83.3
1250	1.250	65.7
800	0.800	35.2
630	0.630	19.3
400	0.400	4.1
250	0.250	1.1
160	0.160	0.7
80	0.080	0.4

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 3.8	CRUSH COUNT: _____
% GRAVEL: 4.9	% FRAC. FACES: _____
% SAND: 94.7	LIQUID LIMIT: _____
% SILT: 0.4	PLASTIC LIMIT: _____
DESCRIPTION OF SAMPLE:	REMARKS:
SAND	
SW	

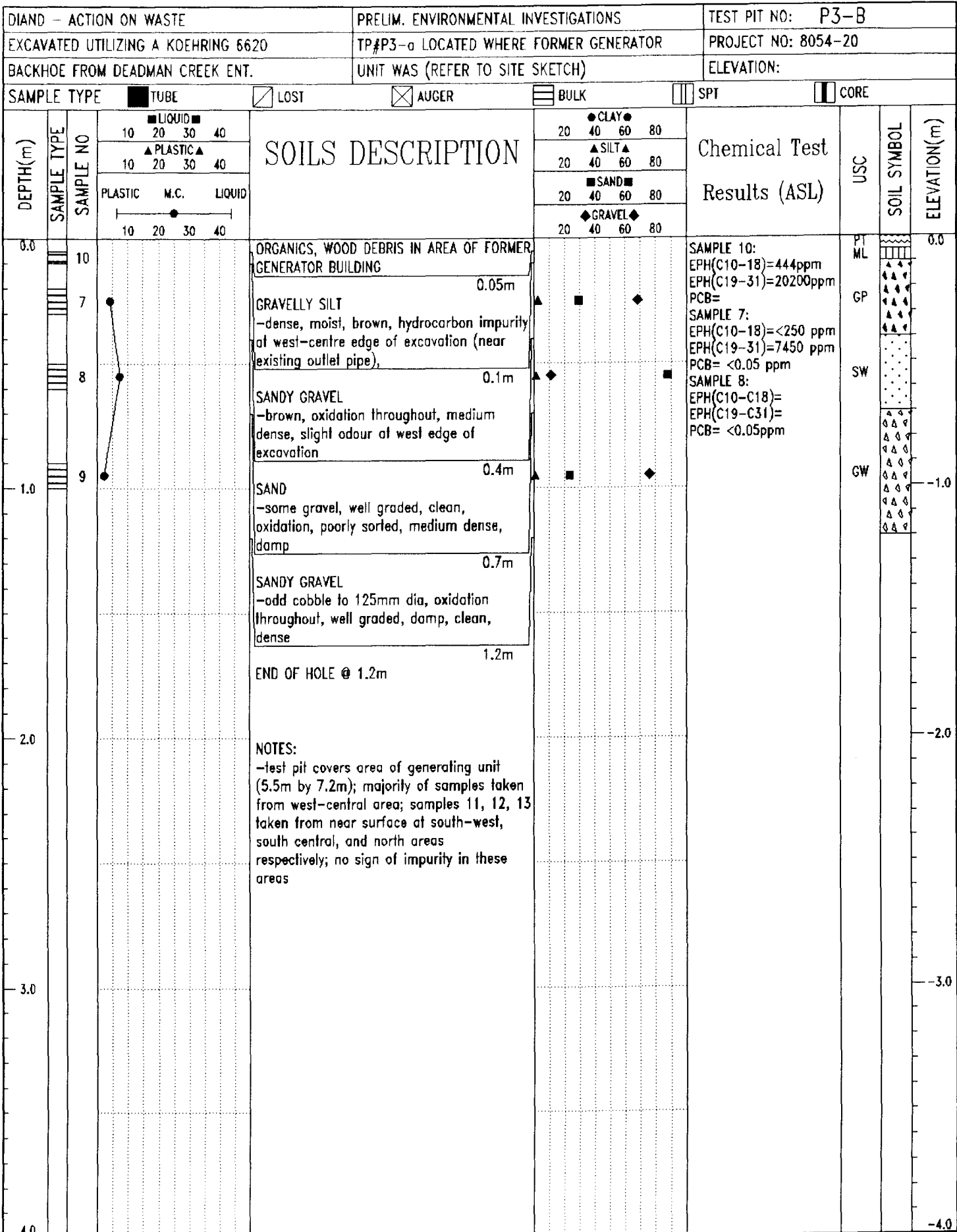


DIAND - ACTION ON WASTE	PRELIM. ENVIRONMENTAL INVESTIGATIONS	TEST PIT NO: P2-D
EXCAVATED UTILIZING A KOEHRING 6620	TP#P2-d LOCATED 10 m NORTH, 8m EAST OF	PROJECT NO: 8054-20
BACKHOE FROM DEADMAN CREEK ENT.	SOUTHWEST CORNER SITE P2 NEAR AIR STRIP	ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	LIQUID			PLASTIC			SOILS DESCRIPTION	CLAY			SILT			SAND	GRAVEL			Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)
			10	20	30	40	10	20		30	40	20	40	60	80		20	40	60				
0.0									SANDY GRAVEL -cover over obvious fill pile of 5 m by 2m area, loose, brown, coarse grained 0.2m												GW	▲▲▲▲	0.0
									GARBAGE FILL -garbage intermixed with gravel and sand soil, garbage includes cable, sheet metal, one empty 45 gal. drum, one empty 15 gallon drum, lumber, stove pipe, tin cans												FI	■	
1.0		15							SANDY GRAVEL -native and undisturbed soil, loose, brown, coarse grained, damp, no soil stain or odour present 0.9m											SAMPLE #15: -EPH(C10-18): <250 ppm EPH(C19-31): <250 ppm	GW	▲▲▲▲	-1.0
									END OF HOLE @ 1.1m 1.1m														
2.0									NOTES: -no physical sign of impurity within soil profile; chemical sample 15 tested for hydrocarbon considerations in area of drums														-2.0
3.0																							-3.0
4.0																							-4.0

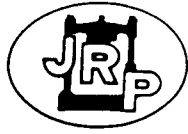
J.R. Paine & Associates Ltd. Whitehorse, Yukon	LOGGED BY: MEB REVIEWED BY: WCK Fig. No:	COMPLETION DEPTH: 1.1 m COMPLETE: 96/10/23 Page 1 of 1
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J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB
REVIEWED BY: WCK
Fig. No:

COMPLETION DEPTH: 1.2 m
COMPLETE: 96/10/23



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EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

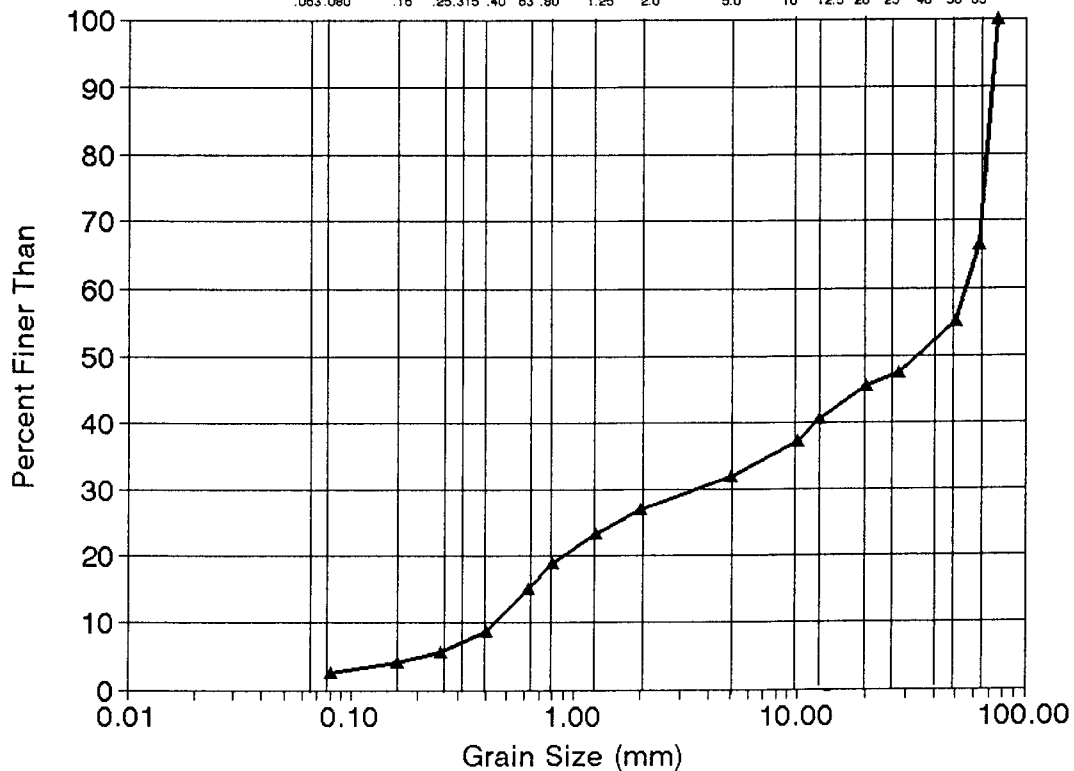
SAMPLE: 7	CLIENT: DIAND - ACTION
DEPTH: 0.2-0.3 m	ON WASTE
LOCATION TP#P3-b	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>MS</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	100.0
63000	63.0	66.4
50000	50.0	55.1
28000	28.0	47.5
20000	20.0	45.6
14000	14.0	41.1
12500	12.5	40.7
10000	10.0	37.2
5000	5.0	31.7
2000	2.0	26.7
1250	1.250	23.1
800	0.800	18.6
630	0.630	14.9
400	0.400	8.7
250	0.250	5.5
160	0.160	4.1
80	0.080	2.6

CHARACTERISTICS OF SAMPLE:

MOIST. CONT.: 4.1	CRUSH COUNT:
% GRAVEL: 68.3	% FRAC. FACES:
% SAND: 29.1	LIQUID LIMIT:
% SILT: 2.6	PLASTIC LIMIT:

DESCRIPTION OF SAMPLE:	REMARKS:
SANDY GRAVEL, GP	





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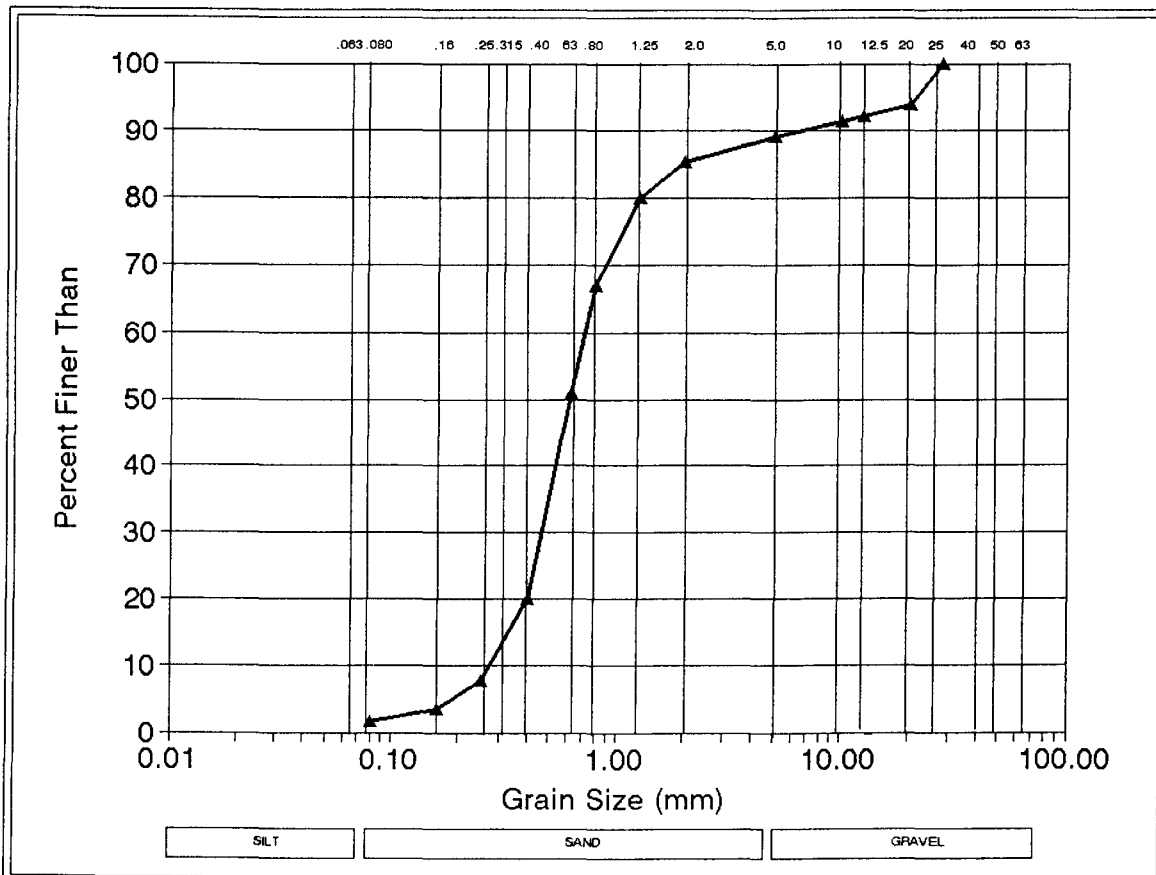
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

SAMPLE: 8	CLIENT: DIAND - ACTION
DEPTH: 0.5-0.6 m	ON WASTE
LOCATION TP#P3-b	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>(Signature)</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	100.0
20000	20.0	93.7
14000	14.0	92.2
12500	12.5	92.2
10000	10.0	91.3
5000	5.0	89.0
2000	2.0	85.1
1250	1.250	79.9
800	0.800	66.9
630	0.630	50.7
400	0.400	20.0
250	0.250	7.5
160	0.160	3.5
80	0.080	1.5

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 7.3	CRUSH COUNT: _____
% GRAVEL: 11.0	% FRAC. FACES: _____
% SAND: 87.5	LIQUID LIMIT: _____
% SILT: 1.5	PLASTIC LIMIT: _____
DESCRIPTION OF SAMPLE:	REMARKS:
SAND, some gravel	
SW	





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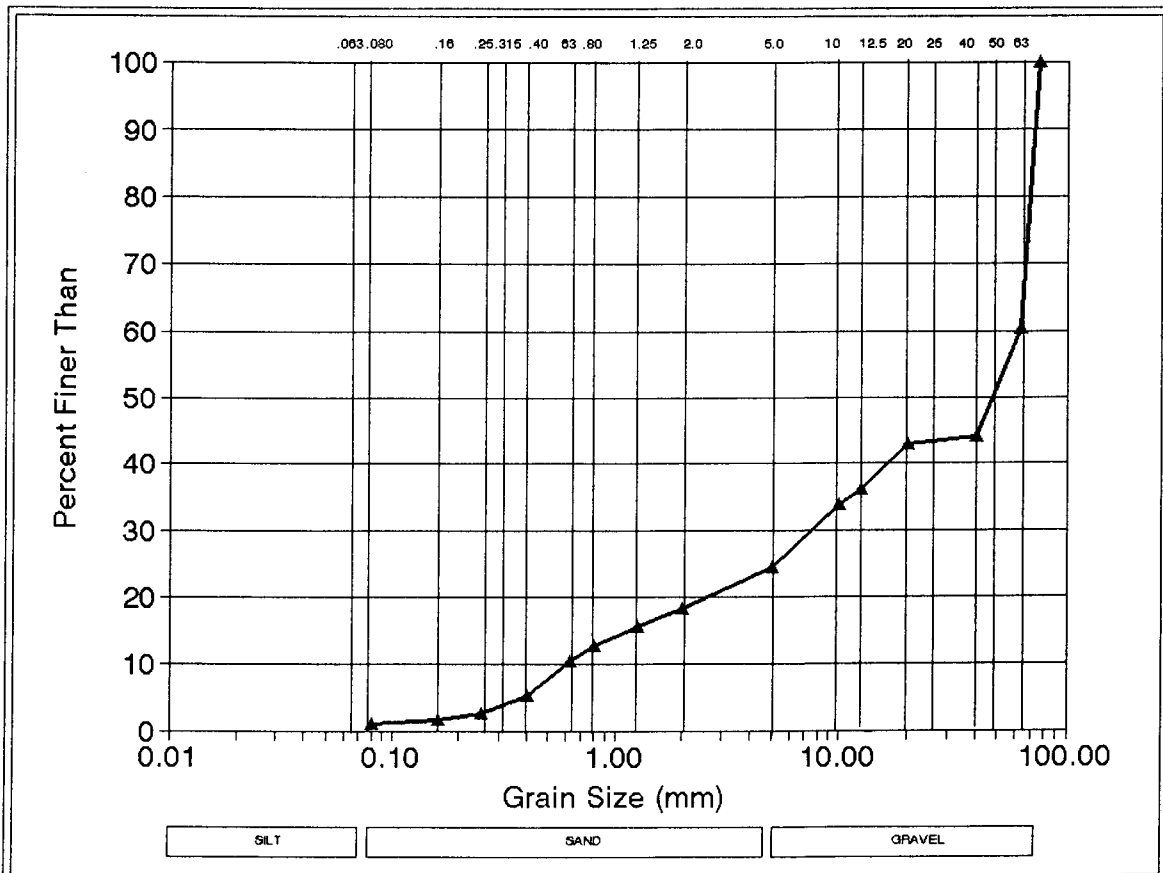
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

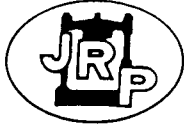
GRAIN SIZE ANALYSIS

SAMPLE: 9	CLIENT: DIAND - ACTION
DEPTH: 0.9-1.0 m	ON WASTE
LOCATION TP#P3-b	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>MS</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	100.0
63000	63.0	60.2
40000	40.0	43.9
28000	28.0	
20000	20.0	42.9
14000	14.0	37.0
12500	12.5	35.9
10000	10.0	33.6
5000	5.0	24.3
2000	2.0	18.2
1250	1.250	15.5
800	0.800	12.7
630	0.630	10.3
400	0.400	5.2
250	0.250	2.6
160	0.160	1.5
80	0.080	0.9

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 2.2	CRUSH COUNT: _____
% GRAVEL: 75.7	% FRAC. FACES: _____
% SAND: 23.4	LIQUID LIMIT: _____
% SILT: 0.9	PLASTIC LIMIT: _____
DESCRIPTION OF SAMPLE:	REMARKS:
SANDY GRAVEL,	
GP	





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

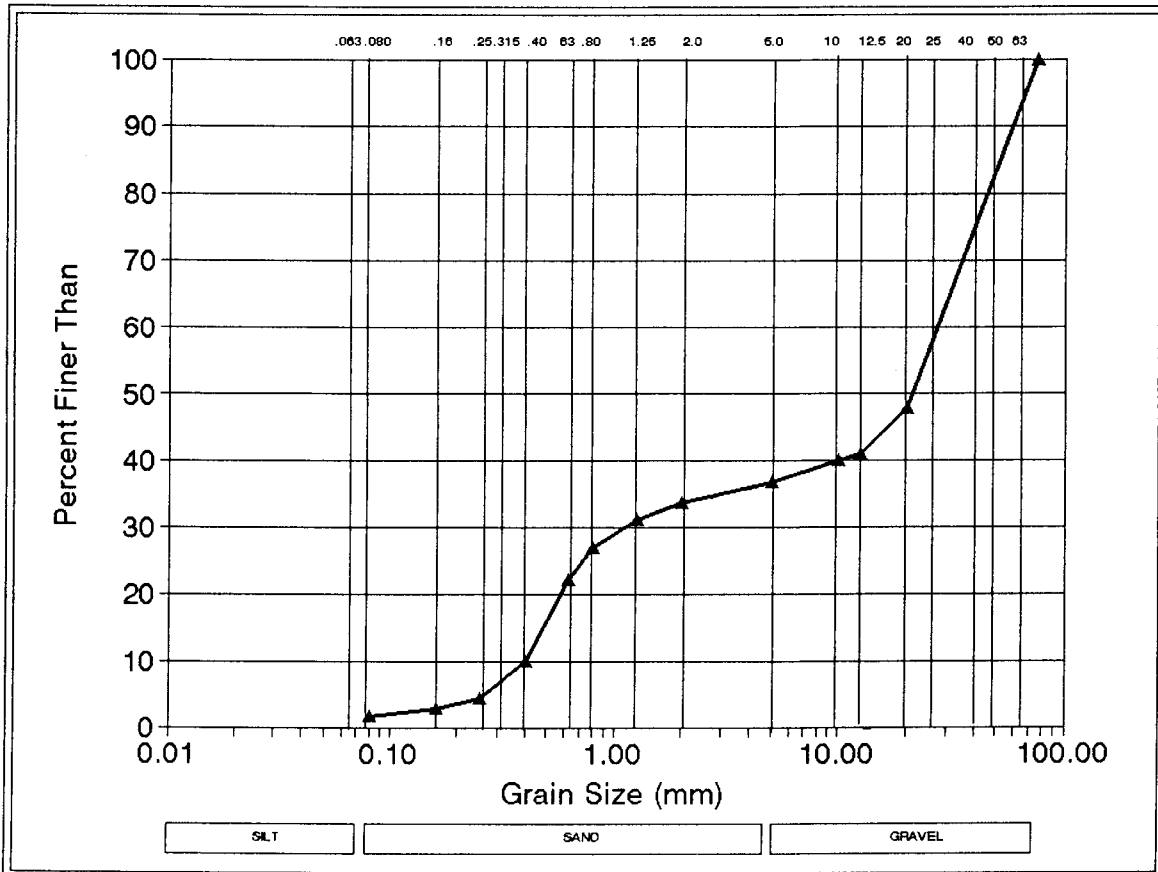
SAMPLE: 11	CLIENT: DIAND - ACTION
DEPTH: 0.1-0.2 m	ON WASTE
LOCATION TP#P3-b	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>W.P.</i>

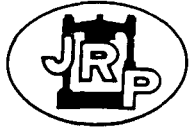
Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	100.0
63000	63.0	
40000	40.0	
28000	28.0	58.2
20000	20.0	47.6
14000	14.0	42.2
12500	12.5	40.8
10000	10.0	39.9
5000	5.0	36.5
2000	2.0	33.5
1250	1.250	31.1
800	0.800	26.9
630	0.630	22.0
400	0.400	10.0
250	0.250	4.2
160	0.160	2.6
80	0.080	1.7

CHARACTERISTICS OF SAMPLE:

MOIST. CONT.: 3.4	CRUSH COUNT: _____
% GRAVEL: 63.5	% FRAC. FACES: _____
% SAND: 34.8	LIQUID LIMIT: _____
% SILT: 1.7	PLASTIC LIMIT: _____

DESCRIPTION OF SAMPLE:	REMARKS:
SANDY GRAVEL, GP	





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CONSULTING AND TESTING ENGINEERS

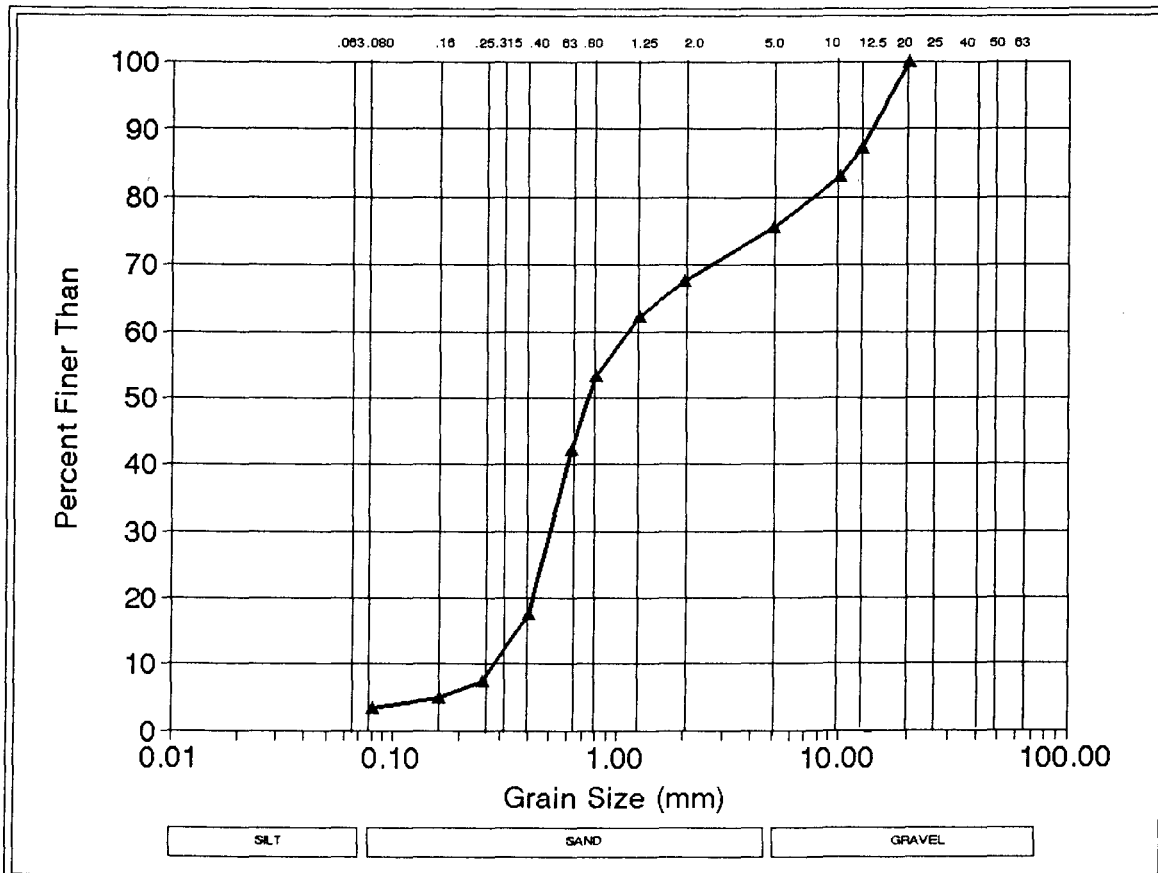
EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

SAMPLE: 12	CLIENT: DIAND - ACTION
DEPTH: 0.1-0.2 m	ON WASTE
LOCATION TP#P3-b	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>h/p</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
50000	50.0	
28000	28.0	
20000	20.0	100.0
14000	14.0	88.2
12500	12.5	87.2
10000	10.0	82.9
5000	5.0	75.6
2000	2.0	67.5
1250	1.250	62.0
800	0.800	53.0
630	0.630	42.0
400	0.400	17.5
250	0.250	7.4
160	0.160	4.7
80	0.080	3.2

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 15.4	CRUSH COUNT:
% GRAVEL: 24.4	% FRAC. FACES:
% SAND: 72.3	LIQUID LIMIT:
% SILT: 3.2	PLASTIC LIMIT:
DESCRIPTION OF SAMPLE:	REMARKS:
GRAVELLY SAND,	
SW	





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

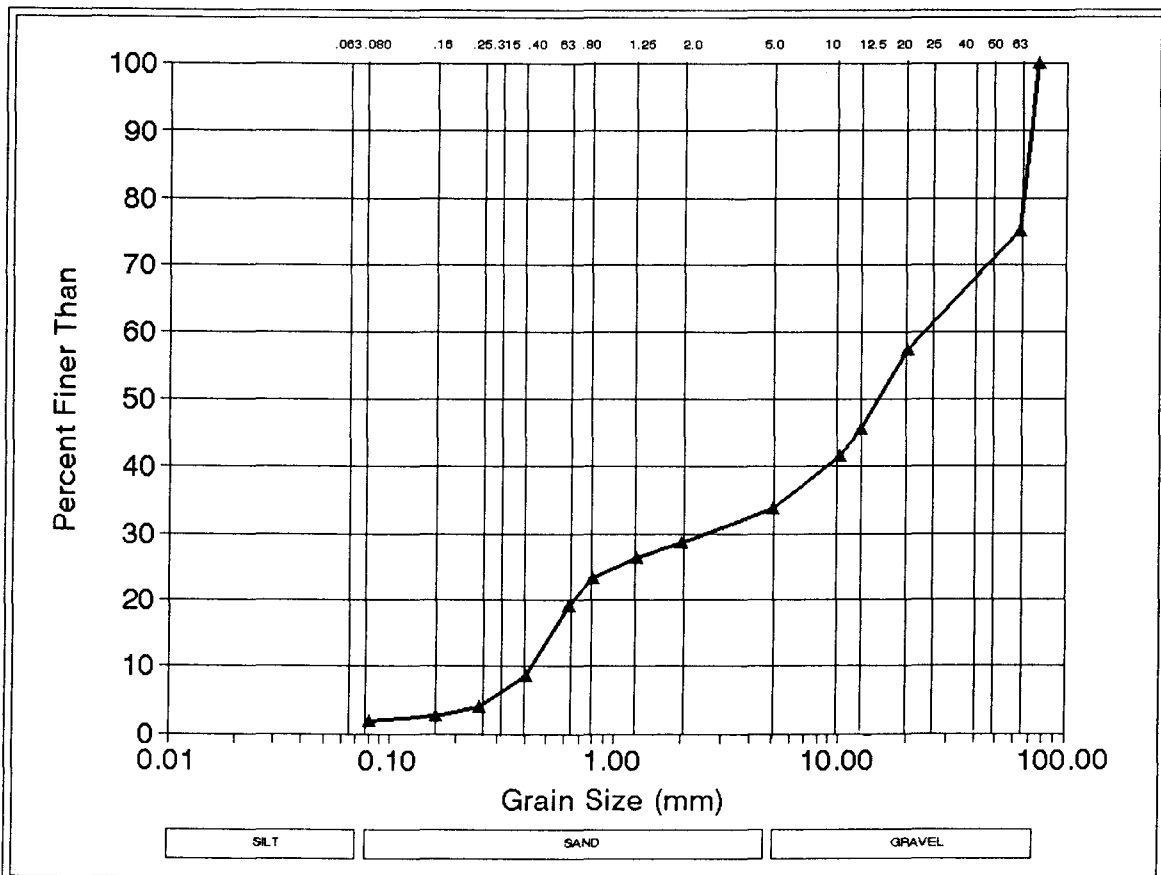
SAMPLE: 13	CLIENT: DIAND - ACTION
DEPTH: 0.1-0.2 m	ON WASTE
LOCATION TP#P3-b	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>MS</i>

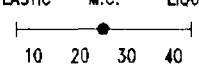
Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	100.0
63000	63.0	75.2
50000	50.0	
28000	28.0	
20000	20.0	57.0
14000	14.0	48.8
12500	12.5	45.6
10000	10.0	41.5
5000	5.0	33.6
2000	2.0	28.4
1250	1.250	26.3
800	0.800	23.0
630	0.630	18.9
400	0.400	8.5
250	0.250	3.9
160	0.160	2.6
80	0.080	1.6

CHARACTERISTICS OF SAMPLE:

MOIST. CONT.: 4.7	CRUSH COUNT:
% GRAVEL: 66.4	% FRAC. FACES:
% SAND: 32.0	LIQUID LIMIT:
% SILT: 1.6	PLASTIC LIMIT:

DESCRIPTION OF SAMPLE:	REMARKS:
SANDY GRAVEL, GW	



DIAND - ACTION ON WASTE		PRELIM. ENVIRONMENTAL INVESTIGATIONS		TEST PIT NO: P3-C				
EXCAVATED UTILIZING A KOEHRING 6620		TP#P3-c LOCATED WHERE METALLIC PRESENCE		PROJECT NO: 8054-20				
BACKHOE FROM DEADMAN CREEK ENT.		DETECTED (SEE SITE SKETCH AND GEOPHYS.)		ELEVATION:				
SAMPLE TYPE		<input type="checkbox"/> TUBE	<input type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK	<input type="checkbox"/> SPT	<input type="checkbox"/> CORE	
DEPTH(m)	SAMPLE TYPE	SAMPLE NO	SOILS DESCRIPTION		Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)
			■ LIQUID ■ 10 20 30 40 ▲ PLASTIC ▲ 10 20 30 40 PLASTIC M.C. LIQUID 	● CLAY ● 20 40 60 80 ▲ SILT ▲ 20 40 60 80 ■ SAND ■ 20 40 60 80 ◆ GRAVEL ◆ 20 40 60 80				
0.0			ORGANICS, typical forest floor cover	0.05m			PT	0.0
			SAND -some gravel, loose, coarse grained, brown, damp,				SW	
			SANDY GRAVEL -cobbles and boulders to 15% by volume, brown, medium dense, damp, well graded	0.6m			GW	-1.0
1.0			END OF HOLE @ 1.5m	1.5m				
2.0			NOTES: -a very large test pit (6m by 3m) was excavated in area where possible buried metallic object identified from AMCL survey, however, no metallic object encountered and no sign of disturbed soil					-2.0
3.0								-3.0
4.0								-4.0

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Whitehorse, Yukon

LOGGED BY: MEB

REVIEWED BY: WCK

Fig. No:

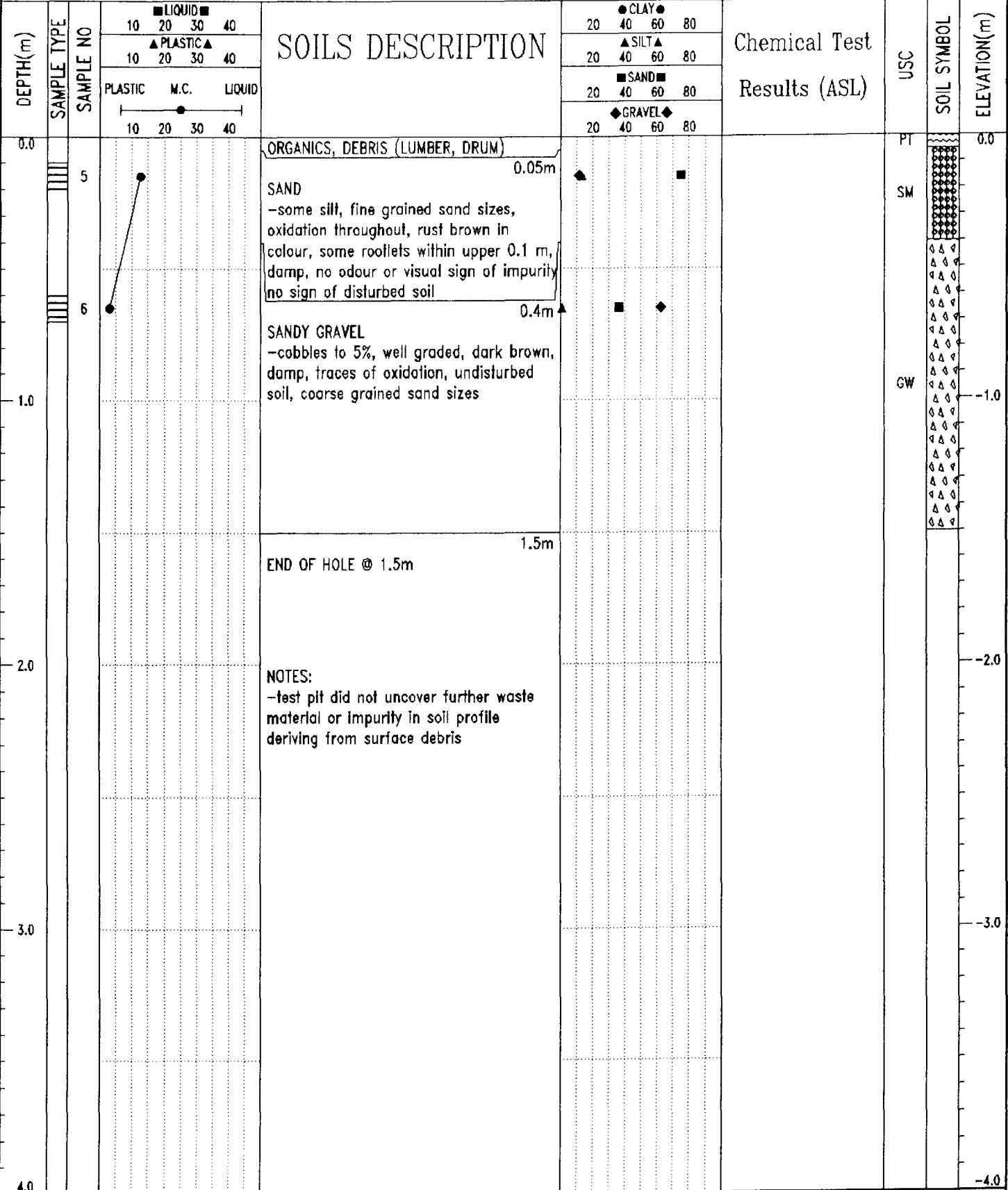
COMPLETION DEPTH: 1.5 m

COMPLETE: 96/10/23

Page 1 of 1

DIAND - ACTION ON WASTE	PRELIM. ENVIRONMENTAL INVESTIGATIONS	TEST PIT NO: P3-D
EXCAVATED UTILIZING A KOEHRING 6620	TP#P3-d LOCATED BELOW GARBAGE ITEMS	PROJECT NO: 8054-20
BACKHOE FROM DEADMAN CREEK ENT.	(OLD LUMBER, DRUM), SEE SITE SKETCH	ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE



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LOGGED BY: MEB
REVIEWED BY: WCK
Fig. No:

COMPLETION DEPTH: 1.5 m
COMPLETE: 96/10/23

DIAND - ACTION ON WASTE PRELIM. ENVIRONMENTAL INVESTIGATIONS TEST PIT NO: C1-A

EXCAVATED UTILIZING A KOEHRING 6620 TP#C1-a LOCATED AT NORTH-WEST CORNER OF PROJECT NO: 8054-20

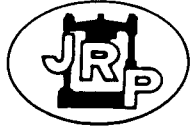
BACKHOE FROM DEADMAN CREEK ENT. AREA C1 WHERE POSSIBLE METAL(SEE SKETCH) ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	LIQUID			PLASTIC			SOILS DESCRIPTION				Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)
			10	20	30	40	10	20	30	40	20	40				
0.0									SILT -some sand, moist, grey, fill material (waste material from recent realignment of highway), non-plastic, loose							0.0
									SANDY GRAVEL -native soil, brown, moist, dense, coarse grained sand sizes, odd cobble and boulder, traces of oxidation	0.4m						
1.0																
2.0																
3.0		24							SANDY GRAVEL -native soil, brown, moist, dense, coarse grained sand sizes, cobbles and boulders to 5% by volume							
4.0																

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LOGGED BY: MEB COMPLETION DEPTH: 6.0 m
REVIEWED BY: WCK COMPLETE: 96/10/24
Fig. No: Page 1 of 2



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

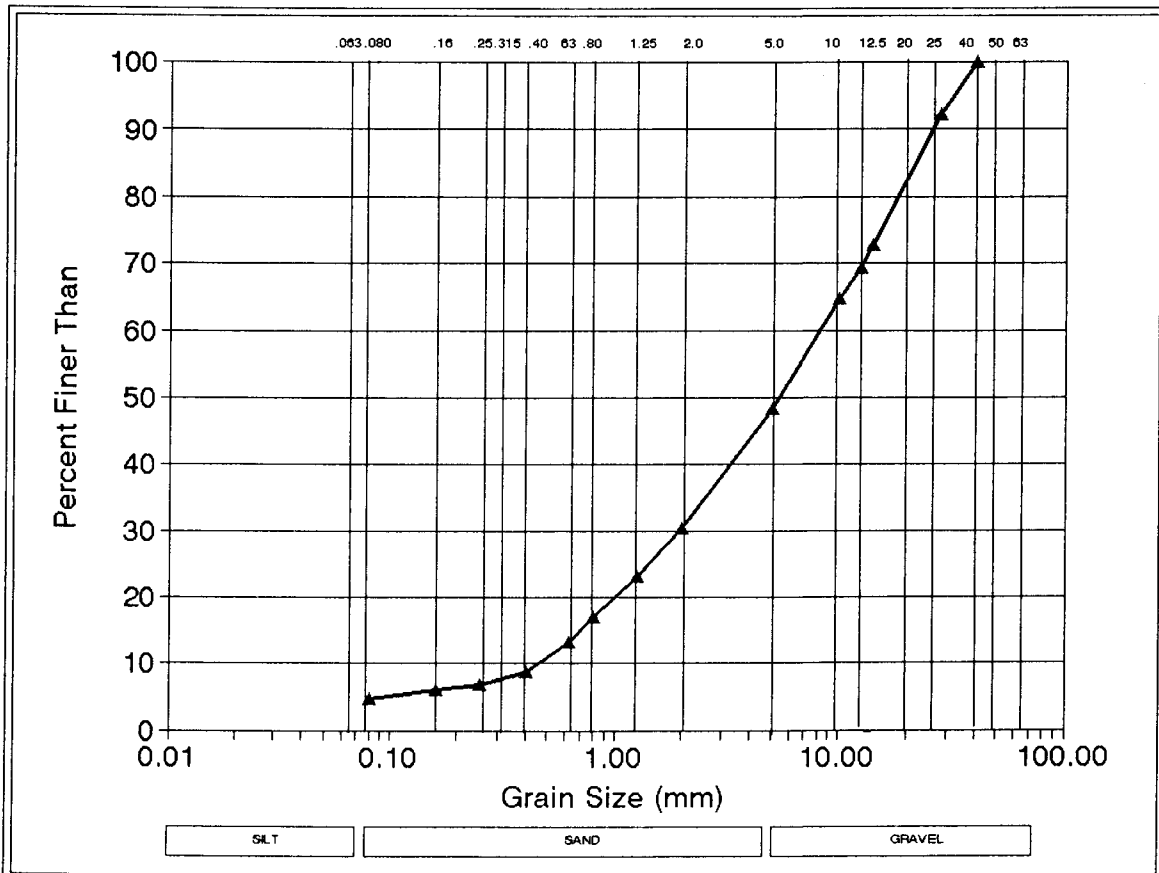
SAMPLE: 24	CLIENT: DIAND - ACTION
DEPTH: 3.0-3.1 m	ON WASTE
LOCATION TP#C1-a	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>ii/B.</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
40000	40.0	100.0
28000	28.0	92.2
20000	20.0	82.9
14000	14.0	72.5
12500	12.5	69.3
10000	10.0	64.6
5000	5.0	48.1
2000	2.0	30.3
1250	1.250	22.9
800	0.800	16.7
630	0.630	13.1
400	0.400	8.7
250	0.250	6.8
160	0.160	5.8
80	0.080	4.6

CHARACTERISTICS OF SAMPLE:

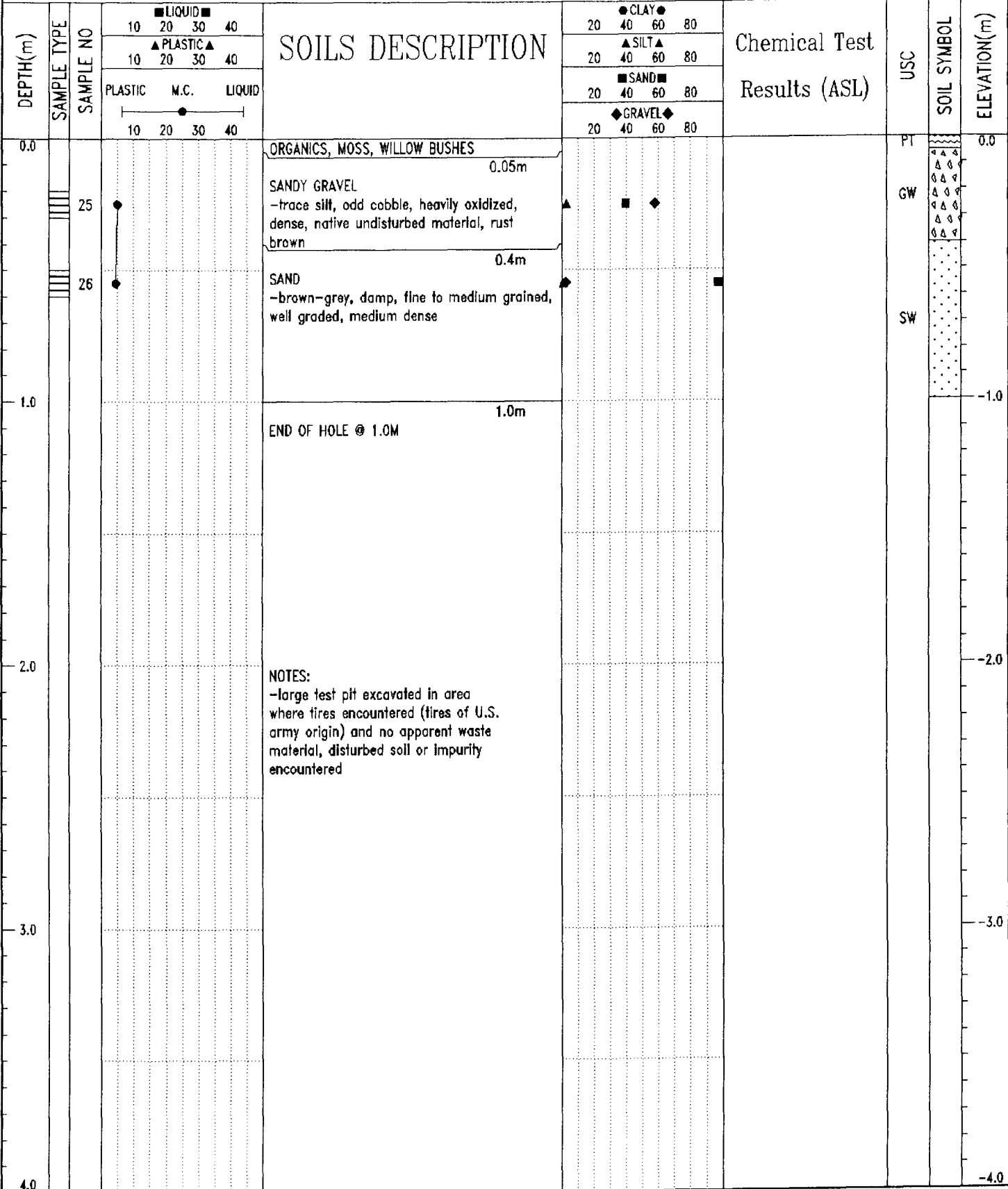
MOIST. CONT.: 4.7	CRUSH COUNT: _____
% GRAVEL: 51.9	% FRAC. FACES: _____
% SAND: 43.5	LIQUID LIMIT: _____
% SILT: 4.6	PLASTIC LIMIT: _____

DESCRIPTION OF SAMPLE:	REMARKS:
SANDY GRAVEL	
GW	



DIAND - ACTION ON WASTE	PRELIM. ENVIRONMENTAL INVESTIGATIONS	TEST PIT NO: C3-A
EXCAVATED UTILIZING A KOEHRING 6620	TP#C2-a LOCATED NEAR TIRES AT AREA C3	PROJECT NO: 8054-20
BACKHOE FROM DEADMAN CREEK ENT.	(SEE SKETCH)	ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE



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Whitehorse, Yukon

LOGGED BY: MEB
REVIEWED BY: WCK
Flg. No:

COMPLETION DEPTH: 1.0 m
COMPLETE: 96/10/24



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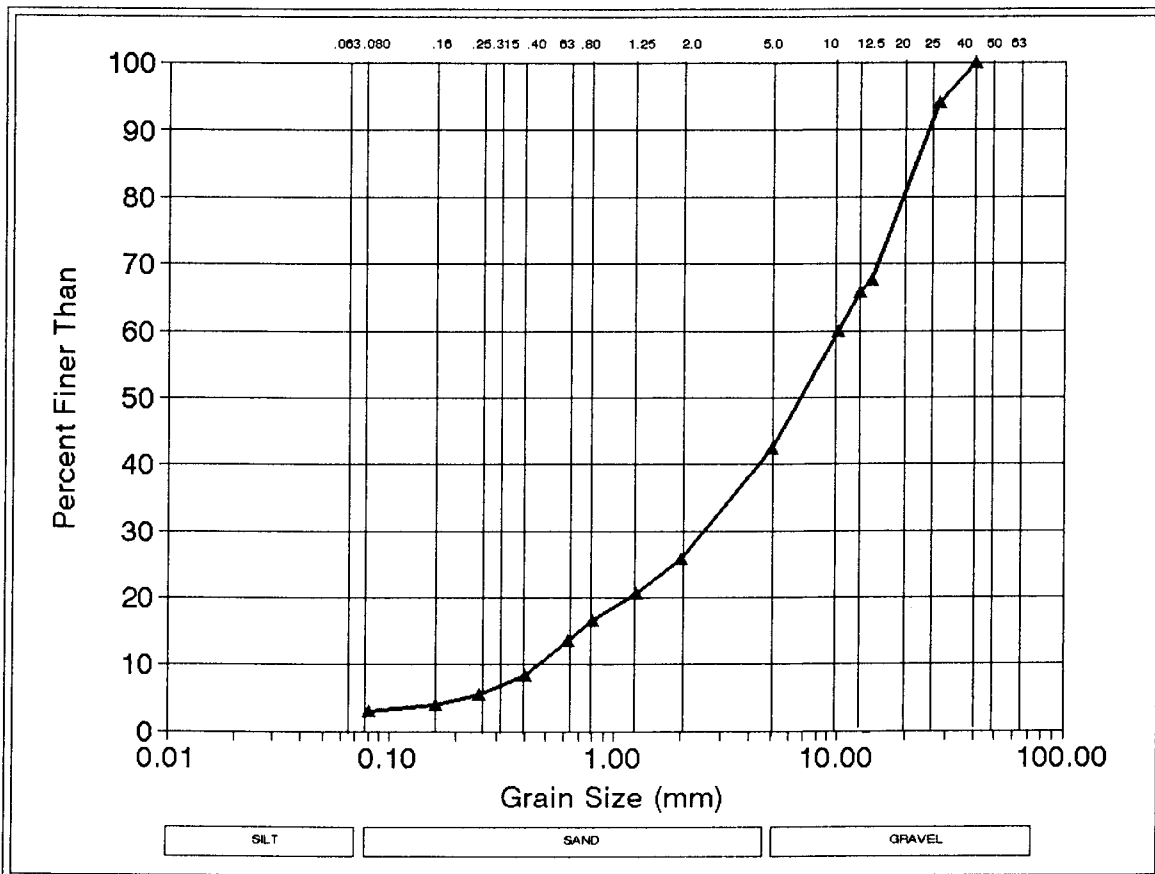
CONSULTING AND TESTING ENGINEERS
 EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

SAMPLE: 25	CLIENT: DIAND - ACTION
DEPTH: 0.2-0.3 m	ON WASTE
LOCATION TP#C2-a	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>u/10</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
40000	40.0	100.0
28000	28.0	94.0
20000	20.0	83.7
14000	14.0	67.5
12500	12.5	65.8
10000	10.0	59.8
5000	5.0	42.2
2000	2.0	25.7
1250	1.250	20.4
800	0.800	16.4
630	0.630	13.4
400	0.400	8.3
250	0.250	5.3
160	0.160	4.0
80	0.080	2.8

CHARACTERISTICS OF SAMPLE:	
MOIST. CONT.: 5.0	CRUSH COUNT: _____
% GRAVEL: 57.8	% FRAC. FACES: _____
% SAND: 39.4	LIQUID LIMIT: _____
% SILT: 2.8	PLASTIC LIMIT: _____
DESCRIPTION OF SAMPLE:	REMARKS:
SANDY GRAVEL	
GW	





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

GRAIN SIZE ANALYSIS

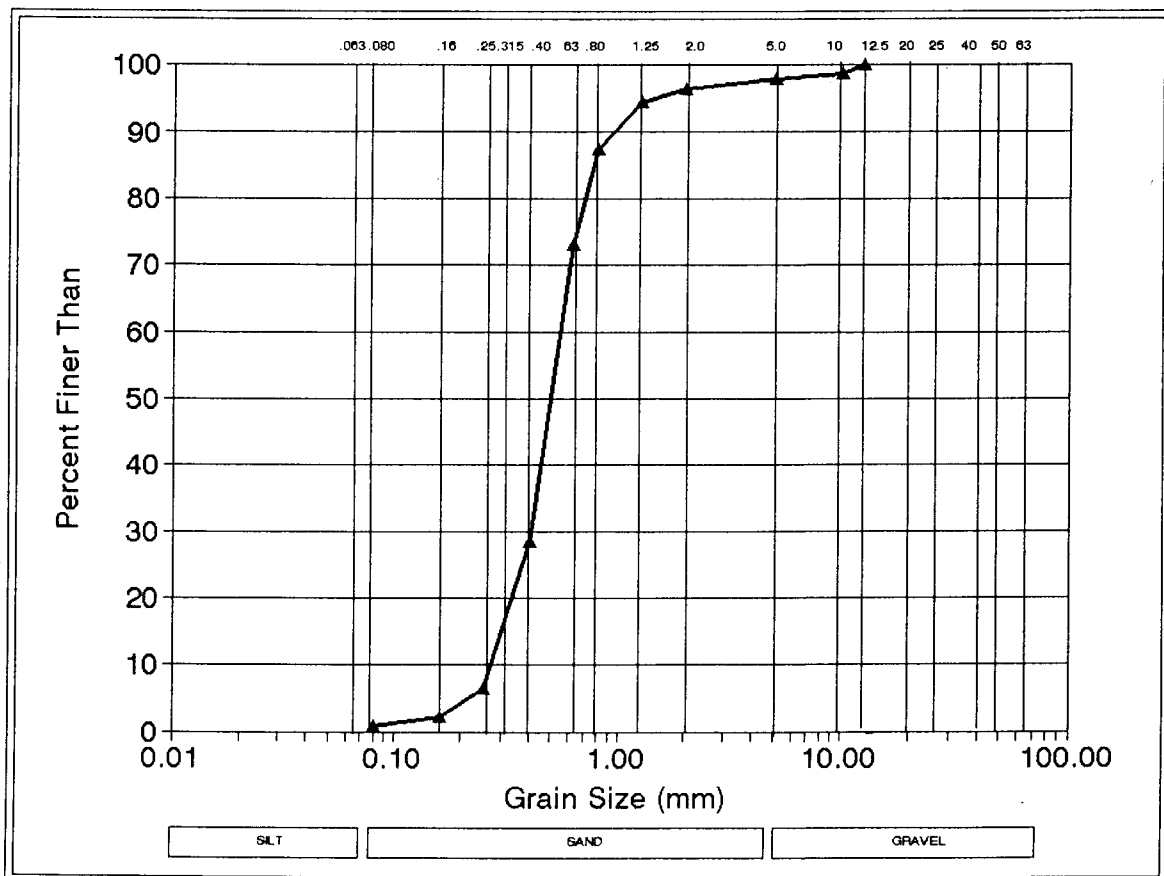
SAMPLE: 26	CLIENT: DIAND - ACTION
DEPTH: 0.5-0.6 m	ON WASTE
LOCATION TP#C2-a	PROJECT: PRELIM. ENVIRONME
DATE: 96/11/4	INVESTIGATIONS
MADE BY: MS	CHECKED: <i>MS</i>

Sieve No.	Size of Opening (mm)	% Finer Than Basis Orig. Sample
75000	75	
63000	63.0	
40000	40.0	
28000	28.0	
20000	20.0	
14000	14.0	
12500	12.5	100.0
10000	10.0	98.7
5000	5.0	97.8
2000	2.0	96.3
1250	1.250	94.4
800	0.800	87.2
630	0.630	73.0
400	0.400	28.4
250	0.250	6.4
160	0.160	2.1
80	0.080	0.8

CHARACTERISTICS OF SAMPLE:

MOIST. CONT.: 4.4	CRUSH COUNT: _____
% GRAVEL: 2.2	% FRAC. FACES: _____
% SAND: 96.9	LIQUID LIMIT: _____
% SILT: 0.8	PLASTIC LIMIT: _____

DESCRIPTION OF SAMPLE:	REMARKS:
SAND	
SW	



DIAND - ACTION ON WASTE	PRELIM. ENVIRONMENTAL INVESTIGATIONS	TEST PIT NO: C3-B
EXCAVATED UTILIZING A KOEHRING 6620	TP#C3-b LOCATED IN AREA OF DEPRESSION	PROJECT NO: 8054-20
BACKHOE FROM DEADMAN CREEK ENT.	AT AREA C3 (SEE SKETCH)	ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	LIQUID			PLASTIC			SOILS DESCRIPTION			Chemical Test Results (ASL)	USC	SOIL SYMBOL	ELEVATION(m)	
			10	20	30	40	10	20	30	40	20					40
0.0								ORGANICS, WILLOW								0.0
								SILT	0.05m							
								-some fine grained sand, light brown, rootlets, undisturbed native soil								
								SAND	0.4m							
								-brown, damp, medium dense, fine to medium grained sizes, native undisturbed								
1.0								END OF HOLE @ 1.0m	1.0m							-1.0
2.0								NOTES:								-2.0
								-test pit excavated in depression area to see if a disposal pit existed, however, no waste material present and no sign of disturbed soil								
3.0																-3.0
4.0																-4.0

J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB	COMPLETION DEPTH: 1.0 m
REVIEWED BY: WCK	COMPLETE: 96/10/24
Fig. No:	Page 1 of 1

APPENDIX C

Chemical Lab Results - ASL Report

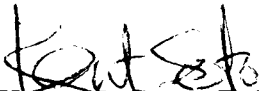



CHEMICAL ANALYSIS REPORT

Date: November 19, 1996
ASL File No. G6538
Report On: 8054-20 Soil Analysis
Report To: **J. R. Paine and Associates Ltd.**
14 Burns Road
Whitehorse, YT
Y1A 4Y9
Attention: **Mr. Michael Billowits**, Project Engineer
Received: October 29, 1996

ASL ANALYTICAL SERVICE LABORATORIES LTD.

per:


Kent H. Seto, B.Sc.
Project Chemist


Joanne Patrick, B.Sc.
Project Chemist



RESULTS OF ANALYSIS

File No. G6538

	1	2	4	7	8
<hr/>					
Physical Tests					
Moisture %	3.5	3.6	0.4	9.5	8.8
Water Soluble Volatiles					
Ethylene Glycol	<100	-	<100	-	-

EPH = Extractable Petroleum Hydrocarbons
Results are expressed as milligrams per dry kilogram except where noted.
< = Less than the detection limit indicated.



RESULTS OF ANALYSIS

File No. G6538

		10	15	20	23
Physical Tests					
Moisture	%	10.4	2.9	3.6	2.1
Total Metals					
Antimony	T-Sb	-	-	<20	<20
Arsenic	T-As	-	-	5.35	4.00
Barium	T-Ba	-	-	99	72
Beryllium	T-Be	-	-	0.7	<0.5
Cadmium	T-Cd	-	-	<2	<2
Chromium	T-Cr	-	-	20	17
Cobalt	T-Co	-	-	7	5
Copper	T-Cu	-	-	15	11
Lead	T-Pb	-	-	<50	<50
Mercury	T-Hg	-	-	0.015	0.008
Molybdenum	T-Mo	-	-	<4	<4
Nickel	T-Ni	-	-	17	14
Selenium	T-Se	-	-	<0.1	<0.1
Silver	T-Ag	-	-	<2	<2
Tin	T-Sn	-	-	<30	<30
Vanadium	T-V	-	-	29	23
Zinc	T-Zn	-	-	78	43
Leachable Anions & Cations					
Bromide	Br	-	-	<5	<5
Chloride	Cl	-	-	13	<5
Fluoride	F	-	-	0.6	0.8
Nitrate Nitrogen		N	-	<1	<1
Nitrite Nitrogen		N	-	<1	<1
Sulphate	SO4	-	-	21	<10

EPH = Extractable Petroleum Hydrocarbons
Results are expressed as milligrams per dry kilogram except where noted.
< = Less than the detection limit indicated.



RESULTS OF ANALYSIS

File No. G6538

	1	2	4	7	8
<u>Chlorinated Hydrocarbons</u>					
1,2-Dichlorobenzene	<0.010	-	-	-	-
1,3-Dichlorobenzene	<0.010	-	-	-	-
1,4-Dichlorobenzene	<0.010	-	-	-	-
Hexachlorobenzene	<0.010	-	-	-	-
Hexachlorobutadiene	<0.010	-	-	-	-
Hexachloroethane	<0.010	-	-	-	-
Pentachlorobenzene	<0.010	-	-	-	-
1,2,3,4-Tetrachlorobenzene	<0.010	-	-	-	-
1,2,3,5-Tetrachlorobenzene	<0.010	-	-	-	-
1,2,4,5-Tetrachlorobenzene	<0.010	-	-	-	-
1,2,3-Trichlorobenzene	<0.010	-	-	-	-
1,2,4-Trichlorobenzene	<0.010	-	-	-	-
<u>Polychlorinated Biphenyls</u>					
Total Polychlorinated Biphenyls	-	-	<0.05	<0.05	<0.05
<u>Extractables</u>					
EPH (C10-18)	2630	<250	350	<250	<250
EPH (C19-31)	2660	<250	6410	7450	10100

EPH = Extractable Petroleum Hydrocarbons
Results are expressed as milligrams per dry kilogram except where noted.
< = Less than the detection limit indicated.



RESULTS OF ANALYSIS

File No. G6538

10

15

20

Polychlorinated Biphenyls

Total Polychlorinated Biphenyls

<0.1

-

-

Extractables

EPH (C10-18)

444

<250

<250

EPH (C19-31)

20200

<250

<250

EPH = Extractable Petroleum Hydrocarbons
Results are expressed as milligrams per dry kilogram except where noted.
< = Less than the detection limit indicated.



METHODOLOGY

File No. G6538

Outlines of the methodologies utilized for the analysis of the samples submitted are as follows:

Moisture

This analysis is carried out gravimetrically by drying the sample to constant weight at 103 C.

Water Soluble Organic Compounds in Sediment and Soil

These analyses are carried out in accordance with EPA Method 8000 (Publ. #SW-846, 3rd Ed., Washington, DC 20460). Sediment/Soil samples are extracted with agitation for one hour at room temperature using reagent quality water. The aqueous phase is then analysed by direct injection into a gas chromatograph with Flame Ionization Detection. Quantification is by external calibration with due consideration of the response of an internal standard.

Metals in Sediment/Soil

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 Method 3050 or Method 3051, published by the United States Environmental Protection Agency (EPA). The procedures involve a digestion using a 1:1 ratio of nitric acid and hydrochloric acid, along with hotplate or microwave heating. Instrumental analysis is by atomic absorption spectrophotometry (EPA Method 7000) and/or inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010).

Method Limitation: The stated acid digestion will provide excellent results for total recoverable metals; however, it is only partially effective on mineralized or non-environmentally available metals.

Conventional Parameters in Sediment/Soil

These analyses are carried out on a leachable basis. The procedure involves mixing with reagent grade water and leaching for several hours. The leachate is centrifuged and analysed in accordance with "Standard Methods for the Examination of Water and Wastewater" 17th ed. published by the American Public Health Association, 1989.



Chlorinated Hydrocarbons in Sediment/Soil

This analysis is carried out in accordance with U.S. EPA Method 8080 (Publ. # SW-846 3rd ed., Washington, DC 20460). The procedure involves a solvent extraction with acetonitrile. The extract is then solvent exchanged to hexane followed by an alumina column clean-up. The final extract is analysed by dual capillary column gas chromatography with electron capture detection.

Polychlorinated Biphenyls in Sediment

This analysis is carried out using a procedure adapted from EPA Method 8082 (Publ. # SW-846 3rd ed., Washington, DC 20460). The procedure involves a solid-liquid extraction of the sample with hexane/acetone and back extraction with water. The hexane extract is cleaned and analysed by capillary column gas chromatography with electron capture detection.

Extractable Petroleum Hydrocarbons in Sediment/Soil

This analysis is equivalent to British Columbia Ministry of Environment, Lands and Parks Method for "Extractable Petroleum Hydrocarbons in Soil by GC/FID", January 1996 but does not provide correction for Polycyclic Aromatic Hydrocarbons (PAHs). The procedure involves a hexane/acetone solvent extraction followed by analysis of the extract by capillary column gas chromatography with flame ionization detection.

End of Report



APPENDIX

**HYDROCARBON
DISTRIBUTION
REPORTS**

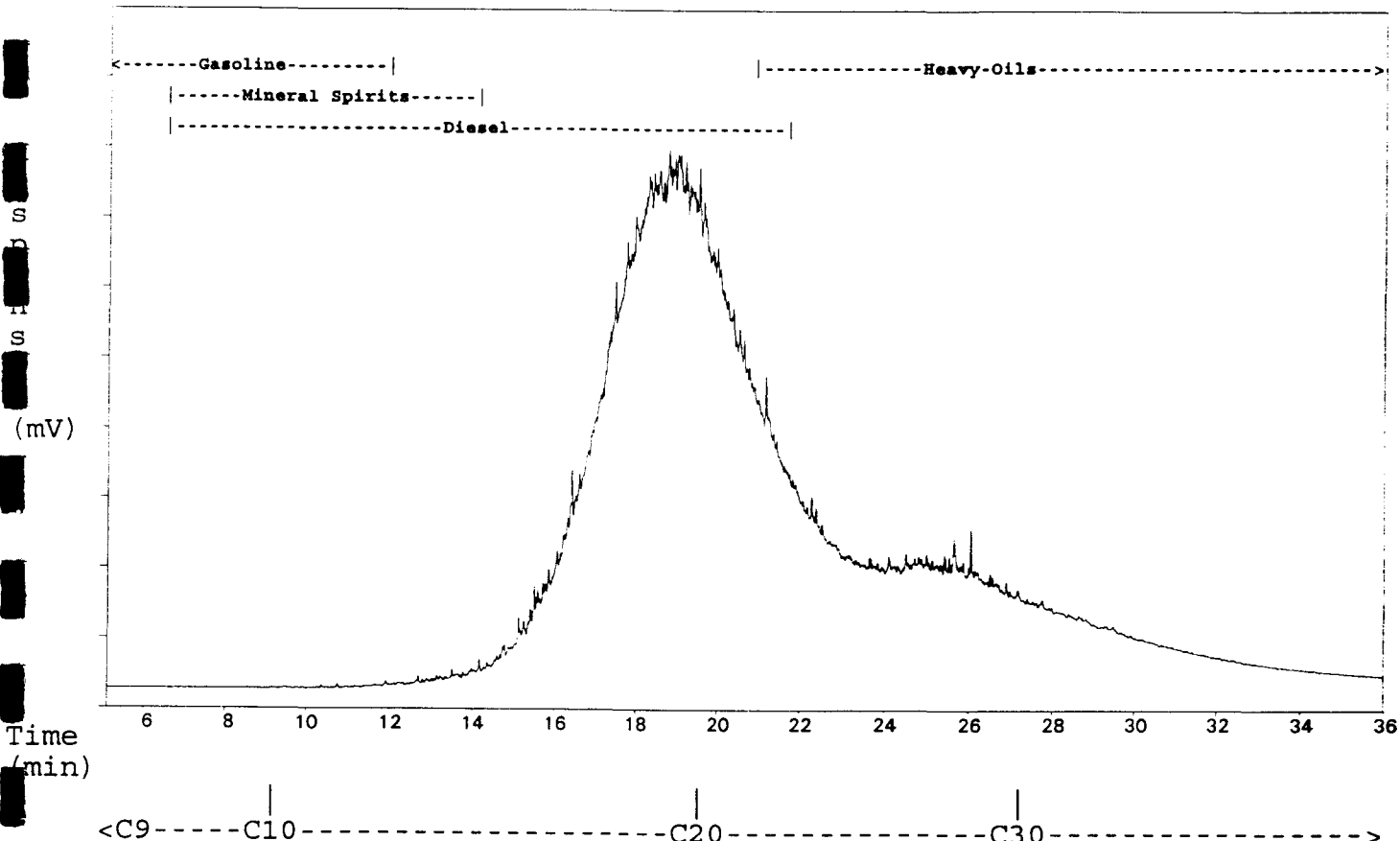
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME 1

Sample acquired: NOV 5, 1996 22:18:23

File Name: c:\TEH\TEHNOV05.16R , Sample Name: G6538 1

Sequence file: TEHNOV05



ASL Sample ID: G6538 1* 8.0Dilution

HYDROCARBON RANGE (by Carbon#)	RELATIVE AMOUNT (%)
C9 (beg-nC9 to beg-nC10)	0.0
C10-C19 (beg-nC10 to beg-nC20)	51.9
C20-C30 (beg-nC20 to beg-nC31)	34.1
C31-C40 (beg-nC31 to beg-nC41)	14.0

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amounts of hydrocarbon product present in the ranges specified. Percent values are relative to the sum of all chromatographic peaks between the retention times of the alkanes n-C9 and n-C40, and are based solely on the areas of those peaks.

HYDROCARBON DISTRIBUTION REPORT

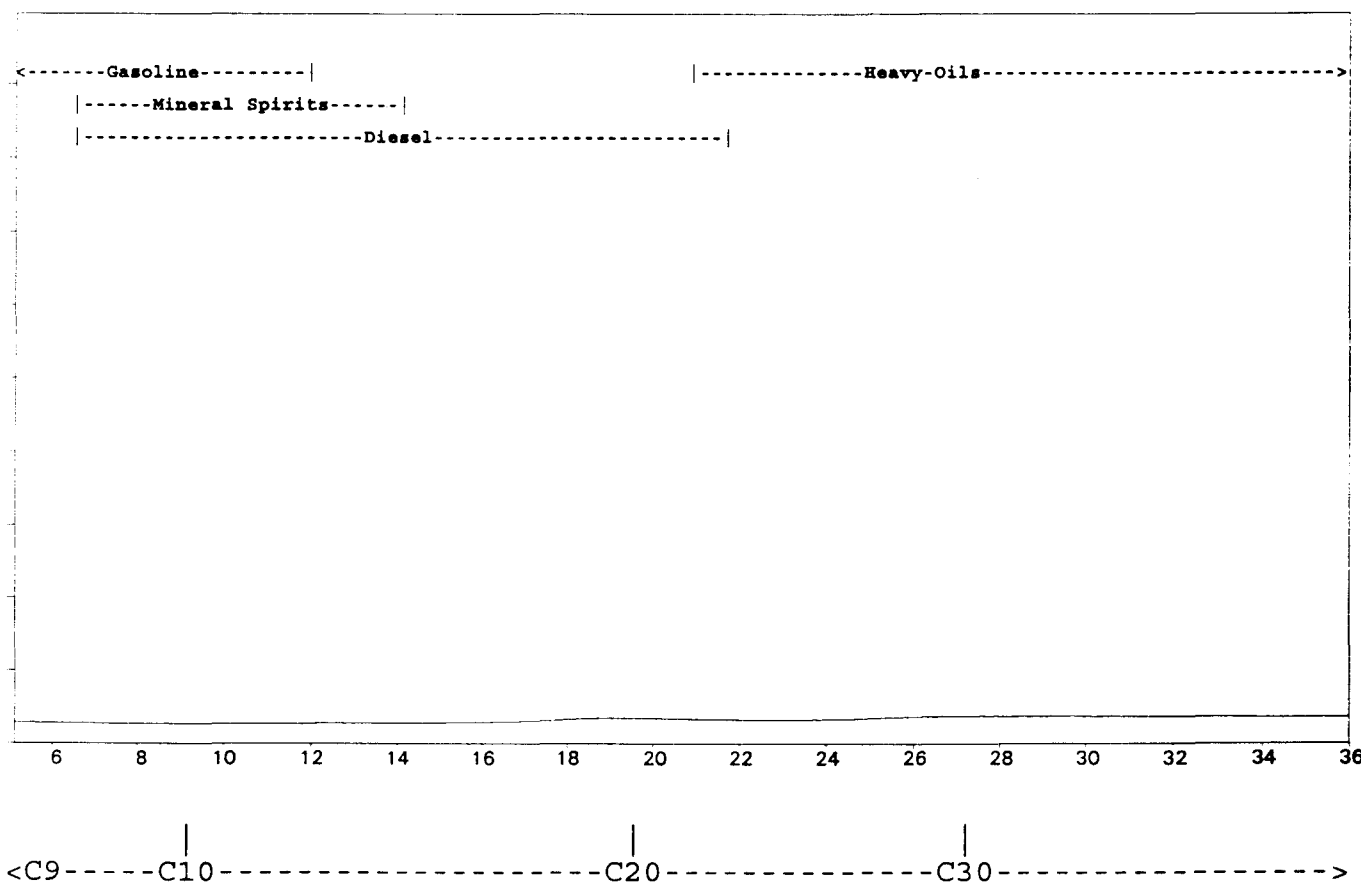
SAMPLE NAME: 2

Sample acquired: NOV 5, 1996 23:11:43

File Name: c:\TEH\TEHNOV05.17R , Sample Name: G6538 2

Sequence file: TEHNOV05

S
H
S
(mV)
Time
(min)



ASL Sample ID: G6538 2* 8.0Dilution

HYDROCARBON RANGE (by Carbon#)	RELATIVE AMOUNT (%)
C9 (beg-nC9 to beg-nC10)	0.0
C10-C19 (beg-nC10 to beg-nC20)	22.7
C20-C30 (beg-nC20 to beg-nC31)	16.8
C31-C40 (beg-nC31 to beg-nC41)	60.6

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amounts of hydrocarbon product present in the ranges specified. Percent values are relative to the sum of all chromatographic peaks between the retention times of the alkanes n-C9 and n-C40, and are based solely on the areas of those peaks.

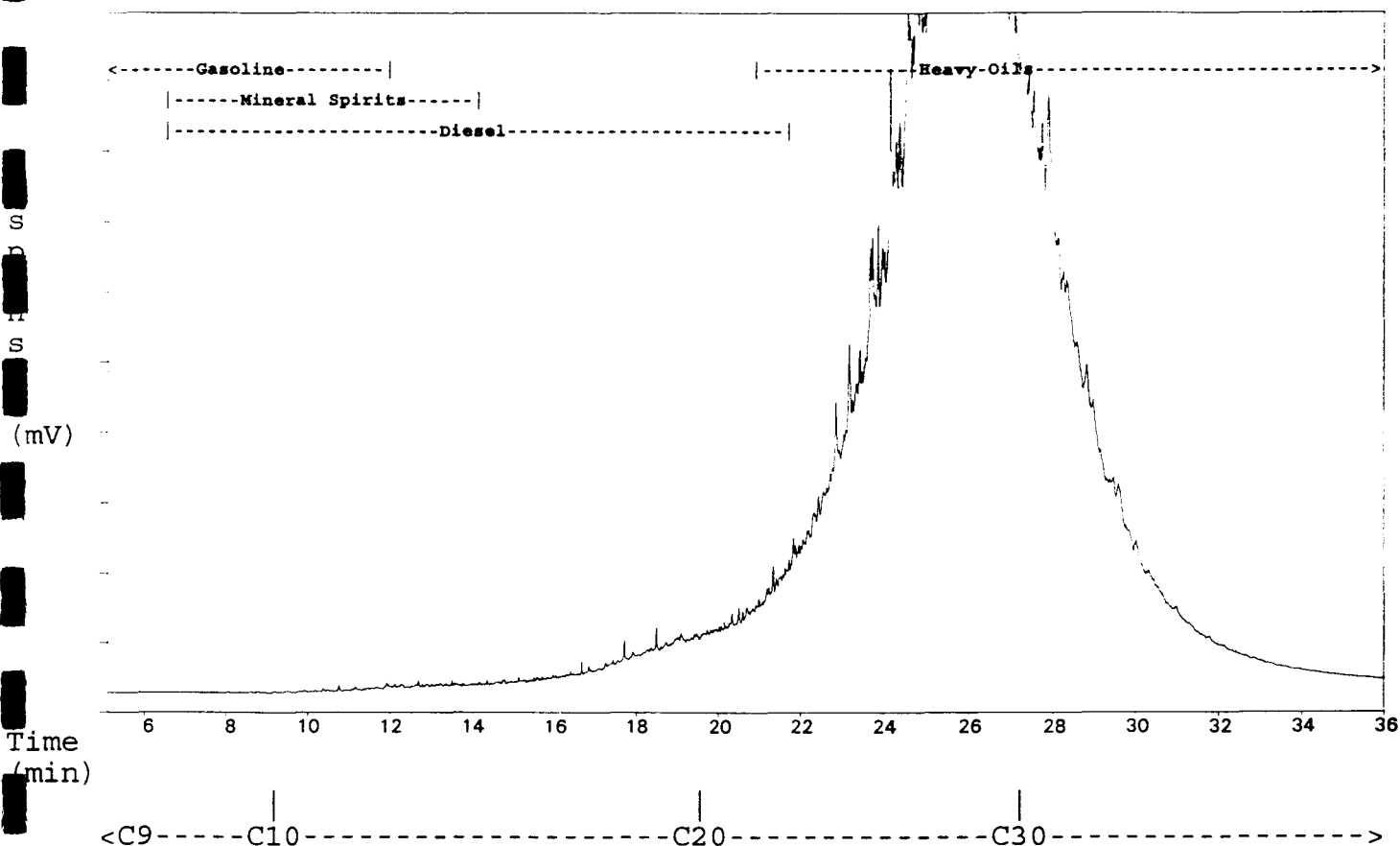
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME: 4

Sample acquired: NOV 5, 1996 23:11:43

File Name: c:\TEH\TEHNOV05.18R , Sample Name: G6538 3

Sequence file: TEHNOV05



ASL Sample ID: G6538 3* 8.0Dilution

HYDROCARBON RANGE (by Carbon#)	RELATIVE AMOUNT (%)
C9 (beg-nC9 to beg-nC10)	0.1
C10-C19 (beg-nC10 to beg-nC20)	3.6
C20-C30 (beg-nC20 to beg-nC31)	45.7
C31-C40 (beg-nC31 to beg-nC41)	50.6

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amounts of hydrocarbon product present in the ranges specified. Percent values are relative to the sum of all chromatographic peaks between the retention times of the alkanes n-C9 and n-C40, and are based solely on the areas of those peaks.

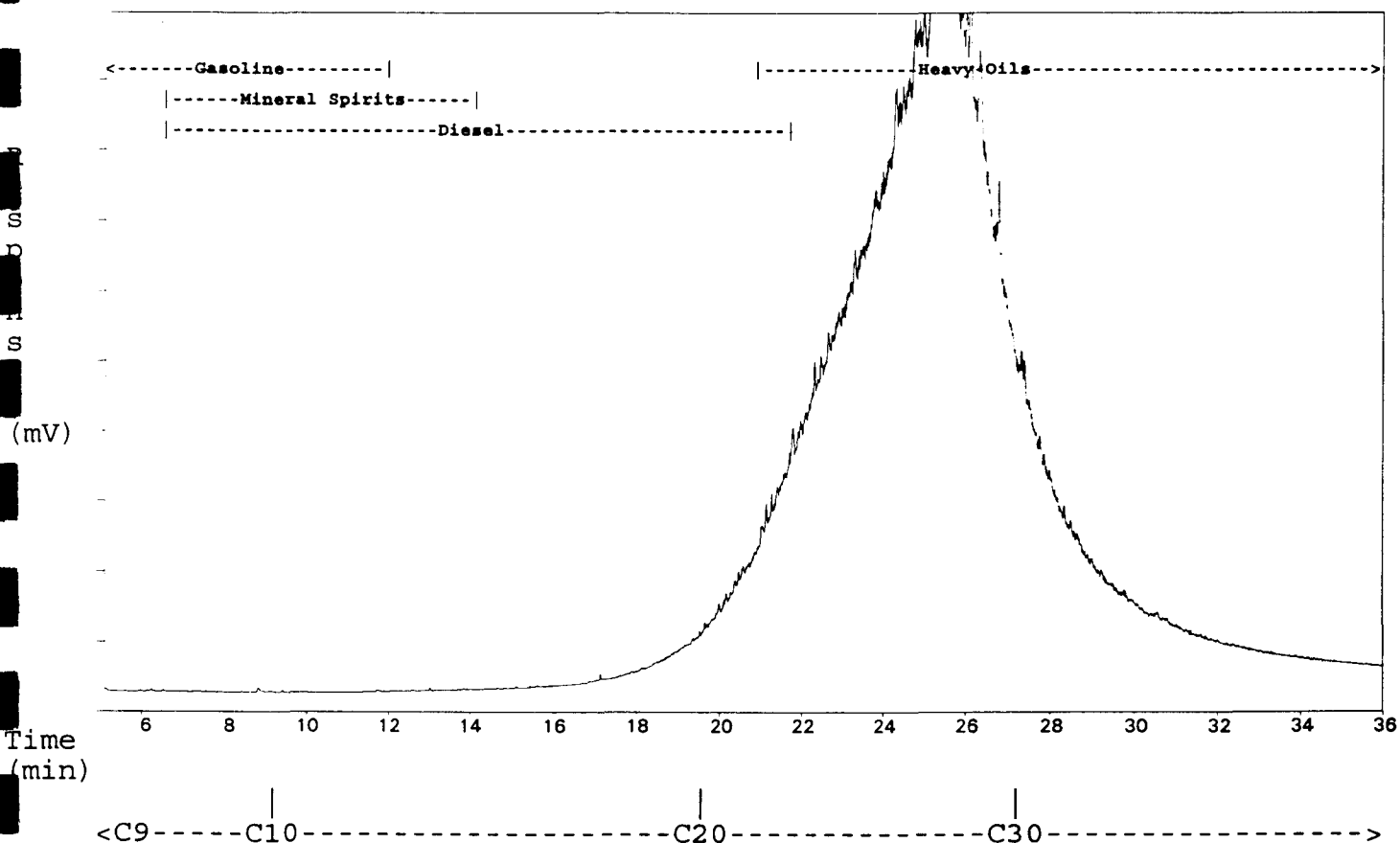
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME: 7

Sample acquired: NOV 6, 1996 00:04:59

File Name: c:\TEH\TEHNOV05.19R , Sample Name: G6538 4

Sequence file: TEHNOV05



ASL Sample ID: G6538 4* 8.0Dilution

HYDROCARBON RANGE (by Carbon#)	RELATIVE AMOUNT (%)
C9 (beg-nC9 to beg-nC10)	0.5
C10-C19 (beg-nC10 to beg-nC20)	3.4
C20-C30 (beg-nC20 to beg-nC31)	61.4
C31-C40 (beg-nC31 to beg-nC41)	34.7

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amounts of hydrocarbon product present in the ranges specified. Percent values are relative to the sum of all chromatographic peaks between the retention times of the alkanes n-C9 and n-C40, and are based solely on the areas of those peaks.

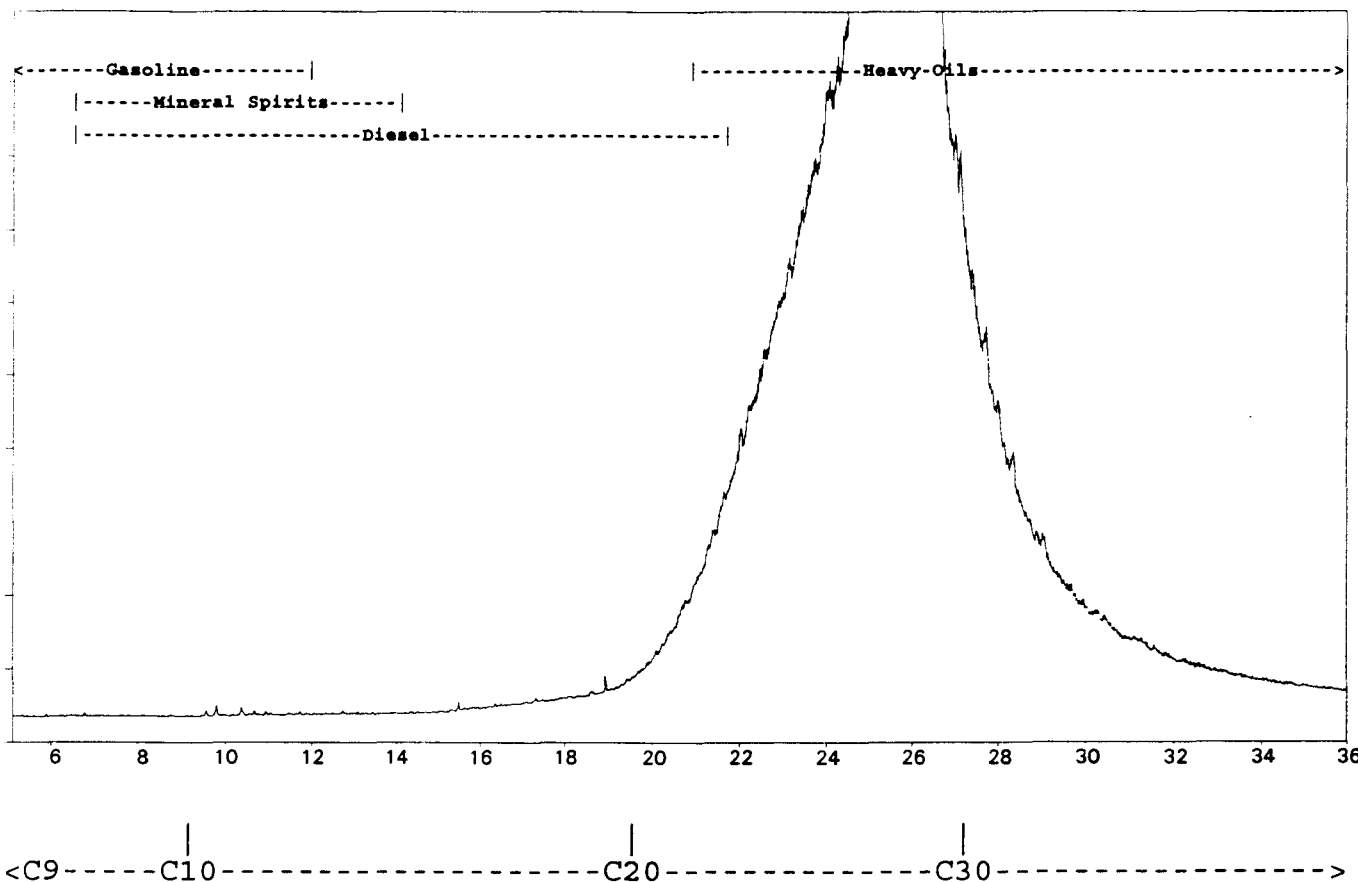
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME: 8

Sample acquired: NOV 8, 1996 00:58:56

File Name: c:\TEH\TEHNOV07.13R , Sample Name: G6538 5

Sequence file:



ASL Sample ID: G6538 5* 8.0Dilution

HYDROCARBON RANGE (by Carbon#)	RELATIVE AMOUNT (%)
C9 (beg-nC9 to beg-nC10)	0.0
C10-C19 (beg-nC10 to beg-nC20)	2.2
C20-C30 (beg-nC20 to beg-nC31)	68.3
C31-C40 (beg-nC31 to beg-nC41)	29.5

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amounts of hydrocarbon product present in the ranges specified. Percent values are relative to the sum of all chromatographic peaks between the retention times of the alkanes n-C9 and n-C40, and are based solely on the areas of those peaks.

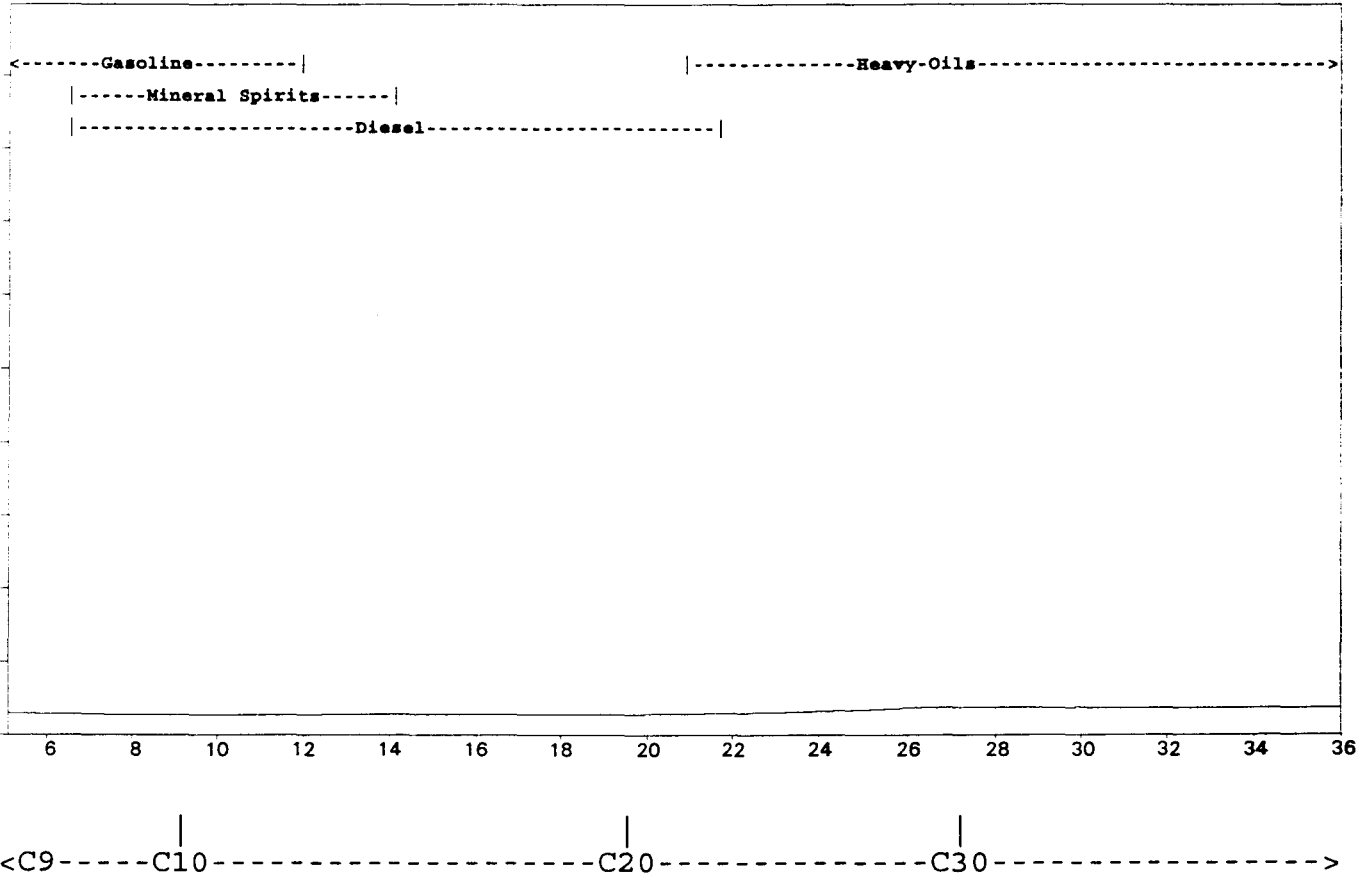
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAME: 15

Sample acquired: NOV 6, 1996 01:50:33

File Name: c:\TEH\TEHNOV05.23R , Sample Name: G6538 7

Sequence file: TEHNOV05



ASL Sample ID: G6538 7* 8.0Dilution

HYDROCARBON RANGE (by Carbon#)	RELATIVE AMOUNT (%)
C9 (beg-nC9 to beg-nC10)	0.0
C10-C19 (beg-nC10 to beg-nC20)	0.2
C20-C30 (beg-nC20 to beg-nC31)	19.6
C31-C40 (beg-nC31 to beg-nC41)	80.2

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amounts of hydrocarbon product present in the ranges specified. Percent values are relative to the sum of all chromatographic peaks between the retention times of the alkanes n-C9 and n-C40, and are based solely on the areas of those peaks.

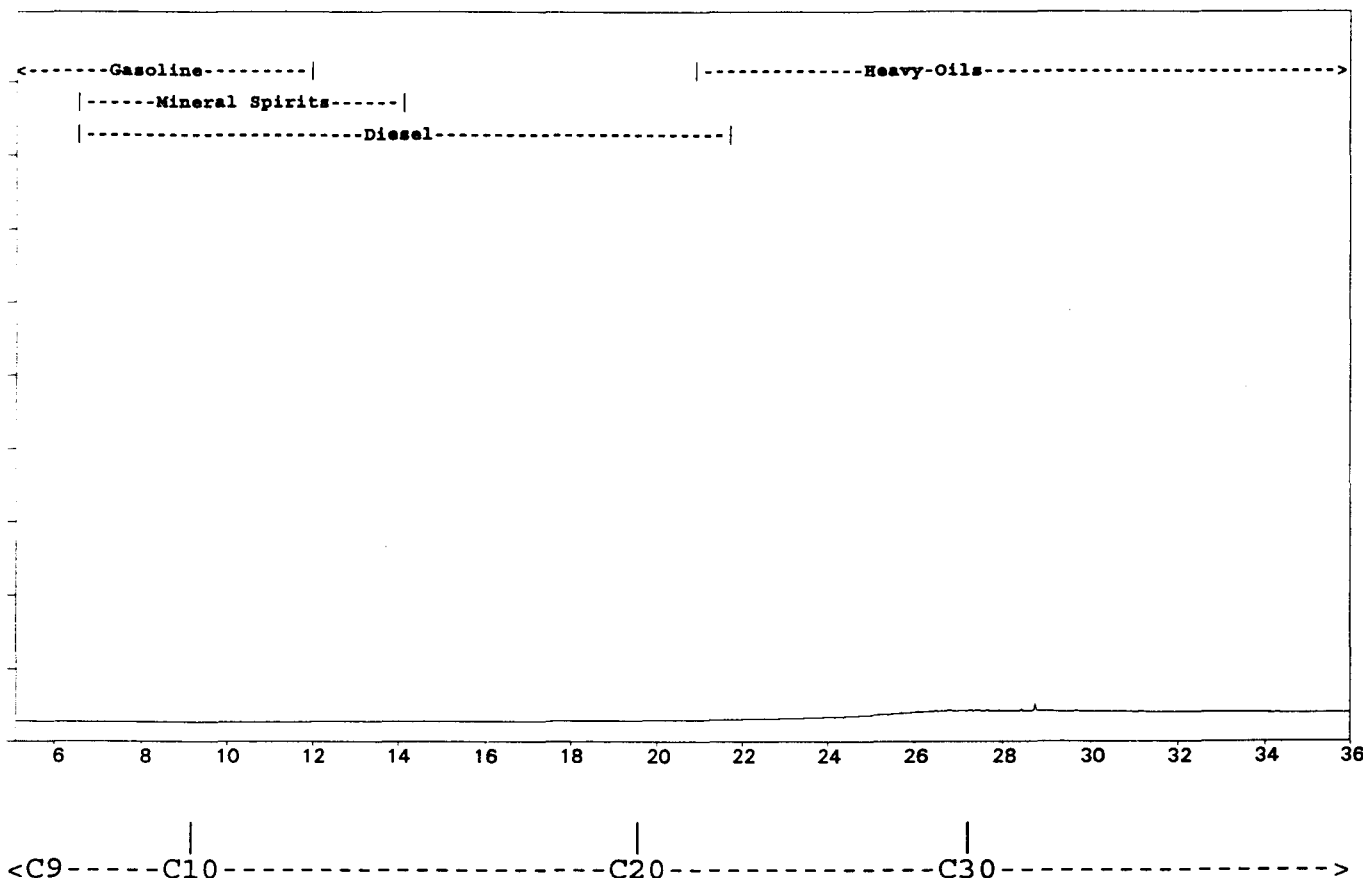
HYDROCARBON DISTRIBUTION REPORT

SAMPLE NAM 20

Sample acquired: NOV 6, 1996 01:50:33

File Name: c:\TEH\TEHNOV05.24R , Sample Name: G6538 8

Sequence file: TEHNOV05



ASL Sample ID: G6538 8* 8.0Dilution

HYDROCARBON RANGE (by Carbon#)	RELATIVE AMOUNT (%)
C9 (beg-nC9 to beg-nC10)	0.0
C10-C19 (beg-nC10 to beg-nC20)	0.0
C20-C30 (beg-nC20 to beg-nC31)	21.4
C31-C40 (beg-nC31 to beg-nC41)	78.6

The Hydrocarbon Distribution Report is intended to assist you in characterizing the hydrocarbon product present in a given sample. The scale at the top of the chromatographic trace represents the hydrocarbon range of common petroleum products. Comparison of this report with those of reference standards may also assist you in the identification of the hydrocarbon product detected in your sample. The second part of the report is a table that expresses the relative amounts of hydrocarbon product present in the ranges specified. Percent values are relative to the sum of all chromatographic peaks between the retention times of the alkanes n-C9 and n-C40, and are based solely on the areas of those peaks.