A TETRA TECH COMPANY

October 7, 2011

ISSUED FOR USE
EBA FILE: W23101474

Yukon Government, Department of Environment (V-8)
Site Assessment and Remediation Unit
Box 2703
Whitehorse, YT, Y1A 2C6

Attention: Ms. Amanda Janssens, Assessment and Remediation Technician

Subject: Review and Summary of Previously Collected Soils, Groundwater and Permafrost Data, Old Crow, Yukon

1.0 INTRODUCTION

EBA, A Tetra Tech Company, was requested to undertake completion of a review and summary of all past work completed in Old Crow, Yukon related to soil, groundwater and permafrost historical data collected by EBA. A summary of general information for the entire Old Crow area is provided, along with more detailed information for the four sites of interest, including: the Aerodrome (which includes the Airport Maintenance Branch Shop and two tank farms), Nursing Station, Chief Zhe Gittlit School and Teachers Residence, and the Solid Waste Management Facility (see Figure 1).

2.0 GENERAL OLD CROW GEOLOGIC INFORMATION

2.1 Bedrock Geology

Old Crow lies within a broad physiographic area known as the Yukon Plateau; the local area is referred to as the Porcupine Plateau. The area is believed to be an erosional surface cut into the bedrock, mantled with a thin veneer of recent sediments. Bedrock consists mainly of marine siltstones, sandstones and shales, interspersed with marine limestone and dolomites. Fine grained quartzites of either fluviatile or marine origin have also been noted. These stratified rocks range in age from Upper Cretaceous to Precambrian, and are observed to be both folded and faulted. The site of the community is bounded by several southwest-northeast trending faults which cut only the rocks older than Lower Cretaceous, not affecting the younger, near-surface rocks. (Old Crow Groundwater Supply a Geotechnical, Hydrological and Thermal Study, July 1982)

2.2 Pleistocene Geology

The Porcupine Plateau is almost entirely unglaciated. The Northern-most part, Old Crow Plain, is underlain by relatively thin deposits of lacustrine silts and clays, capped with peat. Closely spaced lakes and ponds have an oriented rectangular pattern apparently produced by the prevailing winds. These lakes are generally clustered in distinct flat basins, formed by fine grained deposits in the bottoms of large ancient

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lakes. The community of Old Crow is located on the northern edge of the Bluefish Basin, which is located immediately south of the larger Old Crow Basin. These basins are dissected primarily by the Porcupine and Old Crow Rivers (and their tributaries) which flow through youthful valleys in the area, and meander elaborately.

The community is located on the Porcupine River, immediately downstream of the junction of the Old Crow and Porcupine Rivers. The site is an active river floodplain which is slowly eroding at the upstream edge of the community. The Porcupine River at this location is essentially erosional, slowly down cutting through the ancient lacustrine deposits. (Old Crow Groundwater Supply a Geotechnical, Hydrological and Thermal Study, July 1982)

2.3 Stratigraphy

The native soil profile typical of the Old Crow area consists of a clayey silt stratum. Materials of various textures reflecting depositional environments make up the terrain in the vicinity of Old Crow. (Phase 1, August 2007) The upland terrace below Crow Mountain is part of a large pediment. Rock and soils from the exposed bedrock outcrops are carried by gravity down-slope through soil creep, sheet erosion, rain-wash, mudflow movement or solifluction. Thicker wedges of sediments cover the lower parts of the upper terrace as evidenced by the presence of tree cover. These sediments are estimated to be up to 6 m thick, overlying weathered and fragmented bedrock. Permafrost is continuous in this area. (Old Crow North Bypass Road, June 2010) Geotechnical and water well drilling have indicated that overburden sediments consisting of silt and clay with some gravel overlay sedimentary bedrock (sandstone, siltstone, shale, limestone). The depth to bedrock at the community water supply well is approximately 40 m. (Old Crow North Bypass Road, June 2010)

2.4 Permafrost

Geotechnical information within the main portion of the community between the airport and Porcupine River indicates the presence of permanently frozen silt and sand floodplain deposits, with an active layer up to about 3.0 m in thickness in disturbed areas. In undisturbed locations insulated by natural organics and trees, the active layer is less than 1.2 m thick. (Old Crow North Bypass Road, June 2010) Permafrost has been encountered at an average depth of about 1 m (varies with time of year) within the clayey silt stratum during geotechnical evaluations (Phase 1, August 2007), and the depth that permafrost has been observed to reach is in excess of 60 m. The permafrost is locally ice-rich, and contains some below grade seepage zones at the base of the active layer that channels water from the small lakes north of the airstrip towards the Porcupine River. (Old Crow North Bypass Road, June 2010) Ground temperature (thermistor) cables were installed during a foundation assessment for the Arctic Research Facility (shown on Figure 1) in January 2011. It was found that the temperature of permafrost was -0.1°C to -0.6°C. Air temperatures during construction varied from -10.4°C to 3.2°C and several days were sunny leading to rapid warming of exposed permafrost. (Foundation Installation Summary Report, Arctic Research Facility, October, 2009)

2.5 Groundwater

Surface water north of Old Crow infiltrates into the ground and flows down gradient in sheets along the interface with the permafrost layer or bedrock until it reaches the terrace edge where it has eroded a series

of gullies along the escarpment face. Most of the Crow Mountain drainage is intercepted by the lowland basin north of the airstrip, while surface drainages flows to the southeast and directly to a side channel of the Porcupine River. The small lakes in this area effectively act as a groundwater catch basin (Old Crow North Bypass Road, June 2010). Conversations with local residents and Yukon Government staff have indicated that water in June 2010 flowed from the north beneath the airstrip and collected in the interceptor ditch paralleling the south side of the airport (see Figure 2). Drainage continued southwest through a culvert (see Figure 2) and entered the Porcupine River downstream of Old Crow. (Old Crow North Bypass Road, June 2010) A geotechnical report done in August 2003 involving trench crossing of the runway encountered a perched water table on top of the permafrost layer at a depth generally less than 1m. (Phase 1, August 2007) Past projects have encountered perched groundwater at a thickness between 0.05m and 0.2 thick. The regional aquifer is considered confined and has artesian flow. Water was initially encountered at 79 m depth within a fractured limestone unit.

3.0 AERODROME AND AIRPORT MAINTENANCE BRANCH (AMB) INCLUDING THE GARAGES AND TANK FARMS

3.1 Past Projects

Extensive testing has been completed on the aerodrome site and adjacent sites.

Table 1: EBA Aerodrome Past Projects

Date	Project Number	Project Name	Details including Borehole and Test Pit numbers referenced on Figure 1
	W23101270.002	VGFN Tank Farm Assessment	Report not yet submitted
September, 2009	W23101270.001	VGFN Tank Farm Assessment	W23101270-TP01 - TP21
September, 2007	1240236	Airport Wildlife Management Plan	Report completed
January 2006	1240161	Environmental Site Assessment of Old Crow Airport	1240161-BH01 - 41
August, 2005	1240200	Permafrost Probe Holes - Old Crow Airport	1240200-TH01- TH07
June 2005	1240157	Old Crow Grader Station Phase I ESA	Report completed
January 2005	1240145	Phase I ESA Old Crow Airport	Report completed
November, 1999	0201-99-14146	Geotechnical Site Investigation, New Airport Terminal Building	14146-TP01 - TP04
April, 1997	0201-97-13050	Environmental Audit of Old Crow Airport Fueling Facility	13050-BH1 - BH12 Water and soil analysis

3.2 Stratigraphy

While drilling permafrost probes at the AMB in 2005, it was logged that surface conditions were typically peat and organics with observed silt and trace sand ranging from 0.4 to 0.9 m. At some test holes sand and gravel, likely imported river gravel fill, with trace silt were observed. (Permafrost Probe Holes – Old Crow

Airport (1240200), August 2005) Boreholes drilled near the tank farm encountered similar conditions with organics and clayey silt and trace sand as well as observed sand and gravel fill. (Environmental Audit, Airport Fuelling Facility (0201-97-13050), November 2002)

The soil has been characterized as Gravel (fill), sandy, trace of silt to depths ranging from 0.3 to 1.5 m. The fill material rests on a clayey silt stratum which is representative of the native soil profile. (Environmental Site Assessment of Old Crow Airport, January 2006)

3.3 Groundwater

While completing a soil contamination assessment at the tank farm in September 2009 (report completed June 2010), 21 test pits were excavated. The seasonal groundwater table in the Old Crow area was observed to exist as a perched aquifer on the surface of the permafrost. Groundwater was encountered in the test pits between 0.85 m and 2.0 m bgs and ranged between 0.05m and 0.2m thick directly on the surface of permafrost. Information on groundwater collected from previous reports indicated that groundwater in the area flows south toward the Porcupine River. This was supported by the general topography of the area. (Soil Contamination Assessment, June 2010)

There is no shallow groundwater flow regime found within the airport area between the air terminal building and the AMB Garage (see Figure 3). The ground remains frozen for most of the year and the active layer is not thick enough to permit shallow groundwater flow. During the drilling investigation, the only area where it was possible to install a monitoring well was to the east of the Airport tank farm (see Figure 4). In the two monitoring wells that were installed, water stabilized to depths of between 1.0 and 1.3 m bgs. (Environmental Site Assessment of Old Crow Airport, January 2006)

3.4 Permafrost

Seven permafrost probe holes drilled along the north side of the airstrip in August 2005 found the average seasonal depth to permafrost to be 1.03 m and ranging from 0.40 m to 2.30 m. (Permafrost Probe Holes – Old Crow Airport, August 2005) In November 2002, boreholes were drilled near the Aerodrome tank farm and permafrost was typically encountered at 2.1 m. (Environmental Audit, Airport Fueling Facility (0201-97-13050), November 2002)

Permafrost was encountered within the clayey silt at depths varying between 1.4 to 2.4 m below grade in the drilling investigation for the AMB Shop. (Environmental Site Assessment of Old Crow Airport, January 2006)

3.5 Contamination

EBA conducted an environmental site assessment for the Old Crow airport and issued the report in January 2005. Within the report there was anecdotal information with regard to the fill line from the tank farm to the airport and staining at the VGFN fill point. Actual presence of contamination at the subject site was not confirmed within the report. (Old Crow Grader Station Phase I ESA, January, 2005)

Groundtrax Environmental Services Inc. (Groundtrax) issued a document on September 8, 2008, titled Bulk Fuel Pipeline Repair and Testing Service Report. Groundtrax was retained by VGFN to remove and pressure test a 3" fuel line running from the Old Crow Airport to the VGFN tank farm. As part of the work,

Groundtrax purged the pipeline, prepped the pipeline, removed the valve, patched the pipeline, and vacuum tested the line for leaks. The pipeline was approved for re-use on September 2, 2008. Within the report there was no mention of leaks or spills from the pipeline.

Groundtrax issued a report on November 10, 2008, titled Environmental Impact Assessment VGG Tank Farm. Groundtrax coordinated a preliminary environmental impact assessment program to identify the approximate extent of soil and groundwater impacts across the VGFN Tank Farm between September 1 and 5, 2008. As part of the assessment, 39 test-pits were excavated and five samples were collected and analyzed for volatile petroleum hydrocarbons (VPH) light and heavy extractable petroleum hydrocarbons (LEPH, HEPH), polycyclic aromatic hydrocarbons (PAHs), and total metals. The analytical results indicate that soil contamination exists above the Yukon Contaminated Sites Regulation (YCSR), commercial land use (CL) standards in four of the five samples collected. Samples indicating soil contamination were collected in four areas including: the drainage ditch, a historical spill area, next to the RCMP above-ground storage tank (AST), and south of Yukon Energy Corporation (YEC) storage shed outside the fenced tank farm area.

In September 2009 EBA completed 21 test pits for the VGFN Tank Farm Assessment. Laboratory analytical results exceeded the CSR-CL standards for 10 samples collected in 8 locations across the assessment area. Soils which were considered "Special Waste" existed in three test pit locations between surface and 2.4 m below ground surface. (VGFN Tank Farm Assessment, September 2009). EBA is currently in the process of supplying recommendations for additional assessment and remedial work to be completed including the construction of a land treatment facility. (VGFN Tank Farm Assessment, in progress)

In August 2005 EBA completed a site assessment at the Transportation Maintenance Branch (TMB) tank farm (locations shown on Figure 3) and around the Aviation tank farm (locations shown on Figure 4) that included the drilling of 41 boreholes (two of which were completed as monitoring wells). From the drilling, 72 soil samples and 2 groundwater samples were submitted for analysis. The estimated volume of contaminated soil at the TMB tank farm was 1245 m^3 and at the Aviation tank farm was 330 m^3. Additionally, there was an estimated 55 m^3 of Special Waste at the TMB tank farm. Soil samples that were tested and exceeded the YCSR IL standards included exceedances of xylenes, VPH and LEPH. An exceedance of dissolved toluene at MW-12 was found during groundwater sampling.

4.0 NURSING STATION

4.1 Past Projects

Table 2: EBA Nursing Station Past Projects

Date	Project Number	Project Name	Details
January, 2011	W23101323	Old Crow Water Treatment Plant Wells/Aquifer Vulnerability Assessment	Report completed
December, 2009	W14101341	Foundation Design - New Generator Building	W14101341-TP01 - TP03
March, 1987	0201-4633	Geotechnical Investigation, Proposed 3-Bay Garage	BH 4633-1 through BH 4633-3
July, 1982	209-3546	Old Crow Groundwater Supply, A Geotechnical, Hydrological and Thermal Study	2 Water Wells, 5 boreholes, report

4.2 Stratigraphy

A foundation design was completed in December 2009 for the Yukon Electrical Company New Generator Building which is near the nursing station. The test pits reached depths ranging from 1.6 m to 1.85 m. Ground frost was observed in the first 0.20 m bgs, and a material appearing to be fill from the Crow Mountain quarry was encountered within the test pits. In Test Pit 2 and 3, a relatively undisturbed soil composed of dark grey to black silt with some sand and organic pockets was found below the fill material. (Foundation Design- New Generator Building, December 2009)

In March 1987 a geotechnical evaluation was completed at the proposed 3-Bay Garage which is located to the west of the nursing station. The ground surface was covered with peat moss which provided a rough hummocky surface. Permafrost was continuous in this area, insulated by the surface organics. Due to snow cover at the time of investigation, it was not possible to determine drainage characteristics; however, it is likely that the low area between the gravel pad and NCPC berm in poorly drained. (Geotechnical Investigation, March 1987)

In general, the 3-Bay Garage site consists of gravelly sand fill over peat and organics, overlaying a variable thickness of sandy, silts. The deepest drill hole was terminated at 5.3m depth in the alluvial gravel. Information from an adjacent site to the 3-Bay Garage suggests that the gravelly fill is again underlain by sandy silts to depths in excess of 50 m. (Geotechnical Investigation, March 1987)

In 1982, a comprehensive drilling program was completed adjacent to the Nursing Station to install two water supply wells for the community of Old Crow. The wells were drilled to 79.3 and 121.9 m depth. In addition, 5 test holes were drilled to a maximum depth of 18.3 m.

The geology generally consisted of:

- 0 to 5.5 m Silt and Clay
- 5.5 to 10.5m Gravel, sandy, frozen soils from 10 m
- 10.5 to 29 m Clay and Silt
- 29 to 37.5 m Silt and Sand
- 37.5 to 64 m Siltstone and Sandstone
- 63 m End of permafrost
- 64 to 67 m Shale
- 67 to 77 m Siltstone and Sandstone
- 77 to 87 m Limestone
- 87 to >122m Dolomite

(Old Crow Groundwater Supply, July 1982)

4.3 Groundwater

Groundwater was observed seeping just above the permafrost layer. (Foundation Design- New Generator Building, December 2009)

Groundwater was encountered at 79 m bgs in the first water well (WW-1) drilled adjacent to the Nursing Station. The well was terminated at 79.3 m when water under artesian pressure was encountered. Artesian flow from the top of the casing was estimated at 6.1 L/s. The artesian flow prevented proper well completion at the time, therefore the well was partially sealed and the drilling of a second well (WW-2) proceeded approximately 17 m east of WW-1. Water was again detected at 79 mbgs. Significant flows of water in WW-2 were not encountered until 97 m depth when artesian flow from the top of the casing was noted to be approximately 2.3 L/s. The hole was terminated at 122m, utilizing all of the available well casing. Well screens could not be placed in the bottom of either well due to the artesian flow. WW-2 was pumped at rates between 13.1 L/s to 18.9 L/s which caused the water to draw down in WW-1, allowing its completion. A constant rate test at 17 L/s was then conducted for 72 hours on WW-1. The Theis analysis method was used on the data obtained from the observation well (and considered the most accurate) to determine the aquifer transmissivity and storativity. The apparent transmissivity of the aquifer was 42.2 m^3/day/m. The storage coefficient was calculated to be 1.52 x 10^{-3}, and the 20 year safe yield was 18.9 L/s. (Old Crow Groundwater Supply, July 1982)

4.4 Permafrost

Permafrost was encountered at approximately 1.8 m bgs in the three test pits. (Foundation Design- New Generator Building, December 2009)

Permafrost was encountered through the 3-Bay Garage site and was found to be continuous to the maximum hole depth of 5.3 m. The surficial peat layer acted as an insulation protecting against permafrost degradation. The ground ice classification in the permafrost ranges from non-visible (Nbe) to small stratified and randomly oriented ice lenses (Vs, Vr) up to 20% volume. The seasonal frost was continuous with the permafrost at the time of drilling, but seasonal thaw is likely not greater than a meter of so below the organics, and only to the bottom of the organics in the areas of surficial gravel fill. (Geotechnical Investigation, March 1987)

In the 1982 drilling program completed adjacent to the Nursing Station, permafrost extended from near surface to approximately 60 mbgs. Four boreholes were drilled in a north to south direction from near the water wells towards the Porcupine River (See Figure 1). The borehole (TH-6) closest to the water wells indicated frozen conditions through the entire depth. The borehole (TH-7) closest to the Porcupine River appeared unfrozen. TH-4 (near TH-7) and TH-5 (towards the water wells) appeared unfrozen below the seasonal frost line. This testing suggests that in this location, the Porcupine River has the effect of reducing frozen conditions a distance of approximately 80 m inland from the active channel. (Old Crow Groundwater Supply, July 1982). It should be noted that the locations of TH-4 and TH-5 are in locations that are part of the active channel during high water events (break-up and spring freshet). It is likely that this phenomenon of ice-free conditions would be consistent along the length of the active channel.

5.0 CHIEF ZHE GITTLIT SCHOOL AND TEACHER'S RESIDENCE

5.1 Past Projects

Table 3: Chief Zhe Gittlit School and Teachers Residence

Date	Project Number	Project Name	Details
November, 2000	0201-99-14123	Additional work at the YHC Teachers Residence Duplex	Report completed
August, 2000	0201-99-14123	Preliminary Report for Restoration of YHC Teachers Residence Duplex	Report completed
October, 1997	0201-97-13028	Foundation Design for New School	13028-BH02 - BH02
			Report completed
			Ground Temperature Data

5.2 Stratigraphy

The new school site was examined on September 9, 1997, and three shallow test pits were excavated to determine organic cover and obtain samples of inorganic soils. The locations of test pits were selected within the school footprint, as best could be determined at the time. The new school is situated on permanently frozen floodplain deposits of either the Old Crow or Porcupine Rivers. The test pits indicated approximately 400 mm of organics and peat, overlay frozen clayey silt with trace sand. Soil pore water salinities were also measured, and salinity concentrations in all samples were negligible. The excavation was limited to 500 mm below ground level due to the hard and frozen nature of the sub-soils. (Foundation Design for New School, October, 1997)

5.3 Groundwater

No previous work has been completed by EBA in the area of the Chief Zhe Gittlit School that pertains to groundwater, but it is expected for the groundwater to behave as outlined in the General Old Crow section.

5.4 Permafrost

The depth to permafrost was probed at a dozen or so locations in 1997 at the school site. The top 30 m or so of the permafrost was locally ice-rich, with visible ice logged up to 30% by volume, and averaging 10%-15% over most of the borehole(s). This indicates that the foundation soils are susceptible to significant thaw settlements, if not maintained in a permanently frozen condition. (Foundation Design for New School, October, 1997)

The depth to permafrost at the Teacher's Residence was found at a depth of between 1.0 and 1.7 m within silts.

5.5 Contamination

In August, 1999 vandals damaged a fuel transfer line from an above ground heating oil storage tank located at the Teacher's residence complex. The contents of the tank spilled out onto the ground. Some of the fuel oil soaked into the ground while some followed the natural ground slope to the east to a natural drainage channel, and made its way into an old river channel slough. Impacted soils were excavated in the vicinity of the fuel oil tank by Arctic Circle Service. EBA was contacted to collect samples, provide guidance and document activities. An excavation was conducted to remove accessible contaminated soils. Approximately 200 m3 of contaminated soil was transported to the Old Crow landfill for treatment using a land farming technique. Fuel oil was also recovered from the surface of the slough through the use of containment booms and absorbent pads. Approximately 100 L of product was recovered from the surface of the slough. Concentrations of hydrocarbons in soils remained in place below ground surface. Specifically, a sample 1.0 m depth (S3) on the west wall of the excavation (adjacent to the Teacher's Residence, and below the former location of the AST), contained concentrations of ethylbenzene (14 mg/kg), toluene (11.2 mg/kg), xylenes (87.1 mg/kg), VPH (1590 mg/kg), LEPH (4560 mg/kg) and naphthalene (25 mg/kg) greater than the YCSR RL standards. In addition a sample from 0.7 depth on the west wall contained a concentration of LEPH (2690 mg/kg) greater than the YCSR RL standard. (Preliminary Report for Restoration of YHC Teachers Residence Duplex, August 2000)

In August 2000, EBA returned to the site to proceed with additional soil restoration. Soil amendments and moisture were added to the ground surface to stimulate in-situ bioremediation of impacted soil that remained in the affected area. This was recommended to be continued annually for five to ten years or until soils were found to be below YCSR RL standards. In addition, a cut-off wall of material with lower hydraulic conductivity than the surrounding, native material was installed to restrict the transport of leachate derived from the impacted soil that remained in place to the Porcupine River. (Additional work at the YHC Teachers Residence Duplex, November 2000)

6.0 SOLID WASTE MANAGEMENT FACILITY

6.1 Past Projects

Table 4: Solid Waste Management Facility

Date	Project Number	Project Name	Details
September, 2010	W23101270.002	VGFN Tank Farm Assessment	W23101270-SA01 - SA02 (hydrometers)
March, 1987	0201-4614	Proposed Sewage Lagoon	4614-BH01 - BH09 4614-BH04 thermistor cable installed

6.2 Stratigraphy

In 1987 a geotechnical evaluation of the sewage lagoon was completed by EBA. The subsurface soils encountered consisted of a thin veneer or organics (root mat) overlying ancient floodplain deposits (organic silt, some sand, decreasing in organic content with depth) of the Porcupine River which is typical of Old Crow. In general, the subsurface can be summarized as follows. Peat was found between 0.0 m to 0.2 m with 50-100% ground ice content. Organic silt followed with trace to some sand, trace clay and Vs 10% locally as much as 70% ice reaching 4.7m in depth. Sand with some silt and gravel typically began at 4.7 m to an undetermined depth. (Proposed Sewage Lagoon, March 1987)

6.3 Groundwater

No previous work has been completed by EBA that pertains to groundwater in the area of the Solid Waste Management Facility, but it is expected for the groundwater to behave as outlined in the General Old Crow section.

6.4 Permafrost

Permafrost was encountered in 1987 throughout the proposed alternate sewage lagoon site (see Figure 1) and was found to be continuous to the maximum borehole depth of 6.0 m. Borehole data from other holes in Old Crow indicates that permafrost extends to depths in excess of 60 m below the ground surface. The surficial peat layer acts as insulation which protects against permafrost degradation. The ground ice classification in the permafrost ranges from non-visible ice (Nbe) to stratified and randomly oriented ice lenses (Vs, Vr). Ground ice contents were generally high, up to Vs 30% by volume, and locally 70% ice in 0.5 m sections. The conditions were generally similar in all boreholes. (Proposed Sewage Lagoon, March 1987)

7.0 OTHER OLD CROW PAST PROJECTS

Table 5: Other Old Crow Past Projects

Date	Project Number	Project Name	Details
June, 2010	W23101344.002	YESAA Application - Project Proposal, Old Crow North Bypass Road	Report completed
October, 2009	W14101342	Foundation Installation Summary, Arctic Research Facility	Permafrost, temperature data Report completed
August, 2007	W23101011	Phase I Environmental Site Assessment (ESA), Four Sites	Report completed
December, 2004	0201-99-13858.1	Summary Report for Restoration of RCMP Compound	Report completed
April, 1999	0201-99-13858	Preliminary Report of Environmental Site Assessment, RCMP Compound	1388-BH01 - BH03, 14 hand dug pits
September, 1999	0201-99-14146.1	Gravel Source Evaluation	14146.1-TP01 - TP12
November, 1999	0201-99-14125	Evaluation of Surfacing Options for Arena	14125-TP01 - TP08
September, 1993	0201-11329	Cover For Hockey Rink	1329-BH01 - BH02
March, 1987	0201-4633	Geotechnical Investigation Proposed 3-Bay Garage	4633-BH1 - BH3
March, 1984	0201-4027	Ground Temperature Data, Old Crow	Temperature data

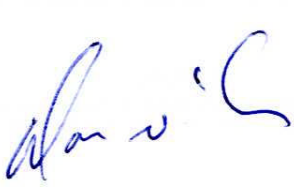
8.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Government of Yukon and their agents. EBA, A Tetra Tech Company, does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the Government of Yukon or their agents, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in EBA's contract with the Government of Yukon.

9.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Sincerely,
EBA, A Tetra Tech Company



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FIGURES

Figure 1 Intrusive Investigation Locations
Figure 2 Drainage and Culvert Locations
Figure 3 Borehole Locations and Delineation at APEC 1
Figure 4 Site Plan Showing Approximate Lateral Extent of Contamination at APEC's 2, 3 & 4

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE LOCATION (WITH GROUND TEMPERATURE CABLE)
- TESTPIT LOCATION

0 250

Scale: 1: 6 000 (metres)

CLIENT

Yukon
Environment Yukon
Site Assessment and Remediation Unit

eba
A TETRA TECH COMPANY

SUMMARY OF PREVIOUSLY COLLECTED DATA OLD CROW, YUKON

INTRUSIVE INVESTIGATION LOCATIONS

PROJECT NO.	DWN	CKD	REV
W23101474	CB	TJR	0

OFFICE: EBA-WHSE

DATE: October 7, 2011

Figure 1

LEGEND

- Culvert
- Discharge/Outfall with Backflow Protection (existing to be upgraded)
- New Drainage/Outfall with Backflow Protection
- Proposed New Drainage
- Existing Drainage
- Road Network

STATUS
ISSUED FOR REVIEW

SUMMARY OF PREVIOUSLY COLLECTED DATA OLD CROW, YUKON

Drainage and Culvert Locations

PROJECTION UTM Zone 7		**DATUM** NAD83			**CLIENT** Yukon Environment, Yukon Site Assessment and Remediation Unit
Scale: 1:8,500 100 50 0 100 200 Metres					eba A TETRA TECH COMPANY
FILE NO. W23101474_Figure02.mxd					
PROJECT NO. W23101474	**DWN** SL	**CKD** TV	**APVD** CB	**REV** 0	**Figure 2**
OFFICE EBA-VANC	**DATE** October 7, 2011				

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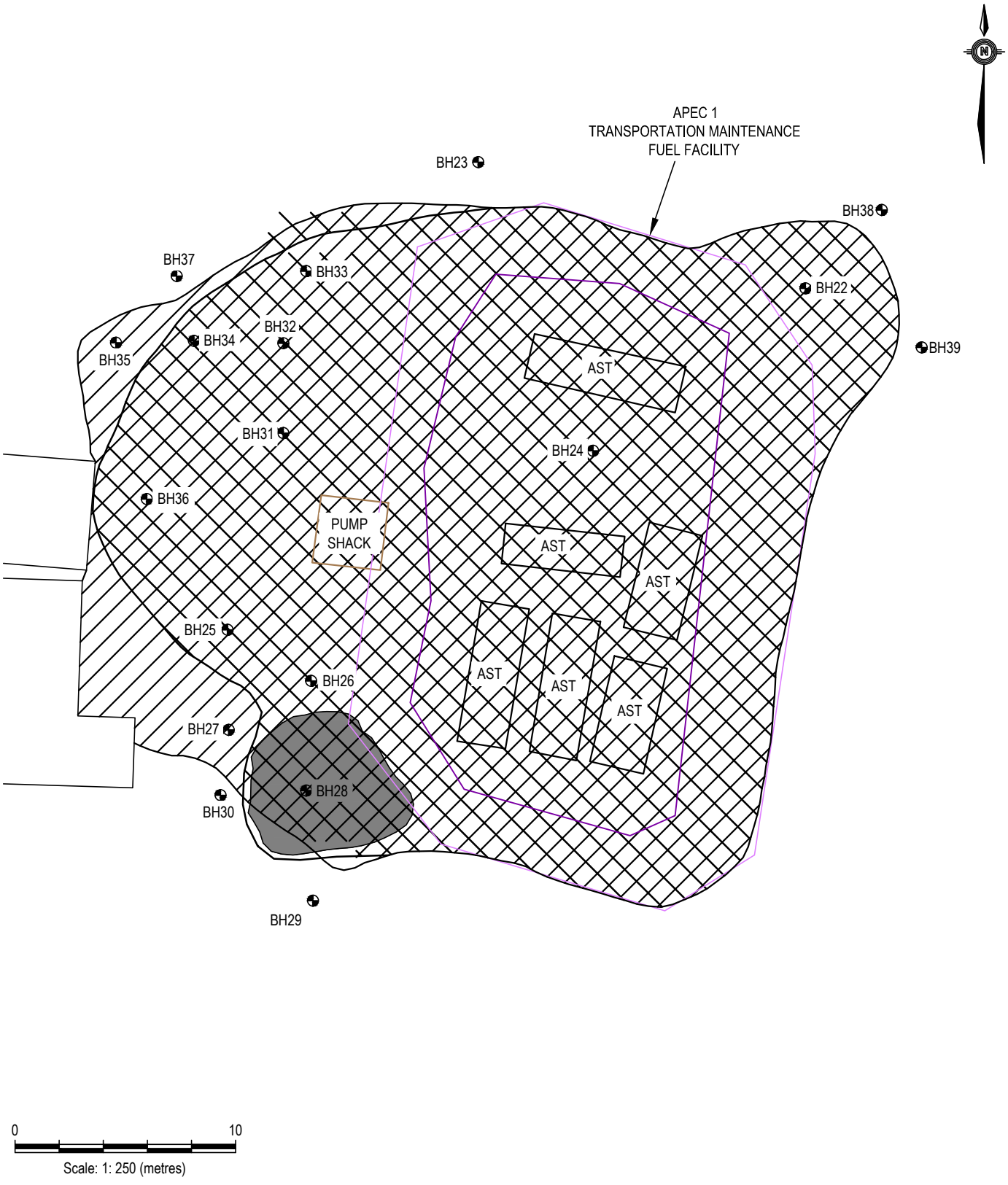


LEGEND:

- BOREHOLE LOCATION
- AREA IMPACTED BY HYDROCARBONS BASED ON FIELD SCREENING
- AREA CONTAMINATED ABOVE CSR STANDARDS
- AREA OF SPECIAL WASTE CONTAMINATION

CLIENT

Yukon
Environment Yukon
Site Assessment and Remediation Unit

eba
A TETRA TECH COMPANY

SUMMARY OF PREVIOUSLY COLLECTED DATA
OLD CROW, YUKON

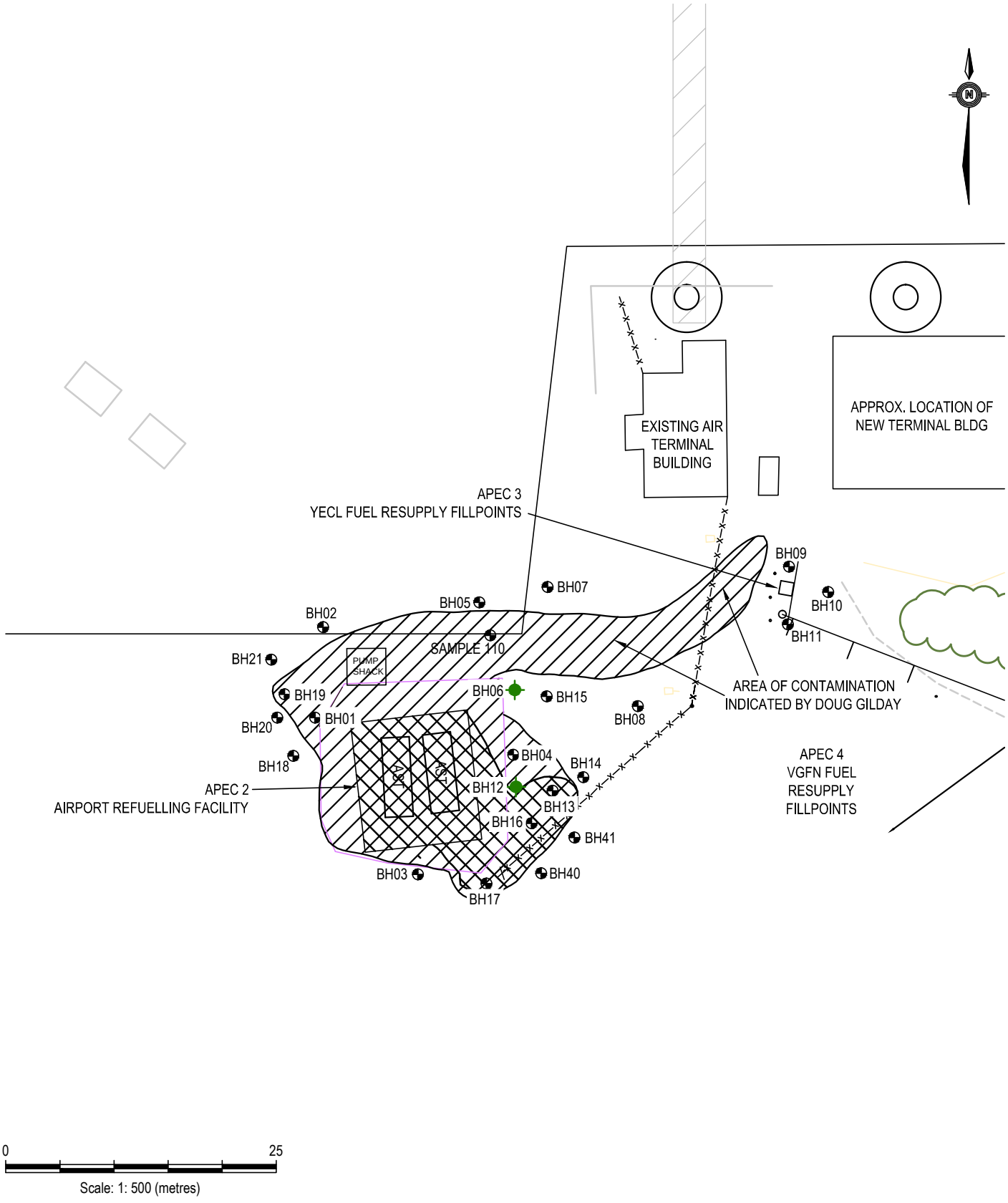
BOREHOLE LOCATIONS AND DELINEATION AT APEC 1

PROJECT NO.	DWN	CKD	REV
W23101474	CB	TJR	0

OFFICE	DATE
EBA-WHSE	October 6, 2011

Figure 3

Q:\Whitehorse\Data\0201drawings\Old Crow\W23101474 Geology, Groundwater and Permafrost Summary\W23101474 Fig.3-4_R0.dwg [FIGURE 3] October 07, 2011 - 11:57:20 am (BY: BUCHAN, CAMERON)



LEGEND:

- BOREHOLE LOCATION
- MONITORING WELL LOCATION
- AREA IMPACTED BY HYDROCARBONS BASED ON FIELD SCREENING
- AREA CONTAMINATED ABOVE CSR STANDARDS

CLIENT

Yukon
Environment Yukon
Site Assessment and Remediation Unit

eba
A TETRA TECH COMPANY

SUMMARY OF PREVIOUSLY COLLECTED DATA
OLD CROW, YUKON

SITE PLAN SHOWING APPROXIMATE LATERAL EXTENT OF CONTAMINATION AT APEC'S 2, 3 & 4

PROJECT NO.	DWN	CKD	REV
W23101474	CB	TJR	0

OFFICE	DATE
EBA-WHSE	October 6, 2011

Figure 4

APPENDIX A

APPENDIX A SELECTED BOREHOLE LOGS

Aerodrome

Nursing Station

Chief Zhe Gittlit School and Teachers Residence

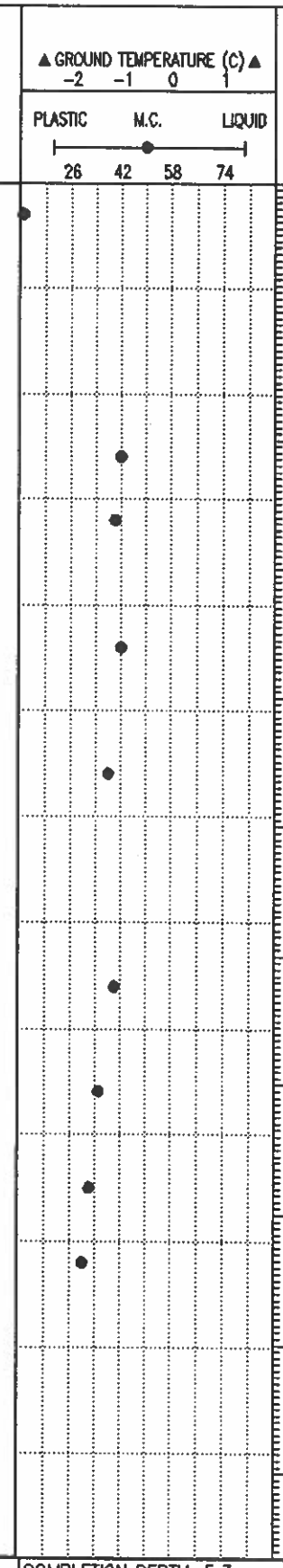
Solid Waste Management Facility

AERODROME

GEOTECHNICAL INVESTIGATION	CLIENT: GOVERNMENT OF YUKON	BOREHOLE NO: 4633-3
PROPOSED 3-BAY GARAGE	RANGER c/w CRREL BARREL	PROJECT NO: 0201-4633
OLD CROW, YUKON	UTM ZONE: - N - E -	ELEVATION:

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	GROUND ICE DESCRIPTION
0.0		1				SAND (SP) AND GRAVEL (FILL) - trace silt; subrounded to subangular, smooth; coarse to fine-grained gravel; coarse to fine grained sand; compact (est.)	
1.0		2				ORGANIC SILT (OL) - trace fine-grained sand; wood fragments and rootlets disseminated throughout	
		2A				- trace coarse-grained sand particles - rootlets disseminated throughout	Vs, Vr 5%
		3A				- with stratified and randomly oriented ice lenses	Vr, Vc 5 - 10%
2.0		4				SILT (ML) - sandy, trace organics and rootlets throughout; with interbedded thin to medium sand laminae, even, parallel, regular; low to non-plastic	
		4A				- trace fine-grained gravel	Vr, Vc 10%
		5				- very thin laminae, even, nonparallel regular; fibrous organics disseminated throughout	
		5A					Vs 5%
3.0		6				- fibrous organics to 5 mm in diameter througout	
		6A					Vr 5%
4.0		7				- becoming by 4.0 m; SILT (ML) AND SAND - trace organics; fine-grained, uniform; interbedded medium to thick laminae; low to nonplastic	
		7A					Vr 5%
		8					
		8A				- sand content increasing with depth	Vx trace, Nbe
		9				- trace fine-grained gravel and fine-grained sand	
5.0		9A				- coarse to medium-grained sand lens with interbeddded thick laminae of silt, nonparallel	Vc trace, Nbe
						GRAVEL (GP) - sandy, trace to some silt	
6.0						END OF BOREHOLE 5.3 m AUGER REFUSAL IN GRAVEL	



EBA Engineering Consultants Ltd.
Whitehorse, Yukon

LOGGED BY: JRT	COMPLETION DEPTH: 5.3 m
REVIEWED BY: JRT	COMPLETE: 87/02/04
Fig. No:	Page 1 of 1

ENVIRONMENTAL AUDIT	CLIENT: YTG – AVIATION BRANCH	BOREHOLE NO: 13050–BH1
AIRPORT FUELING FACILITY	DRILL: POLE AUGER/CAT 950 LOADER	PROJECT NO: 0201–97–13050
OLD CROW, YUKON	UTM ZONE: 7 N494850 E549000	ELEVATION: 98.52 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN ▭ 75 mm SPOON ▯ CRREL BARREL

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL SYMBOL	Soil Description	CHEM TEST
0.0					GRAVEL – sandy, trace of silt, fill material poorly graded, brown, damp hyrdocarbon odour	Sample 1: BTEX – see Lab report, VPH = 52 ppm
	■	1	GP			
			PT		ORGANICS – partically decayed	
1.0	■	2			SILT – clayey, dark brown, wet (non–frozen), hydrocarbon odour decayed organics ordour (almost septic in nature)	
	■	3	ML			
2.0					– permafrost (no visible ice – Nbn)	
	■	4	ML–SM		CLAY, SILT & SAND – some gravel, no ordour, frozen, permafrost (visible ice – Vx)	
					END OF BOREHOLE @ 2.5 m	
3.0					NOTES: – permafrost starts at 2.25 m – hydrocarbon odour present from 0.0 m to approximately 0.4 m, although levels appear to be below criteria	

PERCENT – GRAVEL ■ 20 40 60 80
PERCENT – SAND ● 20 40 60 80
PERCENT – SILT OR FINE ◆ 20 40 60 80
PERCENT – CLAY ▲ 20 40 60 80

ELEVATION(m): 98.0

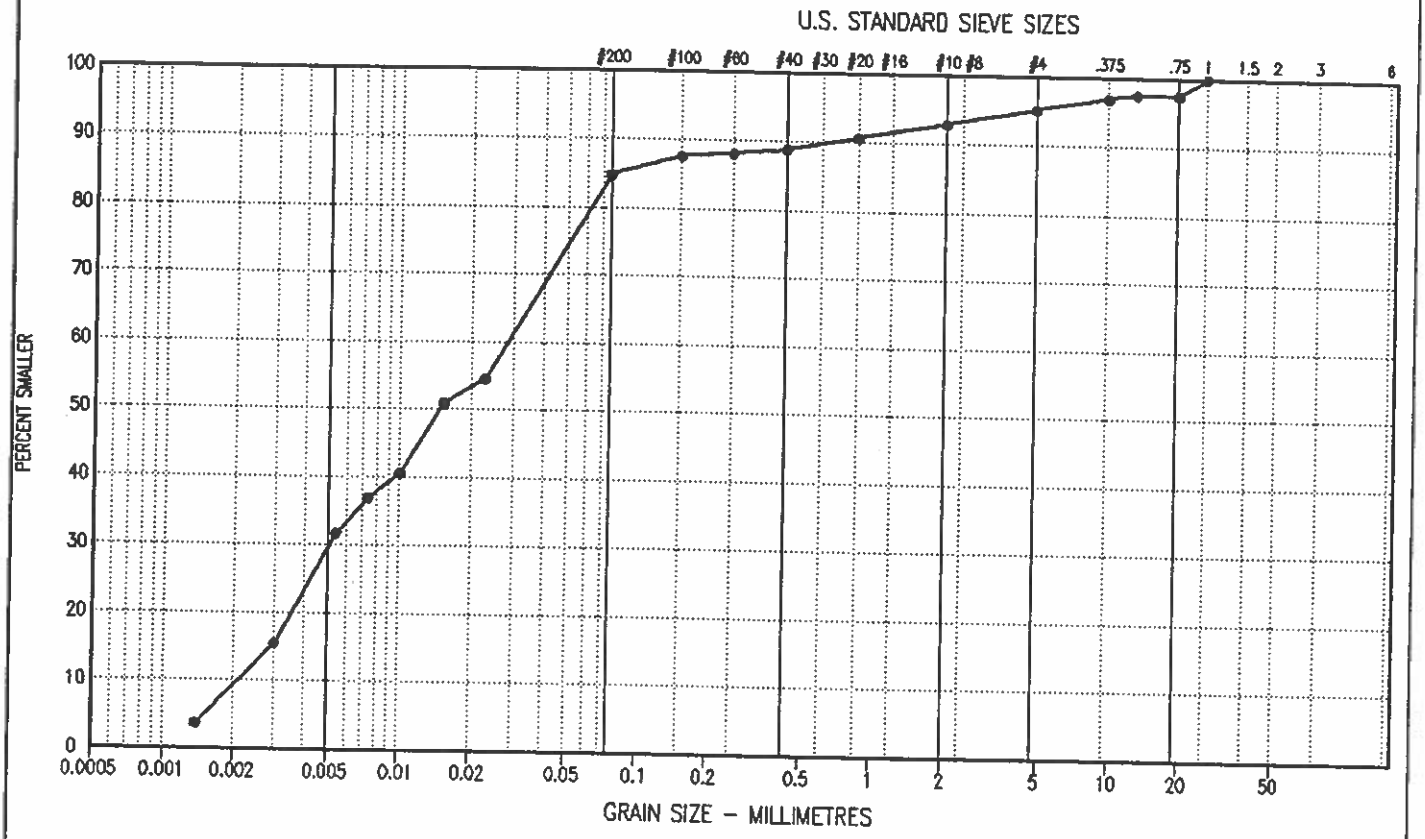
EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MEB	COMPLETION DEPTH: 2.5 m
	REVIEWED BY: JRT	COMPLETE: 97/10/02
	Fig. No:	Page 1 of 1

97/12/15 11:10AM (CHEMTEST)

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●	13050-01	0.90 – 1.00	28.9	55.8	10.3	5.0	14.4	0.4	

Project: 0201-97-13050

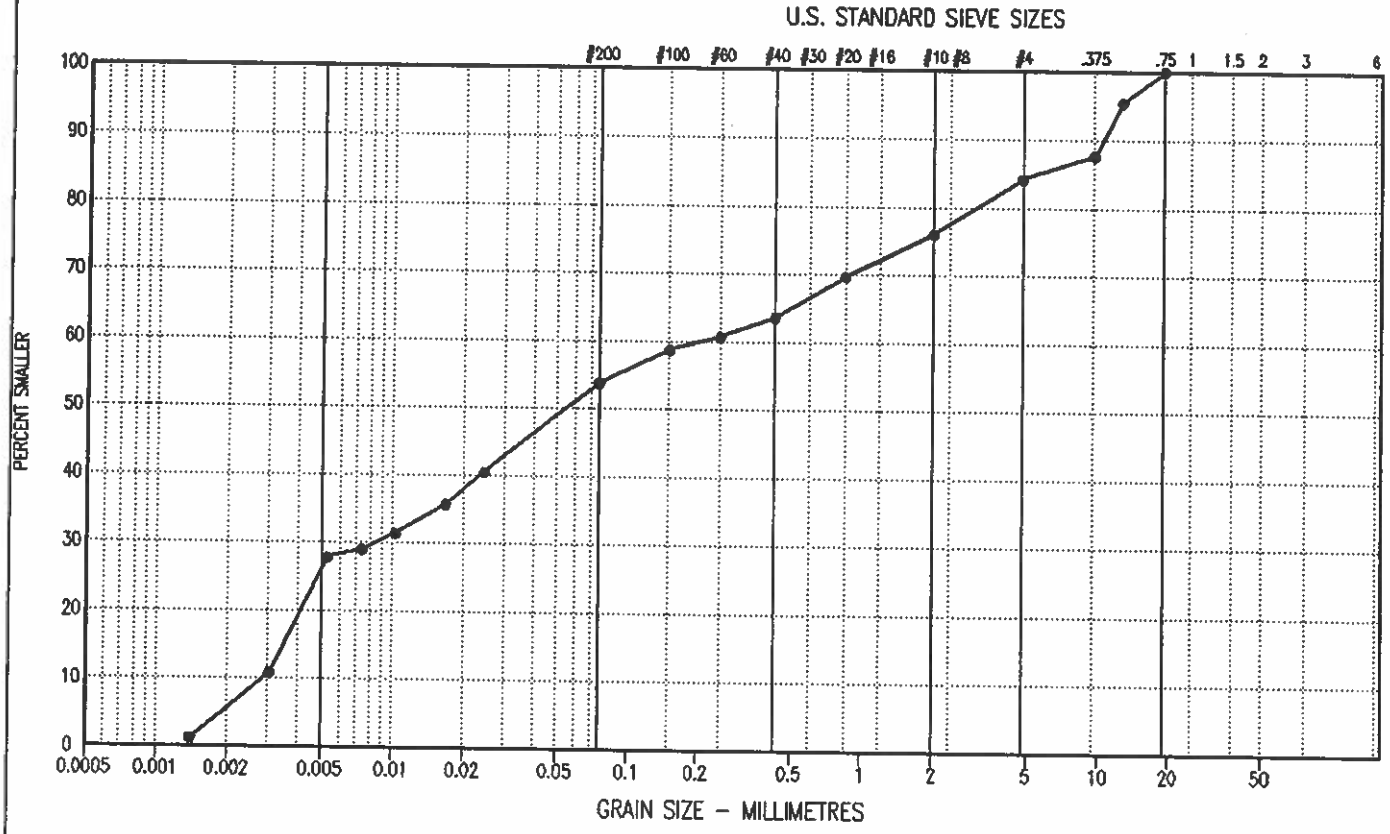
Date Tested: 97/11/25 BY: RS

Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●	13050-01	2.40 – 2.50	25.5	28.2	30.4	15.9	75.2	0.1	

Project: 0201-97-13050

Date Tested: 97/11/25 BY: RS

Tested in accordance with ASTM D422 unless otherwise noted.

ENVIRONMENTAL AUDIT	CLIENT: YTG – AVIATION BRANCH	BOREHOLE NO: 13050-BH9
AIRPORT FUELING FACILITY	DRILL: POLE AUGER/CAT 950 LOADER	PROJECT NO: 0201-97-13050
OLD CROW, YUKON	UTM ZONE: 7 N494850 E549000	ELEVATION: 97.95 m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN | 75 mm SPOON | CRREL BARREL

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL SYMBOL	Soil Description	CHEM TEST
0.0					SAND & GRAVEL – trace of silt, well graded fill, moist, dark brown, slight hydrocarbon odour	
		25	SP-GP		– hydrocarbon odour becomes stronger	Sample 25: BTEX – see lab report VPH = 618 ppm LEPH = 2700 ppm
		26	PT-ML		– organic rich silt, slight hydrocarbon odour, wet	Sample 26: BTEX – see lab report VPH = 19 ppm LEPH = <250 ppm
1.0			ML		SILT – some clay, wet, soft, dark brown, no odour, some water seepage into hole	
		27			PERMAFROST (visible ice crystals, Vx)	
2.0					END OF BOREHOLE @ 2.0 m NOTE: – water seeped into borehole immediately after drilled, left borehole open for water sampling purposes (13050-W9) – hydrocarbon presence within overlying sand and gravel fill, contamination above applicable criteria to a depth of approximately 0.7 m	Refer to lab results for water sample 13050-W9
3.0						

PERCENT – GRAVEL 20 40 60 80 | PERCENT – SAND 20 40 60 80 | PERCENT – SILT OR FINE 20 40 60 80 | PERCENT – CLAY 20 40 60 80

ELEVATION(m): 97.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MEB REVIEWED BY: JRT Fig. No:	COMPLETION DEPTH: 2 m COMPLETE: 97/10/02 Page 1 of 1

97/12/15 11:28AM (CHEMTEST)

ENVIRONMENTAL AUDIT	CLIENT: YTG – AVIATION BRANCH	BOREHOLE NO: 13050-BH11
AIRPORT FUELING FACILITY	DRILL: POLE AUGER/CAT 950 LOADER	PROJECT NO: 0201-97-13050
OLD CROW, YUKON	UTM ZONE: 7 N494850 E549000	ELEVATION: 98.004 m

SAMPLE TYPE: GRAB SAMPLE; NO RECOVERY; STANDARD PEN; 75 mm SPOON; CRREL BARREL

DEPTH(m)	SAMPLE TYPE	SAMPLE NO	USC	SOIL SYMBOL	Soil Description	CHEM TEST	PERCENT – GRAVEL / SAND / SILT OR FINE / CLAY (20 40 60 80)	ELEVATION(m)
0.0					SAND & GRAVEL – trace of silt, fill, strong, hydrocarbon odour			98.0
		28	SP–GP			Sample 28: BTEX – see lab report VPH = 1100 ppm		
					SILT – clayey, soft, wet, dark brown, slight odour remains in silt & clay – odour no longer there at 0.7 m			
1.0		29	ML					
		30			END OF BOREHOLE @ 1.8 m NOTE: – water seeped into borehole, retrieved water sample 13050–W11 – hydrocarbon contamination within top 0.7 m of borehole	– refer to lab results for water sample 13050 – W11		
2.0								
3.0								

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LOGGED BY: MEB	COMPLETION DEPTH: 1.8 m
REVIEWED BY: JRT	COMPLETE: 97/10/02
Fig. No:	Page 1 of 1

97/12/15 11:12AM (CHEMTEST)

GEOTECHNICAL EVALUATION	CLIENT: YTG – TRANSPORTATION ENG.	TEST PIT NO: 14146-TP01
NEW AIRCRAFT APRON/PARKING AREA	BACKHOE: KUBOTA KX 151	PROJECT NO: 0201-99-14146
OLD CROW, YT	UTM ZONE: 7 N7502750 E293800	ELEVATION:

SAMPLE TYPE ■ GRAB SAMPLE ▨ BULK SAMPLE

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION	GROUND ICE DESCRIPTION
0.0	■	1	GW-GM		GRAVEL (FILL) – sandy, trace of silt, well graded gravel, med. to coarse grained sand, compact, moist, dark brownish grey	UNFROZEN
					– organic root mat, tree stumps & roots, black, soft, very moist	
	■	2			SILT & SAND – trace of clay, fine grained, soft, wet, dark grey	
1.0						
	■	3				
2.0					END OF TESTPIT @ 1.8 m (Refusal)	Nbn PERMAFROST
3.0						
4.0						

GROUND TEMPERATURE (C) −1 0 1 2

PLASTIC M.C. LIQUID 10 20 30 40

■PERCENT GRAVEL■ 20 40 60 80

●PERCENT SAND● 20 40 60 80

▲PERCENT SILT OR FINES▲ 20 40 60 80

◆PERCENT CLAY◆ 20 40 60 80

Depth(m) 0.0 2.0 4.0

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Whitehorse, Yukon

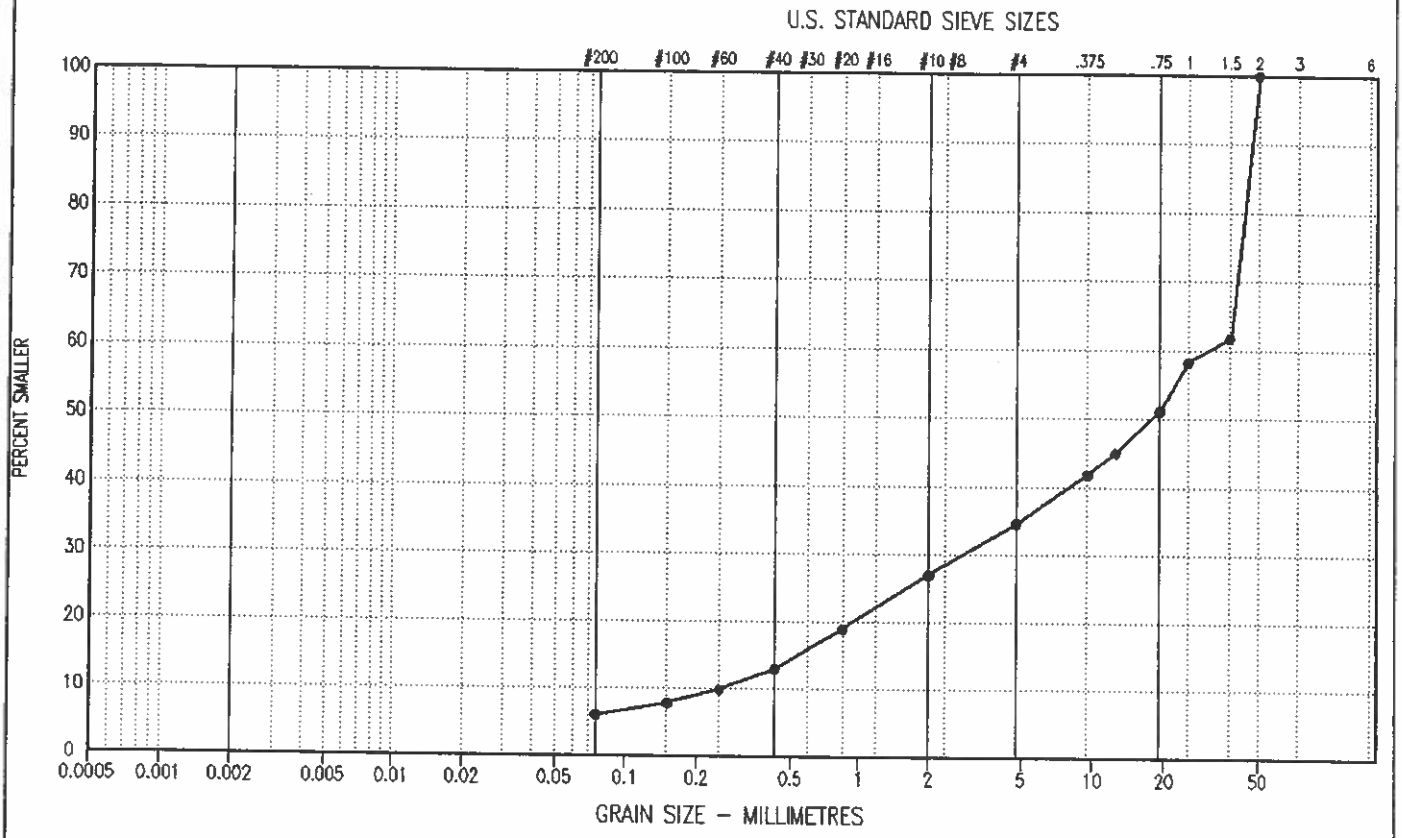
LOGGED BY: JSB	COMPLETION DEPTH: 1.8 m
REVIEWED BY: JRT	COMPLETE: 99/09/21

99/10/26 08:07AM (YUK-PT4)

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	14146-TP01	0.20 – 0.40	6	29	65	123.1	1.2	GW-GM

Project: 0201-99-14146

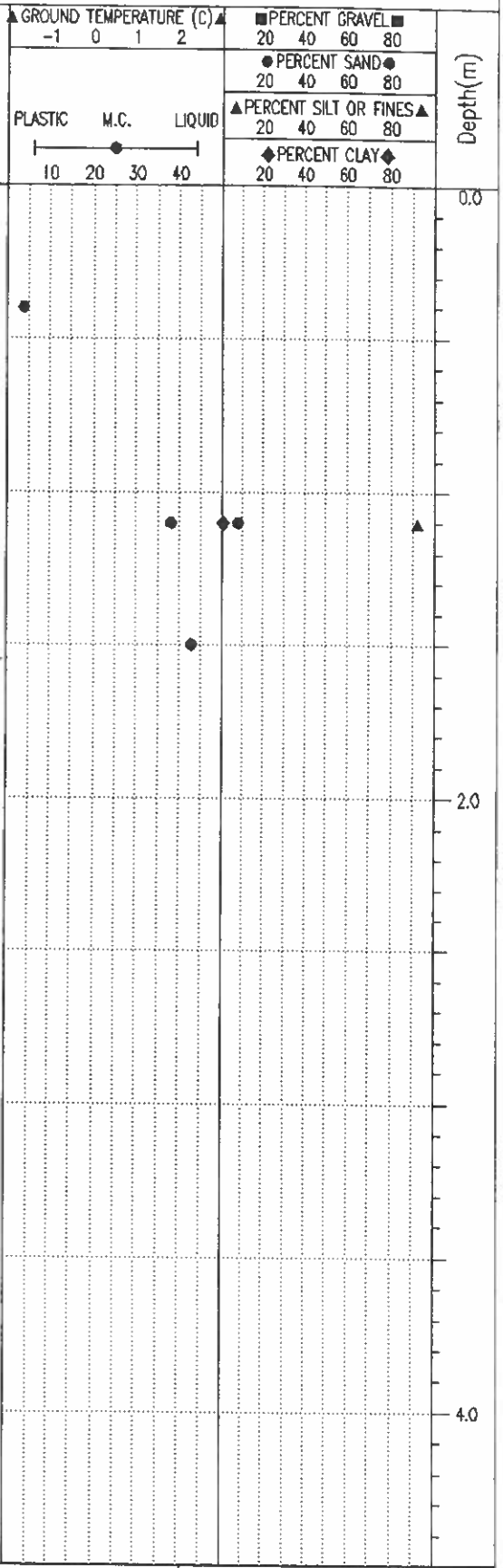
Date Tested: 99/10/15 BY: JEP

Tested in accordance with ASTM D422 unless otherwise noted.

GEOTECHNICAL EVALUATION	CLIENT: YTG – TRANSPORTATION ENG.	TEST PIT NO: 14146-TP02
NEW AIRCRAFT APRON/PARKING AREA	BACKHOE: KUBOTA KX 151	PROJECT NO: 0201-99-14146
OLD CROW, YT	UTM ZONE: 7 N7502725 E293775	ELEVATION:

SAMPLE TYPE ■ GRAB SAMPLE ⧄ BULK SAMPLE

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION	GROUND ICE DESCRIPTION
0.0	■	4			GRAVEL (FILL) – sandy, trace of silt, well graded gravel, med. to coarse grained sand, compact, moist, dark brownish grey – organic root mat, black, soft, very wet	UNFROZEN
1.0	■	5			SILT & SAND – trace of clay, fine grained, soft, wet, dark grey	
	■	6				
2.0					END OF TESTPIT @ 1.6 m (Refusal)	Nbn PERMAFROST
3.0						
4.0						



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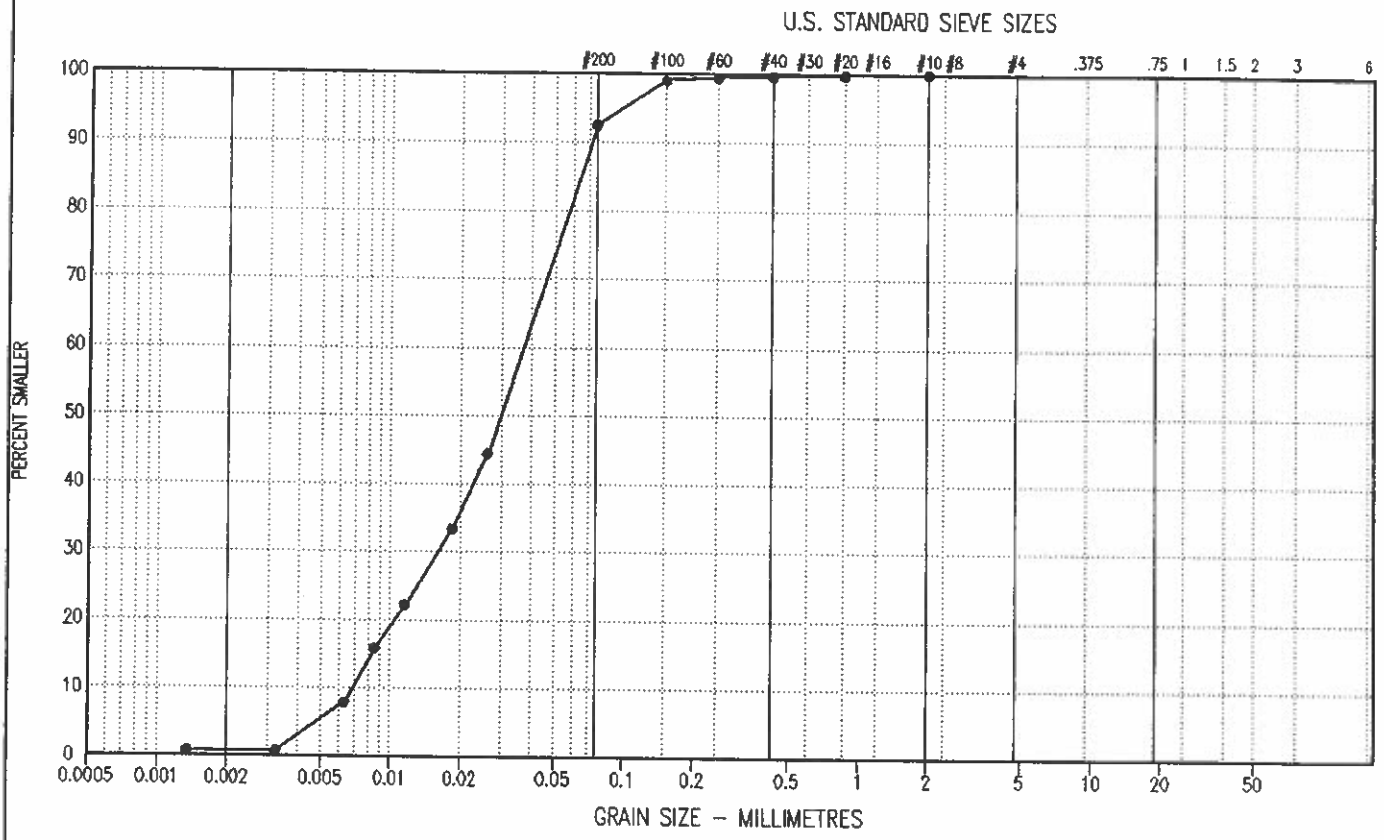
Whitehorse, Yukon

LOGGED BY: JSB	COMPLETION DEPTH: 1.6 m
REVIEWED BY: JRT	COMPLETE: 99/09/21

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●	14146-TP02	1.00 – 1.20	0.7	92	8	0	6.1	0.9	

Project: 0201-99-14146

Date Tested: 99/10/15

BY: JEP

Tested in accordance with ASTM D422 unless otherwise noted.

Permafrost Probe Holes	CLIENT: Government of Yukon	TEST HOLE NO: 1240200-TH01
Old Crow Airport	EXCAVATOR: Kubota KX-121-3 6" S. Stem	PROJECT NO: 1240200
Old Crow, YT	UTM ZONE: 7 N7495624.3 E550259	ELEVATION: 251.2 m

SAMPLE TYPE ■ GRAB ▨ NO RECOVERY

Depth(m)	SAMPLE TYPE	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0				SAND AND GRAVEL (IMPORTED RIVER GRAVEL FILL) – trace of silt, well graded, medium grained sand, subrounded, damp, light brown to brown
1.0				SILT – trace of organics, trace of sand, wood fragments, rootlets, low plasticity, wet, dark brown to dark grey
				PERMAFROST AT 1.8 m
2.0				END OF TESTHOLE 1.8 m
3.0				
4.0				
5.0				

PLASTIC M.C. LIQUID
10 20 30 40

■ PERCENT GRAVEL ■
20 40 60 80

● PERCENT SAND ●
20 40 60 80

▲ PERCENT SILT OR FINES ▲
20 40 60 80

◆ PERCENT CLAY ◆
20 40 60 80

ELEVATION(m)
251.0
249.0
247.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

LOGGED BY: KSD
REVIEWED BY: JRT

COMPLETION DEPTH: 1.8 m
COMPLETE:

05/10/31 03:43PM (YUKON-T4)

Permafrost Probe Holes	CLIENT: Government of Yukon	TEST HOLE NO: 1240200-TH07
Old Crow Airport	Excavator: Kubota KX-121-3 6" Soil Auger	PROJECT NO: 1240200
Old Crow, YT	UTM ZONE: 8 N7494809.7 E548800.3	ELEVATION: 245 m

SAMPLE TYPE ■ GRAB ▨ NO RECOVERY

Depth(m)	SAMPLE TYPE	USC	SOIL SYMBOL	SOIL DESCRIPTION	PLASTIC — M.C. — LIQUID (10 20 30 40)	■ PERCENT GRAVEL ■ (20 40 60 80) / ● PERCENT SAND ● / ▲ PERCENT SILT OR FINES ▲ / ◆ PERCENT CLAY ◆	ELEVATION(m)
0.0				SAND AND GRAVEL (IMPORTED RIVER GRAVEL FILL) – trace of silt, well graded, medium grained sand, subrounded, damp, light brown to brown			245.0
1.0							
				SILT – trace of organics, trace of sand, wood fragments, rootlets, low plasticity, wet, dark brown to dark grey			
2.0							243.0
				PERMAFROST AT 2.3 m			
				END OF TESTHOLE 2.3 m			
3.0							
4.0							241.0
5.0							

EBA Engineering Consultants Ltd. Whitehorse Yukon	LOGGED BY: KSD	COMPLETION DEPTH: 2.3 m
	REVIEWED BY: JRT	COMPLETE:
		Page 1 of 1

05/10/31 03:44PM (YUKON-14)

NURSING STATION

PROJECT: Old Crow Water Supply | **HOLE NO.:** WW 1 | **PROJECT NO.:** 209-3546

LOCATION: Old Crow, Yukon | **SURFACE ELEVATION:**

DRILL: Schramm Rotadrill

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
0	SNOW			
1	SILT (Nbe) - some clay, trace of wood chips, olive-brown			
2	CLAY (Nbe) - silty, trace of wood, gray			
3	SILT (Vs, Vx, Vr 10%) - clayey, trace to some fine sand lenses, trace of wood			
4				
5	SAND - frozen, fine grained, brown SILT - frozen, sandy, brown			
6	GRAVEL - sandy, medium grained, moist to damp, olive brown, probably unfrozen			
7	GRAVEL - possibly unfrozen, silty, medium grained, some fine grained sand, moist to wet, brown, very dirty			
8				
9				
10	- frozen at 10 m			
11	CLAY (Vs 15%) - silty, some silt and fine grained sand lenses, grey			
12				
13				
14				
15				
16				
17				
18	SILT (Vr, Vs, 15%) - clayey, occasional ice lenses to 10 mm thick, grey			
19				
20	SILT - (Vr, Vx, Vs, 20%) - clayey, brown, horizontal and vertical ice lenses with crystalline ice to 10 mm thick, some lenses at 45° also with crystalline ice			
21				
22				
23				
24				
25				

WATER CONTENT-% : ●
PLASTIC LIMIT (W_p) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

6" = 60 blows, 3" spoon

26/47/-, 3" spoon

44/6/10 = ", 3" spoon

50/82/-, 3" spoon

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

eba

DEPTH TO WATER: ▽

DEPTH TO SLOUGH: —

COMPLETION DEPTH: 79.3 m	DATE DRILLED: 1982 02 17
LOGGED BY: PKG	DRAWING NO.:

PROJECT: Old Crow Water Supply	HOLE NO.: WW 1	PROJECT NO.: 209-3546
LOCATION: Old Crow, Yukon	SURFACE ELEVATION:	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER .

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
24				80
25	SILT - as above, frozen			82
26				84
27	CLAY - silty to some silt, grey			86
28				88
29	SAND - frozen, clayey, trace of gravel and cobbles, quartz-rich, fine grained, brown, ice lenses			90
30				92
31	SILT AND SAND - frozen, trace of clay, brown			94
32				96
33	SILT AND SAND - frozen, trace of clay, medium grained sand, brown, ice crystals			98
34	SAND - frozen, fine grained, uniform, grey			100
35				102
36	SAND - frozen, fine grained, uniform, golden brown, ice crystals			104
37				106
38	SANDSTONE - small quartz/quartzite pebbles, fine grained, uniform, dense, well indurated, brown			108
39				110
40	- possibly siltstone			112
41				114
42				116
43				118
44				120
45				122
46				124
47				126
48	- dark brown, trace of mafic minerals			128
49				130
				132
				134
				136
				138
				140
				142
				144
				146
				148
				150
				152
				154
				156
				158
				160

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

Casing Originally Set To This Depth---
Reset to 78 m (256 feet) on March 24, 1982

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

eba

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 79.3 m	DATE DRILLED: 1982 02 17, 18
LOGGED BY: PKG	DRAWING NO.:

PROJECT: Old Crow Water Supply | **HOLE NO.:** WW 1 | **PROJECT NO.:** 209-3546

LOCATION: Old Crow, Yukon | **SURFACE ELEVATION:**

DRILL: Schramm Rotadrill

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
48	SANDSTONE-as above, frozen			158
49				160
50				162
				164
51				166
				168
52				170
				172
53				174
				176
54				178
55	- finer grained, light golden brown			180
				182
56				184
	- ice lenses up to approximately 250 mm thick from 56.4m to 57.9 m			186
57				188
				190
58				192
				194
59				196
60	- possible unfrozen zones			198
				200
61	- more pebbles to 8 mm diameter, frozen from 61.0 m to 64.0 m, darker brown colour			202
				204
62				206
				208
63	- medium grained quartzitic sandstone			210
				212
64				214
	SHALE - appears unfrozen, some sandstone lenses, friable, platy, grey, graphitic			216
65				218
				220
66				222
				224
67	SILTSTONE AND SHALE - unfrozen, uniform, dry to damp, feels "talcy", grey			226
				228
68	- interbeds of fine, brown, uniform sand and some graphite (?) from 67.1m to 71.6m			230
				232
69				234
				236
70				238
71	- poorly lithified			
72	SANDSTONE - trace shale, fine grained, uniform, damp to moist, brown, thin shale interbeds			
73				

BOTTOM OF PERMAFROST ?

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) ⊢ LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 79.3 m

DATE DRILLED: 1982 02 17, 18

LOGGED BY: PKG

DRAWING NO.:

PROJECT: Old Crow Water Supply	HOLE NO.: WW 1	PROJECT NO.: 209-3546
LOCATION: Old Crow, Yukon	SURFACE ELEVATION:	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY · ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
72	SANDSTONE (as above)			238
73	SILTSTONE - uniform, light brown to white, sandstone interbeds, quartzitic			240
74				242
				244
75				246
				248
76				250
				252
77				254
78	LIMESTONE - dark grey, crystalline, fractured, water-bearing			256
				258
79				260
				262
80	END OF HOLE (79.3 m)			264
				266
81	Note: Artesian water conditions encountered at 78.0 m. Initial flow from top of casing at approximately 6.1 L/s Could not drill further.			268
82				270
				272
83				274
				276
84				278
				280
85				282
				284
86				286
				288
87				290
				292
88				294
				296
89				298
				300
90				302
				304
91				306
				308
92				310
				312
93				314
				316
94				
95				
96				
97				

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

BOTTOM OF CASING
(Reset on March 24, 1982)

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

eba

DEPTH TO WATER: ▼

DEPTH TO SLOUGH: —

COMPLETION DEPTH:	79.3 m	DATE DRILLED:	1982 02 17, 18
LOGGED BY:	PKG	DRAWING NO.:	

PROJECT: Old Crow Water Supply	**HOLE NO.:** WW 2	**PROJECT NO.:** 209-3546
LOCATION: Old Crow, Yukon	**SURFACE ELEVATION:**	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
1–4	SILT AND CLAY - frozen, trace of wood, olive brown, to grey			2–14
5	SAND AND SILT - frozen, brown			16
6–10	GRAVEL - possibly unfrozen, silty, some sand, medium grained			18–32
11–17	CLAY - frozen, silty, grey			34–58
18–24	SILT - frozen, clayey, grey, ice lenses			60–80

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ⏚
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 121.9 m	DATE DRILLED: 1982 02 18, 19, 20
LOGGED BY: PKG	DRAWING NO.:

PROJECT: Old Crow Water Supply	**HOLE NO.:** WW 2	**PROJECT NO.:** 209-3546
LOCATION: Old Crow, Yukon	**SURFACE ELEVATION:**	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▧ NO RECOVERY ▦ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE
25	SILT - as above, frozen		
26			
27	CLAY - some silt, grey, frozen		
28			
29	SAND - frozen, clayey, trace of gravel, fine grained, brown		
30			
31			
32	- silty from 32.0 to 33.5 m		
33			
34			
35			
36	SANDSTONE - frozen, trace of pebbles, fine grained, uniform, brown		
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			

DEPTH (ft.): 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 121.9 m	DATE DRILLED: 1982 02 18, 19, 20
LOGGED BY: PKG	DRAWING NO.:

This log is a compilation of subsurface conditions and soil or rock classification obtained from the field as well as from laboratory testing of samples from the borehole. Soil zones have been interpreted according to commonly accepted practice. The change from one zone to another, as indicated on the log, may be transitional and approximate in nature. Groundwater conditions refer only to those observed at the times and places indicated and they may vary with time, geologic conditions, and construction activity.

PROJECT:	Old Crow Water Supply	HOLE NO.:	WW 2	PROJECT NO.:	209-3546
LOCATION:	Old Crow, Yukon	SURFACE ELEVATION:			
		DRILL:	Schramm Rotadrill		

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ▦ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
49	SANDSTONE - as above, frozen			158
				160
50				162
				164
51				166
				168
52				170
				172
53				174
				176
54				178
				180
55				182
				184
56				186
				188
57				190
				192
58				194
				196
59				198
				200
60				202
				204
61				206
				208
62				210
				212
63				214
				216
64	SILTSTONE AND SHALE - highly weathered, faulted(?), fractured, grey, trace of biotite			218
				220
65				222
				224
66				226
				228
67				230
				232
68				234
				236
69				238
70				
71				
72				

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

BOTTOM OF PERMAFROST?

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT WEIGHT-O $\frac{kN}{m^3}$ 16 18 20 22
P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

eba

DEPTH TO WATER: ▽

DEPTH TO SLOUGH: —

COMPLETION DEPTH:	121.9 m	DATE DRILLED:	1982 02 18, 19, 20
LOGGED BY:	PKG	DRAWING NO.:	

PROJECT: Old Crow Water Supply	HOLE NO.: MW 2	PROJECT NO.: 209-3546
LOCATION: Old Crow, Yukon	SURFACE ELEVATION:	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
72				238
73	SILTSTONE AND SHALE - as above			240
74				242
75				244
76				246
77				248
78	ROCK FLOUR - silty, clayey, damp, orange-brown, no free water, may be fault gouge or an erosional surface, mylonite?			250
79	- water at 79.3 m			252
80	LIMESTONE - grey, lithology uncertain, little water			254
81				256
82				258
83	LIMESTONE - shaley, fractured, grey, water bearing but little water to 83.8 m			260
84				262
85	- grey brown, thinly bedded, dolomitic			264
86				266
87				268
88	DOLOMITE - dark grey-green, clayey bands approximately 5 - 10 mm thick that contain numerous rock fragments and could possibly be called mylonite zones, extensively fractured, fractures are water bearing but mylonite debris is preventing proper well development and keeping a high sediment load in the water			270
89				272
90				274
91				276
92	- interbedded clayey bands and shale from 91.4 m			278
93				280
94	- fractured, appears weathered			282
95				284
96				286
				288
				290
				292
				294
				296
				298
				300
				302
				304
				306
				308
				310
				312
				314
				316

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

eba

DEPTH TO WATER: ▼

DEPTH TO SLOUGH: —

COMPLETION DEPTH:	121.9 m	DATE DRILLED:	1982 02 18, 19, 20
LOGGED BY:	PKG	DRAWING NO.:	

PROJECT:	Old Crow Water Supply	**HOLE NO.:** WW 2	**PROJECT NO.:** 209-3546
LOCATION:	Old Crow, Yukon	**SURFACE ELEVATION:**	
		DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▧ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
97	DOLOMITE - as above			316
				318
98				320
				322
99				324
				326
100				328
	- occasional "mylonite like" layers up to 250 mm thick, from 100.6 m			330
101				332
				334
102				336
				338
103				340
				342
104				344
				346
105				348
				350
106				352
				354
107				356
				358
108				360
				362
109				364
				366
110				368
				370
111				372
				374
112				376
				378
113				380
				382
114				384
				386
115				388
				390
116				392
				394
117				396
118				
119				
120				

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

BOTTOM OF CASING

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 121.9 m	DATE DRILLED: 1982 02 18, 19, 20
LOGGED BY: PKG	DRAWING NO.:

This log is a compilation of subsurface conditions and soil or rock classification obtained from the field as well as from laboratory testing of samples from the borehole. Soil zones have been interpreted according to commonly accepted practice. The change from one zone to another, as indicated on the log, may be transitional and approximate in nature. Groundwater conditions refer only to those observed at the times and places indicated and they may vary with time, geologic conditions, and construction activity.

PROJECT: Old Crow Water Supply	HOLE NO.: WW 2	PROJECT NO.: 209-3546
LOCATION: Old Crow, Yukon	SURFACE ELEVATION:	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
121	DOLOMITE - as above			394
122	- increased water flow noted at 121.3 m			396
	END OF HOLE (121.9 m)			398
123				400
124	NOTE: No more drill stem; artesian water conditions encountered. Flow from top of casing approximately 2.3 L/s at time of drilling.			402
125				404
126				
128				
130				
131				
132				
133				
134				
135				
136				
137				
138				
139				
140				
141				
142				
143				
144				
145				

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 121.9 m	DATE DRILLED: 1982 02 18, 19, 20
LOGGED BY: PKG	DRAWING NO.:

BOREHOLE LOG – PERMAFROST

DEPTH (metres)	SOIL DESCRIPTION	SAMPLE	GROUND ICE DESCRIPTION
	SNOW	C	Nbn
	SILT - some sand and organics, trace of clay, light greyish brown	C	Nbn, trace Vs
1	- trace of organics (25 mm dia.roots)	C	Nbn, Nbe?
	- trace to some sand and clay	C	Nbn, possible Vx
	- some sand, trace of clay and organics	C	Nbn, Nbe
2	- trace of organics (25 mm dia. roots)	C	Vr, Vs 10%
	- trace of organics (12 mm dia. roots)	C	Vs, Vr, Vc 10%
	- trace of organics (25 mm dia. roots)	C	Nbn
3		C	Vs, Vr 10%
		C	Vs, Vc 10%
4		C	Vr, Vs 15%
		C	Vs, Vr 5%
		C	Nbn, possible Vx
	- increase in clay content	C	Nbn
5		C	Vs, Vr 15%
		C	Nbn
	GRAVEL - medium to coarse grained, silty, sandy, trace of clay, brown	G	
6		G	POSSIBLY UNFROZEN
7			

BULK DENSITY (Mg/m^3) ▲
1.4 1.6 1.8 2.0 2.2
MOISTURE CONTENT
10 20 30 40 50

63%

SFC. ELEVATION (m)	DATE DRILLED 1982 03 21	BOREHOLE No. TH 3
COMPLETION DEPTH (m) 12.2	LOGGED BY PKG/TRM	
DRILLING RIG Schramm	LOCATION Old Crow, Yukon	PAGE 1 OF 2

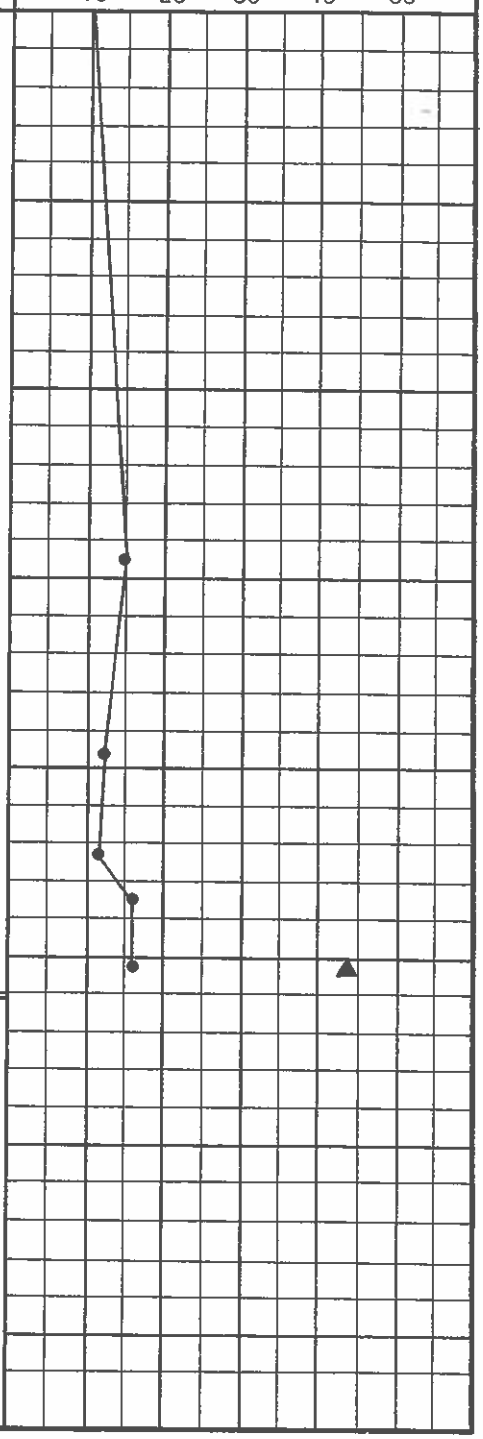
This log is a compilation of subsurface conditions and soil or rock classification obtained from the field as well as from laboratory testing of samples from the boreholes. Soil zones have been interpreted according to commonly accepted practice. The change from one zone to another, as indicated on the log, may be transitional and approximate in nature. Groundwater conditions refer only to those observed at the times and places indicated and that may vary with time, geologic conditions, and construction activity.

209-3546

BOREHOLE LOG — PERMAFROST

DEPTH (metres)	SOIL DESCRIPTION	SAMPLE	GROUND ICE DESCRIPTION
8	GRAVEL - medium to coarse, silty, sandy, trace of clay, brown		POSSIBLY UNFROZEN
9		G	
10			
10	SILT AND CLAY - trace of fine sand, greyish brown		FROZEN
11		C	Vs, Vr 5%
		C	Vs, Vr 5%
		C	Vs, Vr 5%
12		C	Vs, Vr 5%
	END OF HOLE (12.2 m)		
13			
14			

BULK DENSITY (Mg/m^3) ▲
1.4 1.6 1.8 2.0 2.2
MOISTURE CONTENT
10 20 30 40 50



SFC. ELEVATION (m)	DATE DRILLED 1982 03 21	BOREHOLE No. TH 3
COMPLETION DEPTH (m) 12.2	LOGGED BY PKG/TRM	
DRILLING RIG Schramm	LOCATION Old Crow, Yukon	PAGE 2 OF 2

This log is a compilation of subsurface conditions and soil or rock classification obtained from the field as well as from laboratory testing of samples from the boreholes. Soil zones have been interpreted according to commonly accepted practice. The change from one zone to another, as indicated on the log, may be transitional and approximate in nature. Groundwater conditions refer only to those observed at the times and places indicated and that may vary with time, geologic conditions, and construction activity.

PROJECT: Old Crow Water Supply | **HOLE NO.:** TH 4 | **PROJECT NO.:** 209-3546

LOCATION: Porcupine River, Old Crow, Yukon | **SURFACE ELEVATION:**

DRILL: Schramm Rotadrill

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
1	RIVER ICE			2, 4
2	WATER			6
3	GRAVEL - silty, some sand, medium grained, brown, saturated			8, 10
4	SILT AND SAND - trace of clay, fine grained sand, very soft, grey, saturated			12, 14, 16
5				18
6	CLAY - unfrozen, silty, trace of sand, dry to damp, crumbly, grey			20
7				22, 24
8				26
9				28, 30
10				32
11				34, 36
12				38, 40

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 18.3 m
DATE DRILLED: 1982 02 22
LOGGED BY: PKG
DRAWING NO.

PROJECT:	Old Crow Water Supply	**HOLE NO.:** TH 4	**PROJECT NO.:** 209-3546
LOCATION:	Porcupine River Old Crow, Yukon	**SURFACE ELEVATION:**	
		DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE
13	CLAY - as above		
14	SILT - dry, grey		
15			
16	SAND - interbedded silt and clay, fine grained, dry, brown		
17			
18	SILT AND CLAY - dry to moist, grey		
19	END OF HOLE (18.3 m) NOTE: Probe hole only, no sampling or testing		
20			
21			
22			
23			
24			

DEPTH (ft.): 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) ⊢—⊣ LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 18.3 m	DATE DRILLED: 1982 02 22
LOGGED BY: PKG	DRAWING NO.:

This log is a compilation of subsurface conditions and soil or rock classification obtained from the field as well as from laboratory testing of samples from the borehole. Soil zones have been interpreted according to commonly accepted practice. The change from one zone to another, as indicated on the log, may be transitional and approximate in nature. Groundwater conditions refer only to those observed at the times and places indicated and they may vary with time, geologic conditions, and construction activity.

PROJECT: Old Crow Water Supply	**HOLE NO.:** TH 5	**PROJECT NO.:** 209-3546
LOCATION: Porcupine River, Old Crow, Yukon	**SURFACE ELEVATION:**	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE
0–3	GRAVEL - frozen, sandy, trace of clay, brown - may or may not be frozen from 2.1 m		
3–5	CLAY - appears unfrozen, gravelly, moist, grey		
5–7	CLAY - unfrozen, silty to sandy, moist, grey		
7–9	CLAY - unfrozen, some to trace of silt, moist, medium plasticity, grey		
9–12	SAND - unfrozen, clayey, silty, some clay layers, fine grained, uniform, brown		

DEPTH (ft.): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 16.8 m	DATE DRILLED: 1982 02 22
LOGGED BY: PKG	DRAWING NO.:

PROJECT:	Old Crow Water Supply	**HOLE NO.:** TH 5	**PROJECT NO.:** 209-3546
LOCATION:	Porcupine River Old Crow, Yukon	**SURFACE ELEVATION:**	
		DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE
13	SAND - as above		
	SILT AND SAND - unfrozen, clay interbeds, fine grained sand, grey		
14			
15			
16			
17	END OF HOLE (17.8 m)		
18			
19			
20			
21			
22			
23			
24			

DEPTH (ft.): 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 16.8 m	DATE DRILLED: 1982 02 22
LOGGED BY: PKG	DRAWING NO.:

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PROJECT:	Old Crow Water Supply	HOLE NO.: TH 6	PROJECT NO.: 209-3546
LOCATION:	Porcupine River Bank Old Crow, Yukon	SURFACE ELEVATION:	
		DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE	DEPTH (ft.)
0	SILT AND CLAY - frozen, some sand, interbedded			0
1				2
2				4
				6
				8
3	GRAVEL - frozen, sandy, brown			10
4				12
				14
5				16
				18
6				20
				22
7				24
				26
8				28
	CLAY (Vx 5%) - frozen, trace of silt, grey			
9				30
				32
10				34
				36
11	END OF HOLE (10.7 m)			38
	NOTE: Probe hole only, no sampling or testing			40
12				

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

eba

DEPTH TO WATER: ▽
DEPTH TO SLOUGH: —

COMPLETION DEPTH:	10.7 m	DATE DRILLED:	1982 02 22
LOGGED BY:	PKG	DRAWING NO.:	

PROJECT: Old Crow Water Supply	HOLE NO.: TH 7	PROJECT NO.: 209-3546
LOCATION: Porcupine River, Old Crow, Yukon	SURFACE ELEVATION:	
	DRILL: Schramm Rotadrill	

SAMPLE TYPE: ■ THIN WALLED TUBE ☒ SPLIT SPOON ▤ DISTURBED ▨ NO RECOVERY ⊞ CORE ☐ OTHER

DEPTH (m.)	SOIL DESCRIPTION	UNIFIED SOIL CLASS.	SAMPLE
	ICE		
1	WATER		
2			
3	END OF HOLE (3.1 m)		
	Note: Hole abandoned due to ice deflection under weight of drill rig		
4			
5			
6			

DEPTH (ft.): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

WATER CONTENT-% : ●
PLASTIC LIMIT (W_P) — LIQUID LIMIT (W_L)
20 40 60 80

COMPRESSIVE STRENGTH
Unconfined..... ▲
Pocket Penetrometer..... △
TSF 1 2 3 4 5
kPa 100 200 300 400

WET UNIT $\frac{kN}{m^3}$ 16 18 20 22
WEIGHT-O P.C.F. 100 110 120 130 140 150

20 40 60 80
STANDARD PENETRATION: N- ■

eba

DEPTH TO WATER: ▼
DEPTH TO SLOUGH: —

COMPLETION DEPTH: 3.1 m	DATE DRILLED: 1982 02 23
LOGGED BY: PKG	DRAWING NO.:

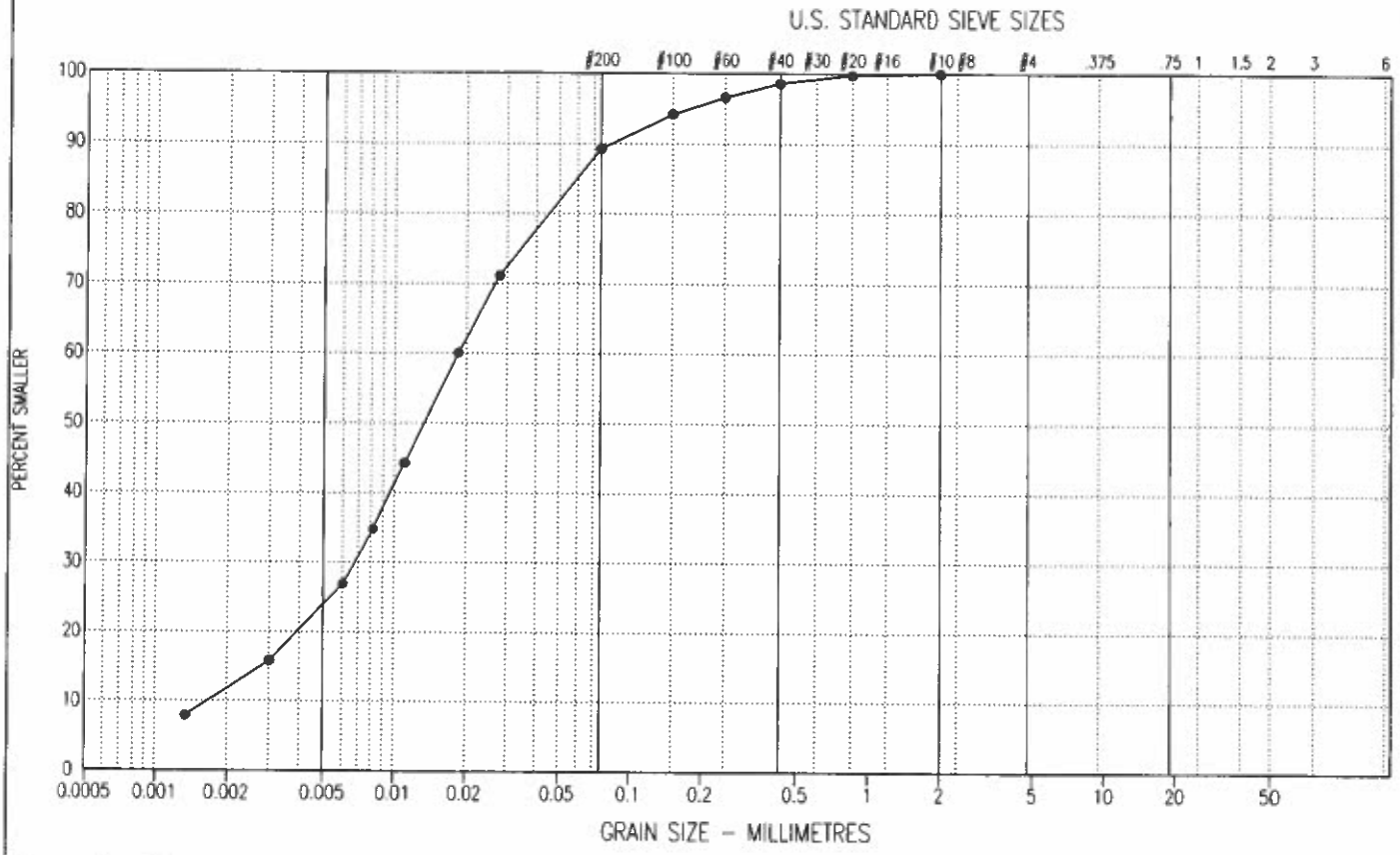
This log is a compilation of subsurface conditions and soil or rock classification obtained from the field as well as from laboratory testing of samples from the borehole. Soil zones have been interpreted according to commonly accepted practice. The change from one zone to another, as indicated on the log, may be transitional and approximate in nature. Groundwater conditions refer only to those observed at the times and places indicated and they may vary with time, geologic conditions, and construction activity.

CHIEF ZHE GITTLIT SCHOOL AND TEACHERS RESIDENCE

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●——●	TP2	0.45	23.1	66.1	10.8	0.0	10.3	1.4	

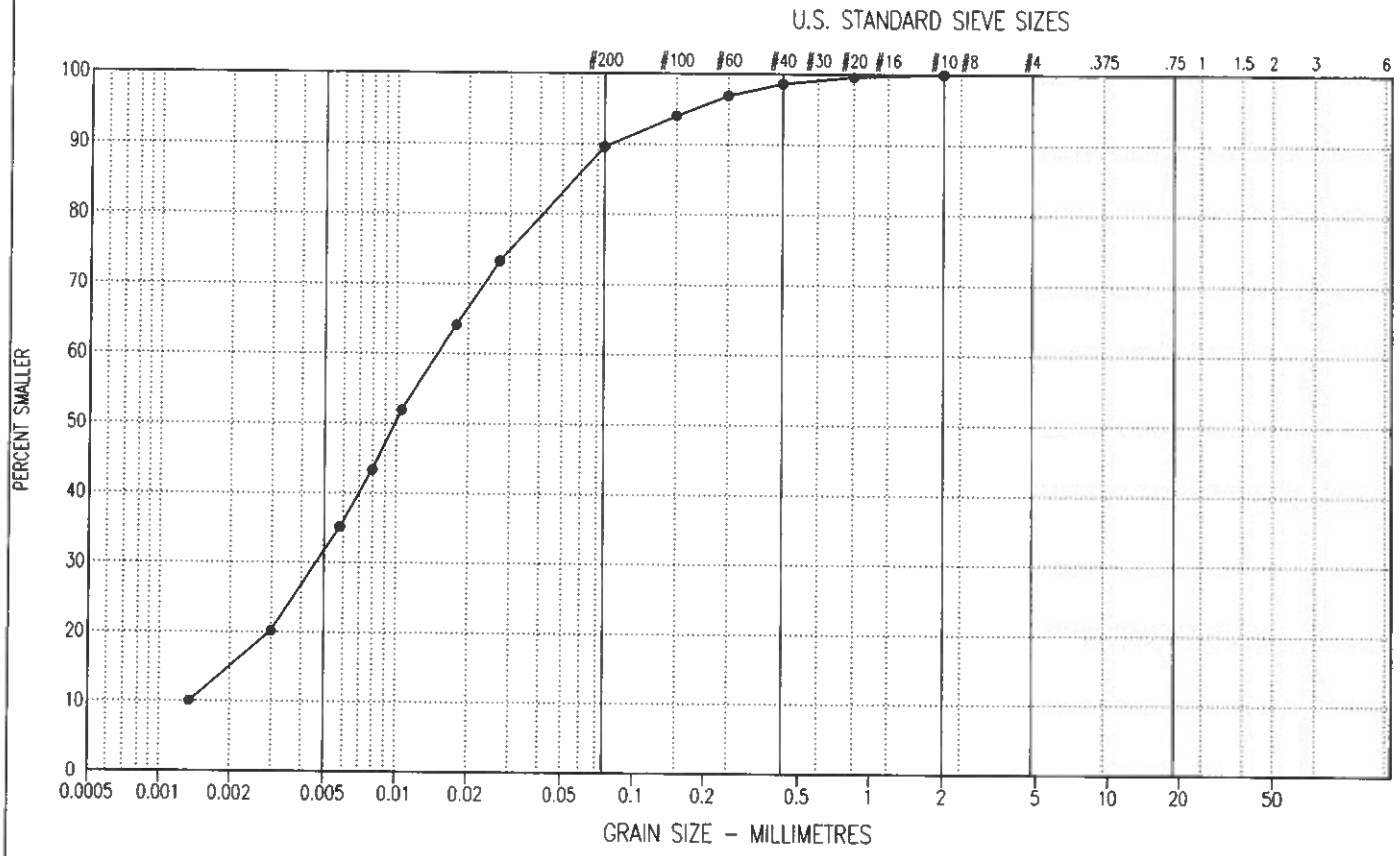
Project: 0201-97-13028 Date Tested: 97/07/22 BY: SK

Tested in accordance with ASTM D422 unless otherwise noted

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●	TP3	0.45	30.8	58.8	10.4	0.0	–	–	

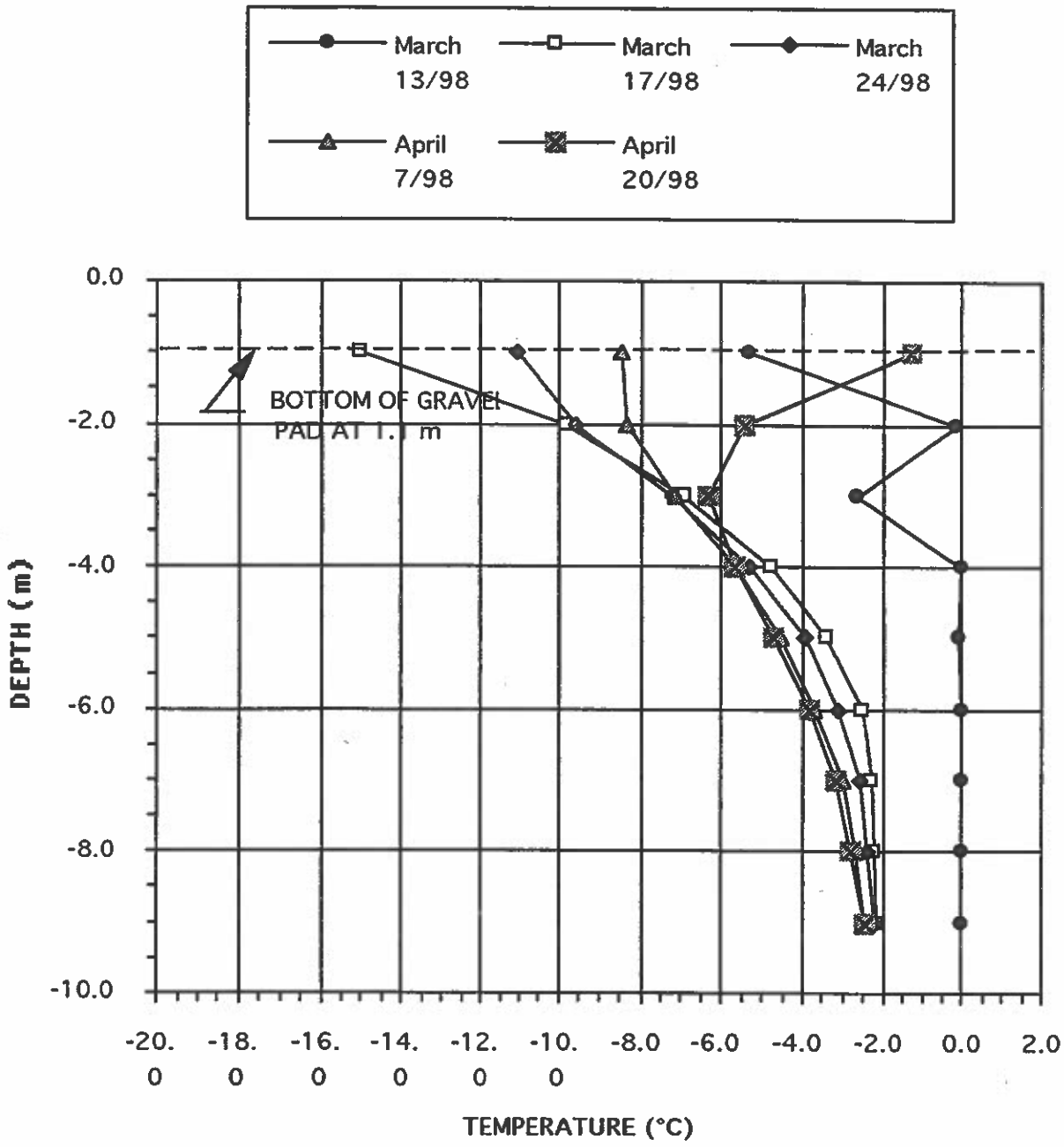
Project: 0201-97-13028

Date Tested: 97/07/22

BY: SK

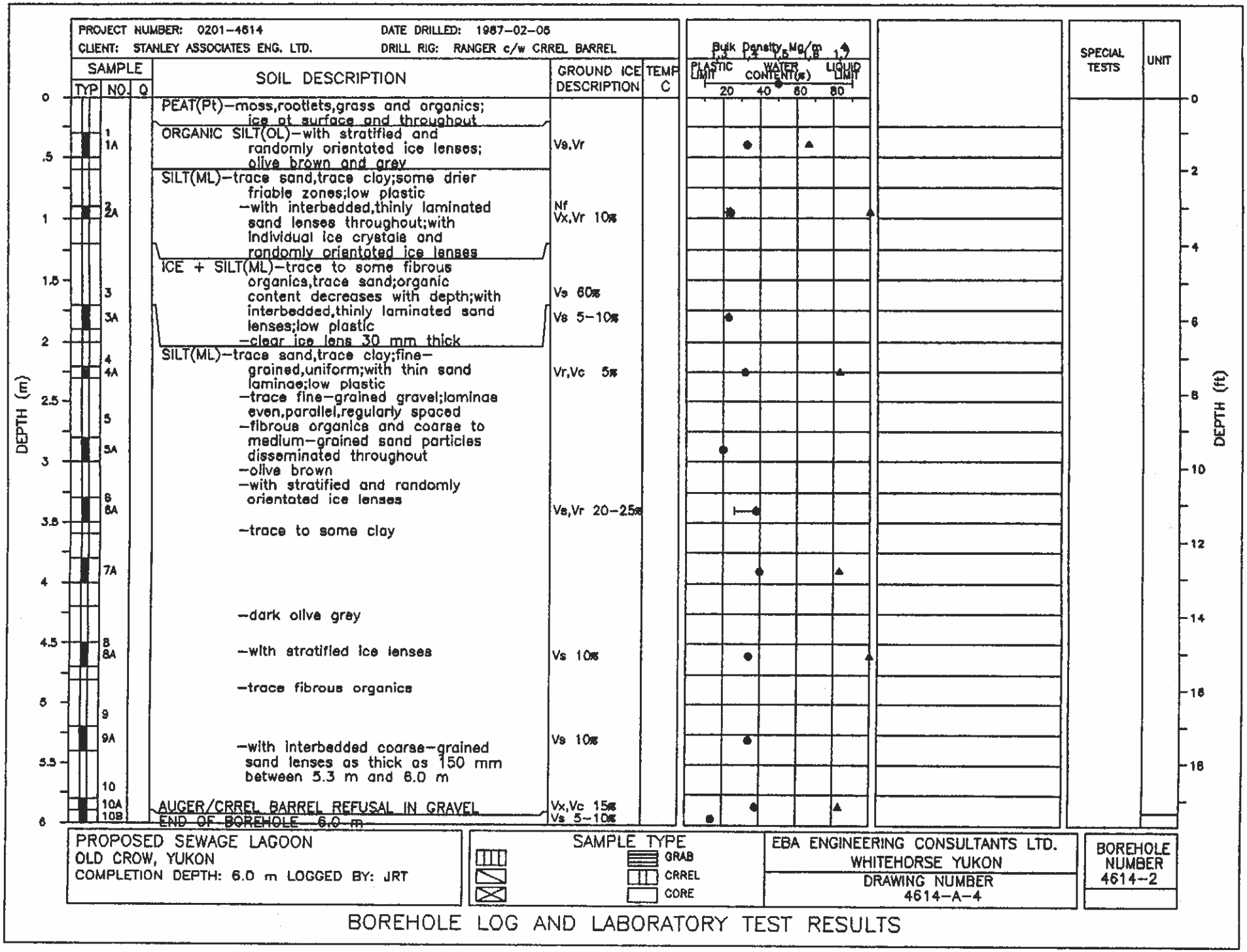
Tested in accordance with ASTM D422 unless otherwise noted.

Thermistor No.: 1206
Date Installed: Mar. 12,1998



GROUND TEMPERATURE PROFILE
NEW SCHOOL - OLD CROW, YUKON
PILE # G+5/6 (Y.E.S. # 901)

SOLID WASTE MANAGEMENT FACILITY



BOREHOLE LOG AND LABORATORY TEST RESULTS

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: Proposed Sewage Lagoon
Old Crow, Yukon

Project Number: 0201-4614

Date Tested: 1987 02 19

Borehole Number: BH #2

Depth: 0.9 - 1.0 m

Soil Description: SILT(ML), trace sand, trace organics, trace clay

Cu:

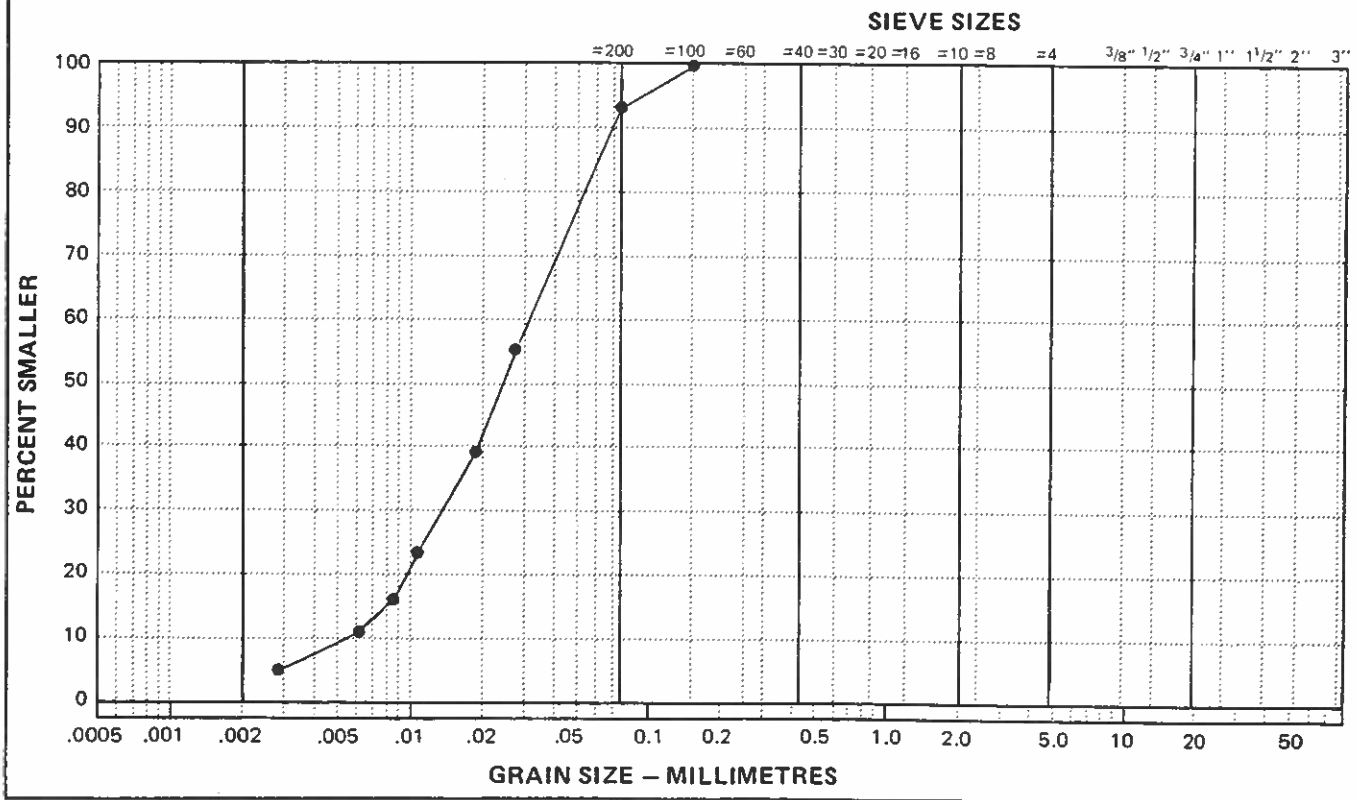
Cc:

Natural Moisture Content: %

Remarks:

SIEVE	PERCENTAGE PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
No. 4	
No. 10	
No. 20	
No. 40	
No. 60	
No. 100	100
No. 200	93

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: Proposed Sewage Lagoon
Old Crow, Yukon

Project Number: 0201-4614

Date Tested: 1987 02 19

Borehole Number: BH #2

Depth: 3.0 - 3.5 m

Soil Description: SILT(ML), trace sand, trace organics
some clay

Cu:

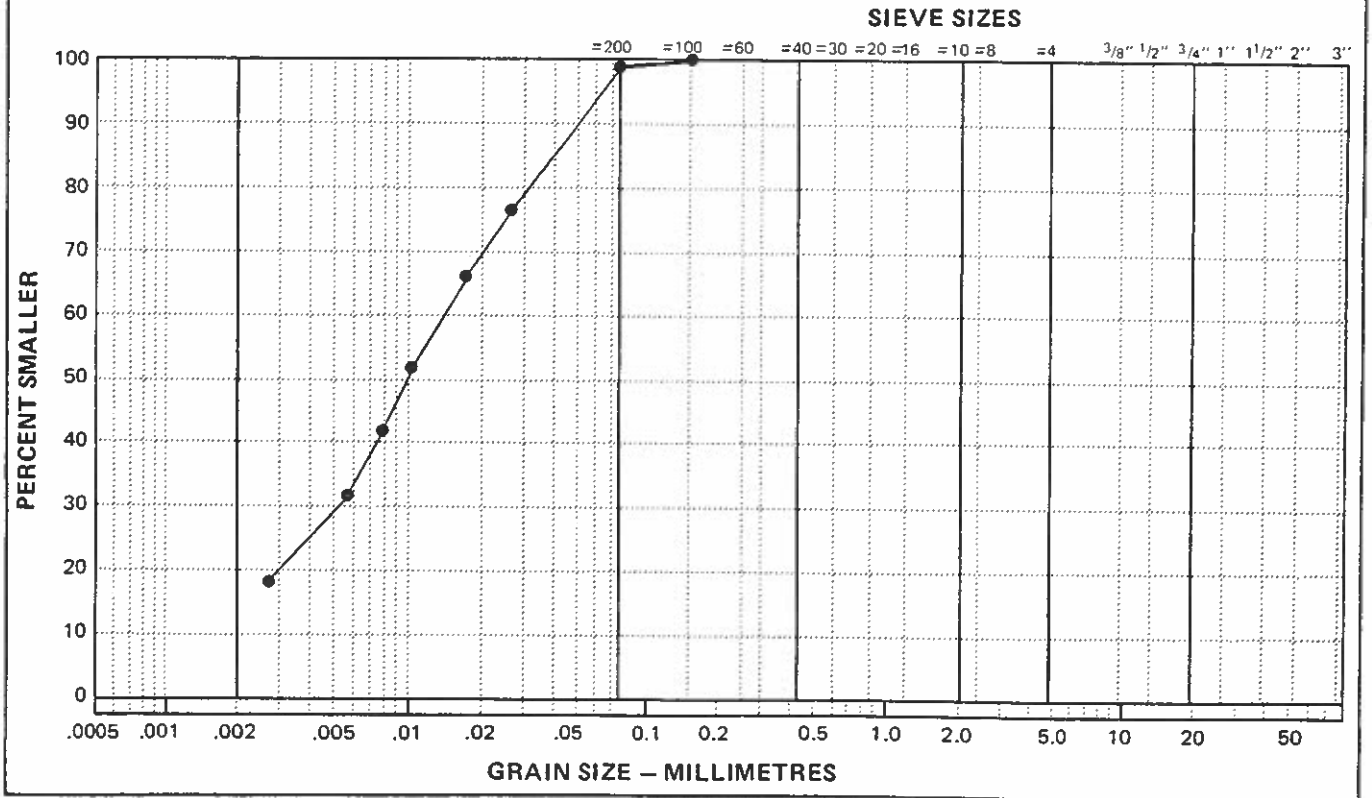
Cc:

Natural Moisture Content: %

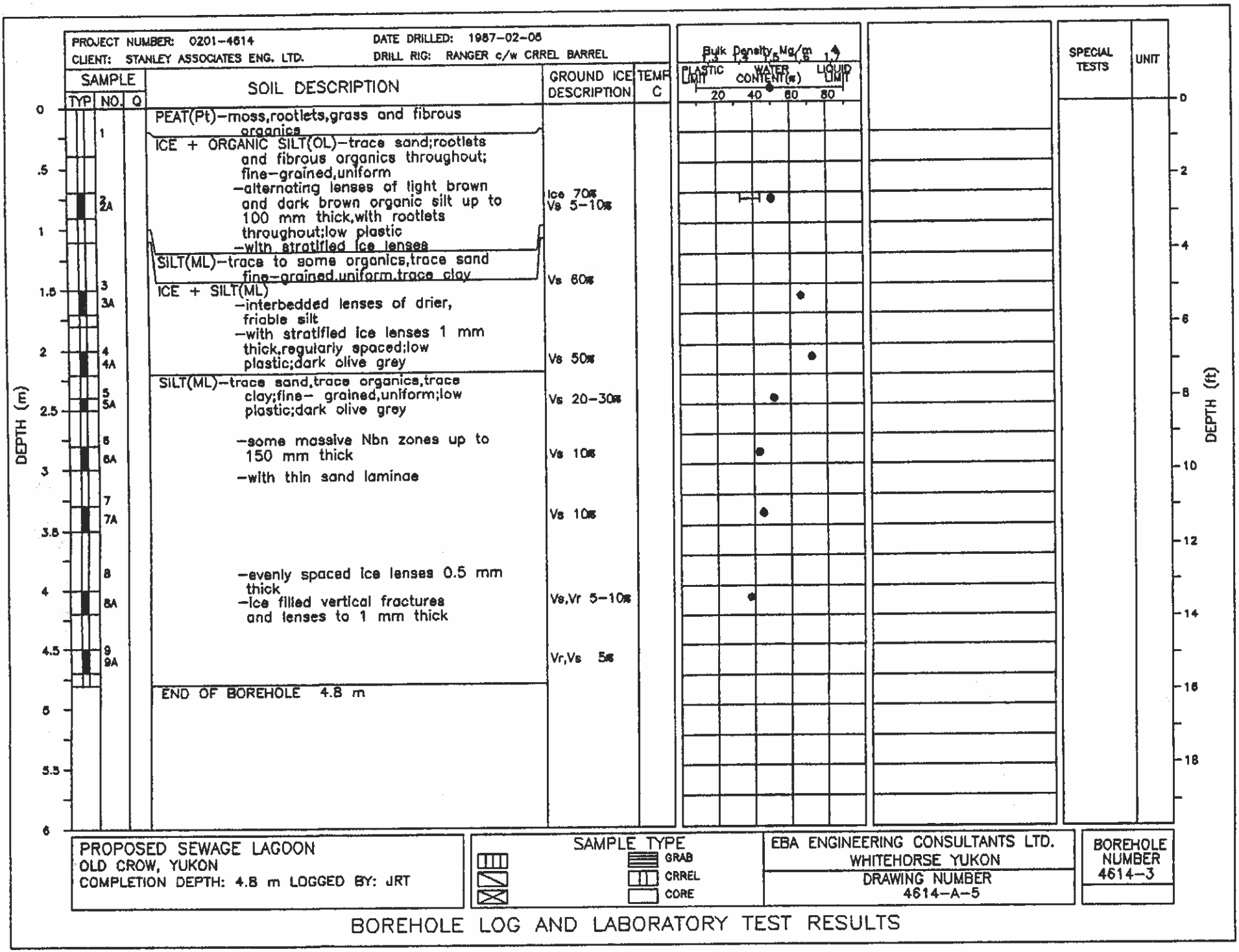
Remarks:

SIEVE	PERCENTAGE PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
No. 4	
No. 10	
No. 20	
No. 40	
No. 60	
No. 100	100
No. 200	99

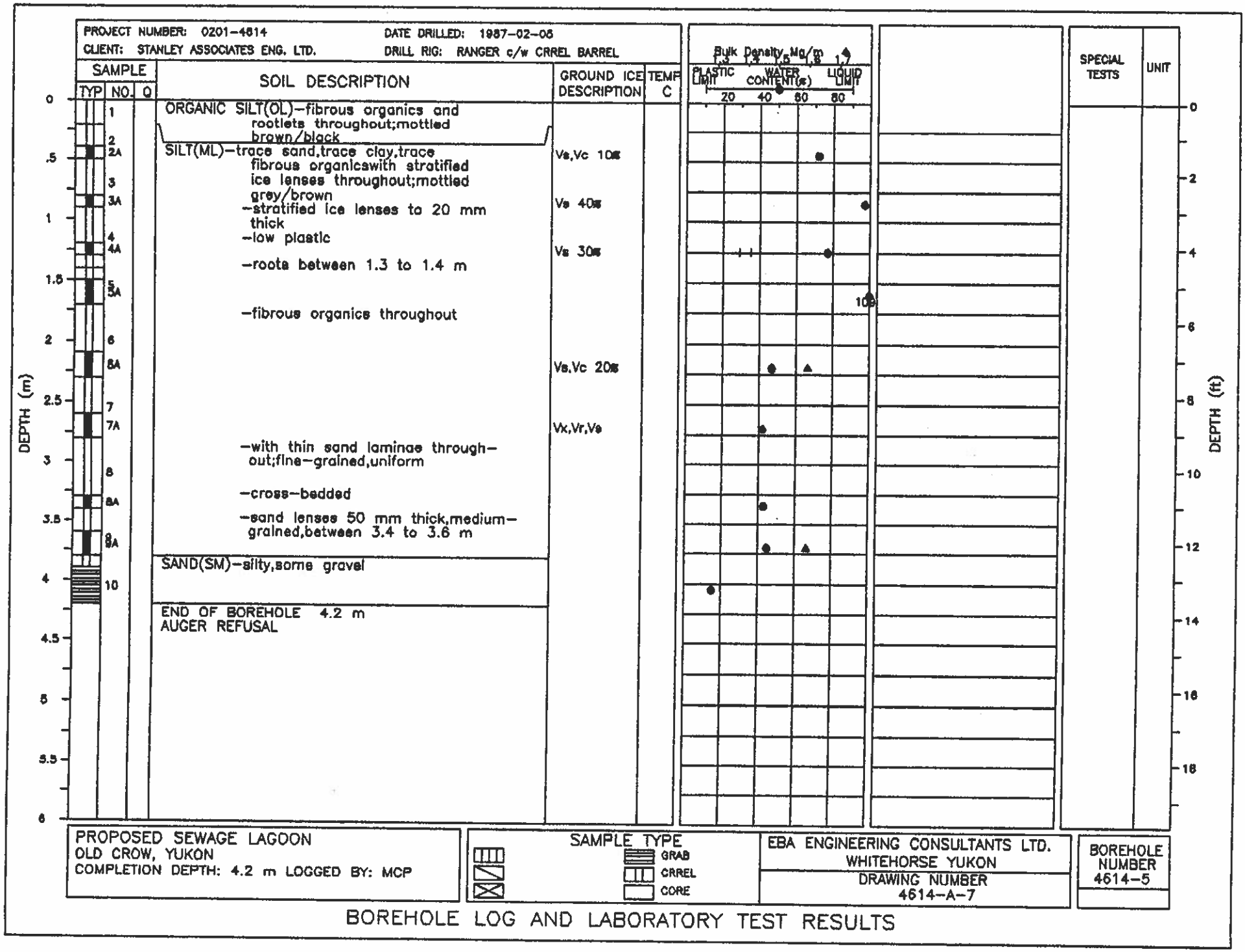
CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



Tested in accordance with ASTM D422 unless otherwise noted.



BOREHOLE LOG AND LABORATORY TEST RESULTS



BOREHOLE LOG AND LABORATORY TEST RESULTS

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: Proposed Sewage Lagoon
Old Crow, Yukon

Project Number: 0201-4614

Date Tested: 1987 02 19

Borehole Number: BH #5

Depth: 1.2 - 1.3 m

Soil Description: SILT(ML), trace sand, trace organics, trace clay

Cu:

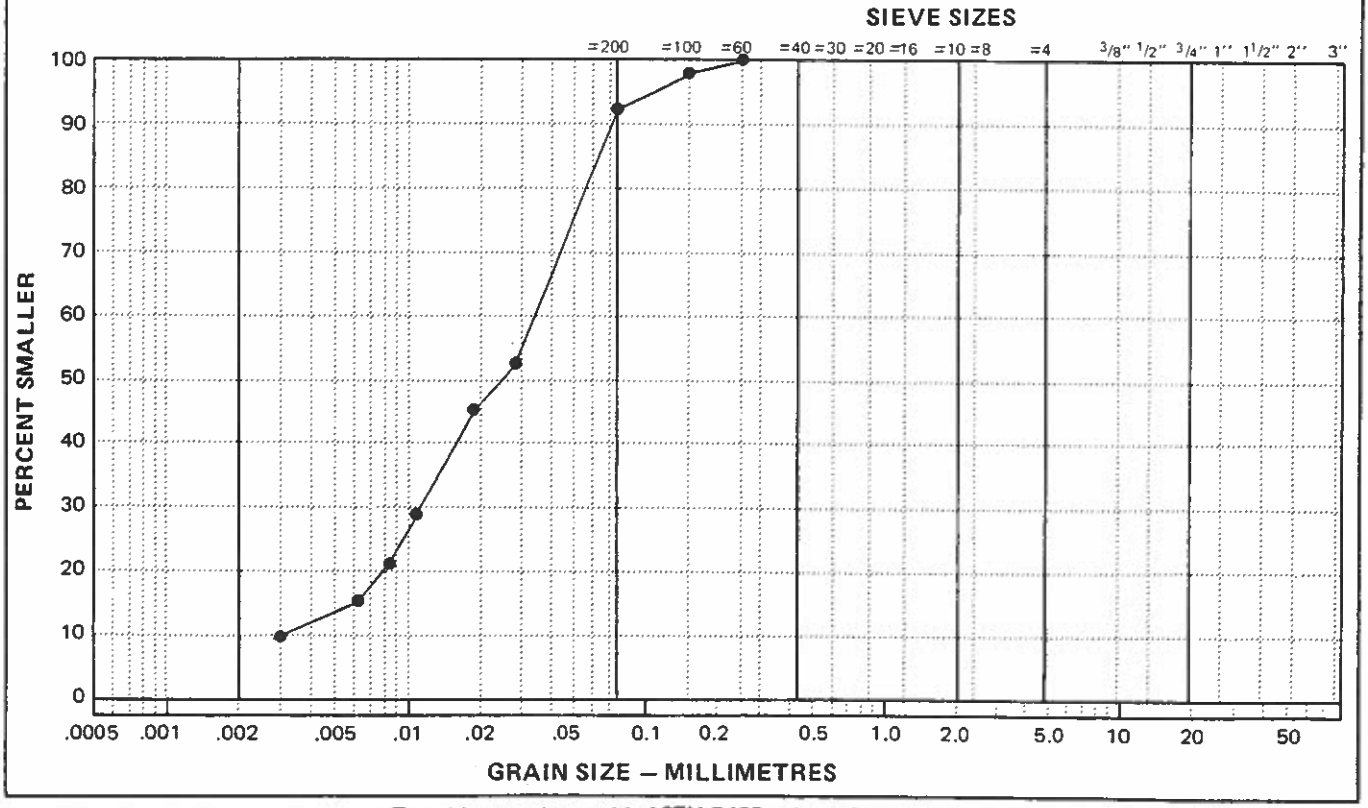
Cc:

Natural Moisture Content: %

Remarks:

SIEVE	PERCENTAGE PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
No. 4	
No. 10	
No. 20	
No. 40	
No. 60	100
No. 100	98
No. 200	92

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: Proposed Sewage Lagoon
Old Crow, Yukon

Project Number: 0201-4614

Date Tested: 1987 02 19

Borehole Number: BH #5

Depth: 2.6 - 2.8 m

Soil Description: SILT(ML) AND SAND, trace organics

Cu:

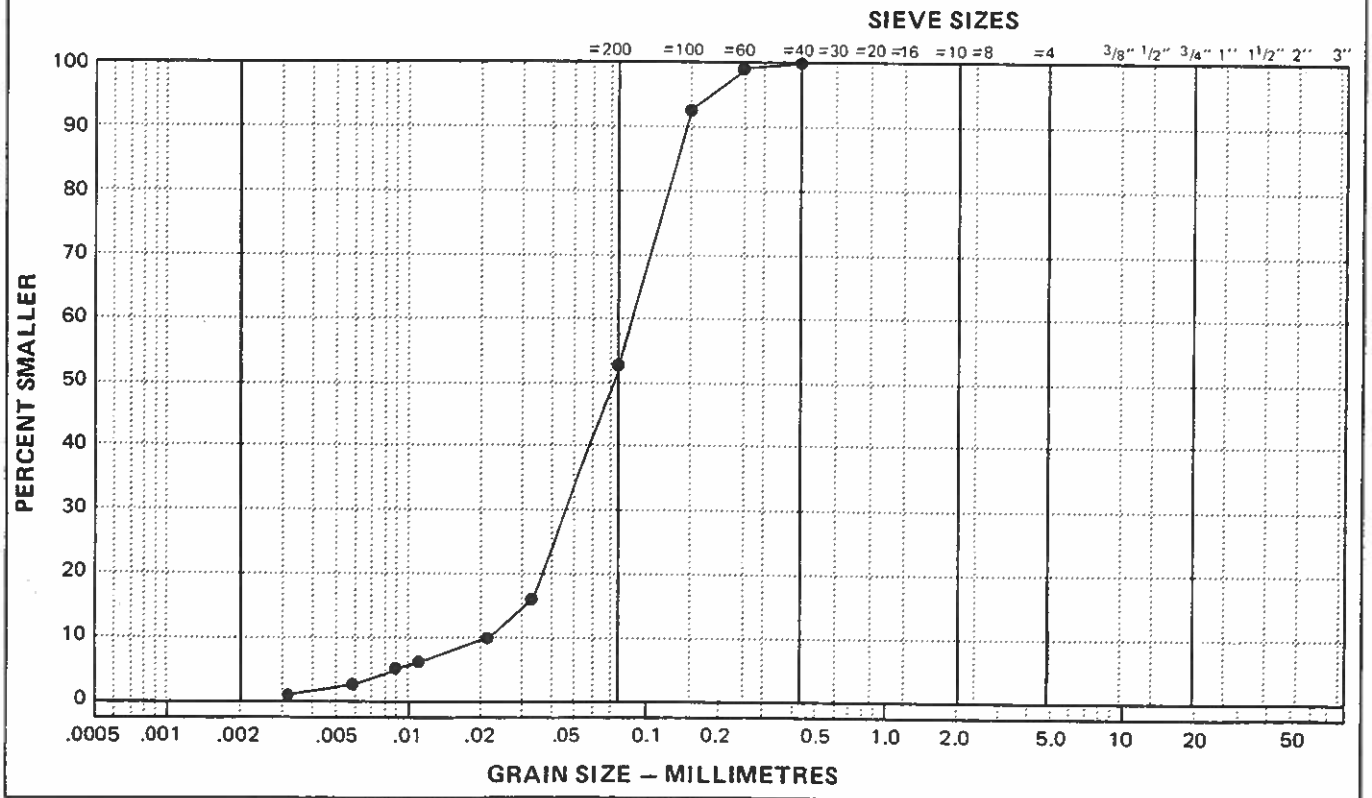
Cc:

Natural Moisture Content: %

Remarks:

SIEVE	PERCENTAGE PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
No. 4	
No. 10	
No. 20	
No. 40	100
No. 60	99
No. 100	93
No. 200	53

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering Consultants Ltd.

PARTICLE - SIZE ANALYSIS OF SOILS

Project: Proposed Sewage Lagoon
Old Crow, Yukon

Project Number: 0201-4614

Date Tested: 1987 02 17

Borehole Number: BH #5

Depth: 3.9 - 4.2 m

Soil Description: SAND(SM), silty, some gravel

Cu:

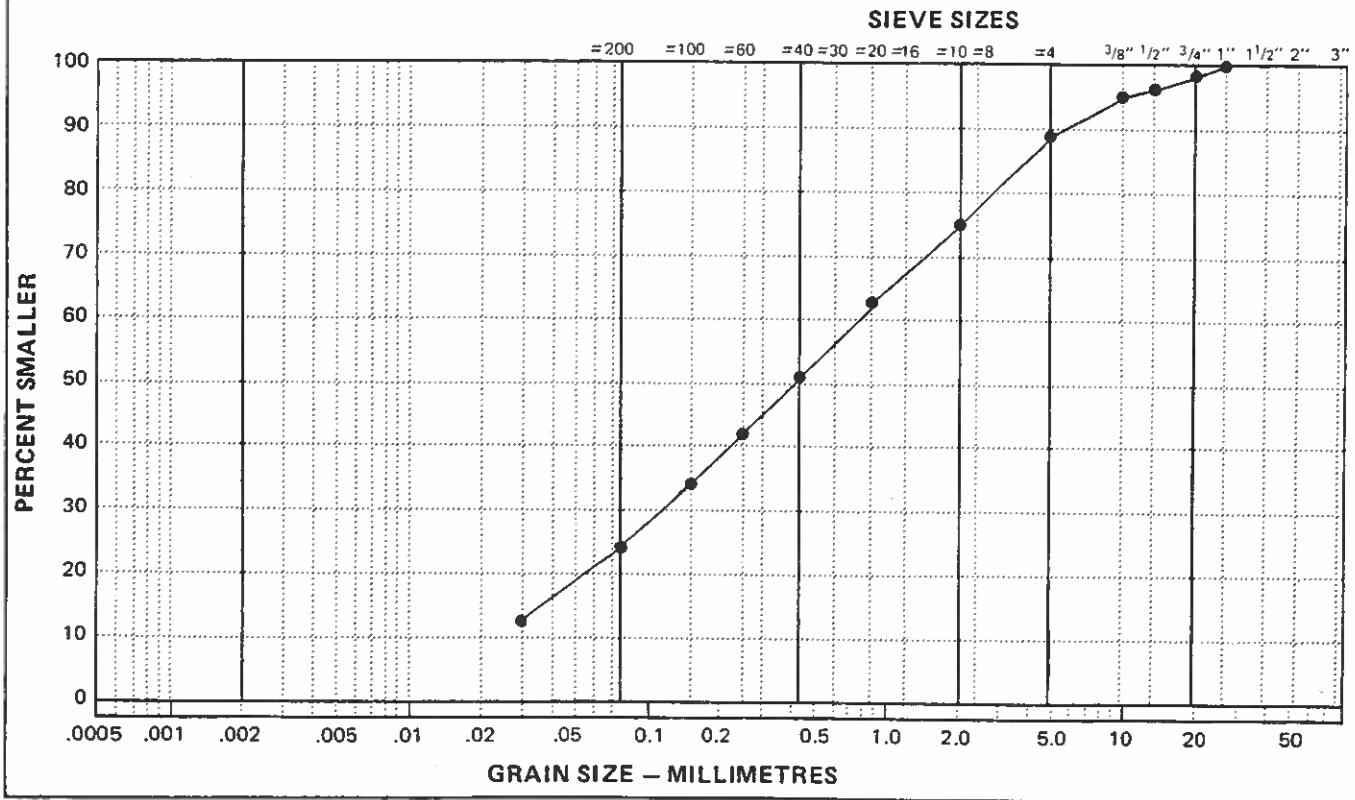
Cc:

Natural Moisture Content: %

Remarks:

SIEVE	PERCENTAGE PASSING
3"	
1 1/2"	
1"	100
3/4"	98
1/2"	96
3/8"	95
No. 4	89
No. 10	75
No. 20	63
No. 40	51
No. 60	42
No. 100	34
No. 200	24

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



Tested in accordance with ASTM D422 unless otherwise noted.

PROJECT NUMBER: 0201-4614 DATE DRILLED: 1987-02-05

CLIENT: STANLEY ASSOCIATES ENG. LTD. DRILL RIG: RANGER c/w CRREL BARREL

SAMPLE TYP	SAMPLE NO.	SAMPLE Q	SOIL DESCRIPTION	GROUND ICE DESCRIPTION	TEMP C
	1		ICE + ORGANIC SILT(OL)–with fibrous organics,trace sand,brown –Ice lens 100 mm thick –with interbedded fine–grained silt laminae,grey	Ice 50%	
	3A		–with stratified ice formations throughout	Vs 50% Vs 40–50%	
	4		SILT(ML)–trace sand;trace clay,trace fibrous organics;fine–grained, uniform;with thin sand laminae; stratified ice formations throughout;low plastic;mottled grey/brown	Vs,Vc 15%	
	5A			Vs,Vc 10–20%	
	6				
	6A			Vs,Vr,Vc 10%	
	7		–with stratified and randomly orientated ice formations to 3 mm thick		
	8A				
			END OF BOREHOLE 3.0 m		

Bulk Density Mg/m³ 1.3 1.4 1.5 1.6 1.7

PLASTIC LIMIT — WATER CONTENT(%) — LIQUID LIMIT

20 40 60 80

SPECIAL TESTS

UNIT

DEPTH (m): 0 .5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6

DEPTH (ft): 0 2 4 6 8 10 12 14 16 18

PROPOSED SEWAGE LAGOON (ALTERNATE SITE)
OLD CROW, YUKON
COMPLETION DEPTH: 3.0 m LOGGED BY: MCP

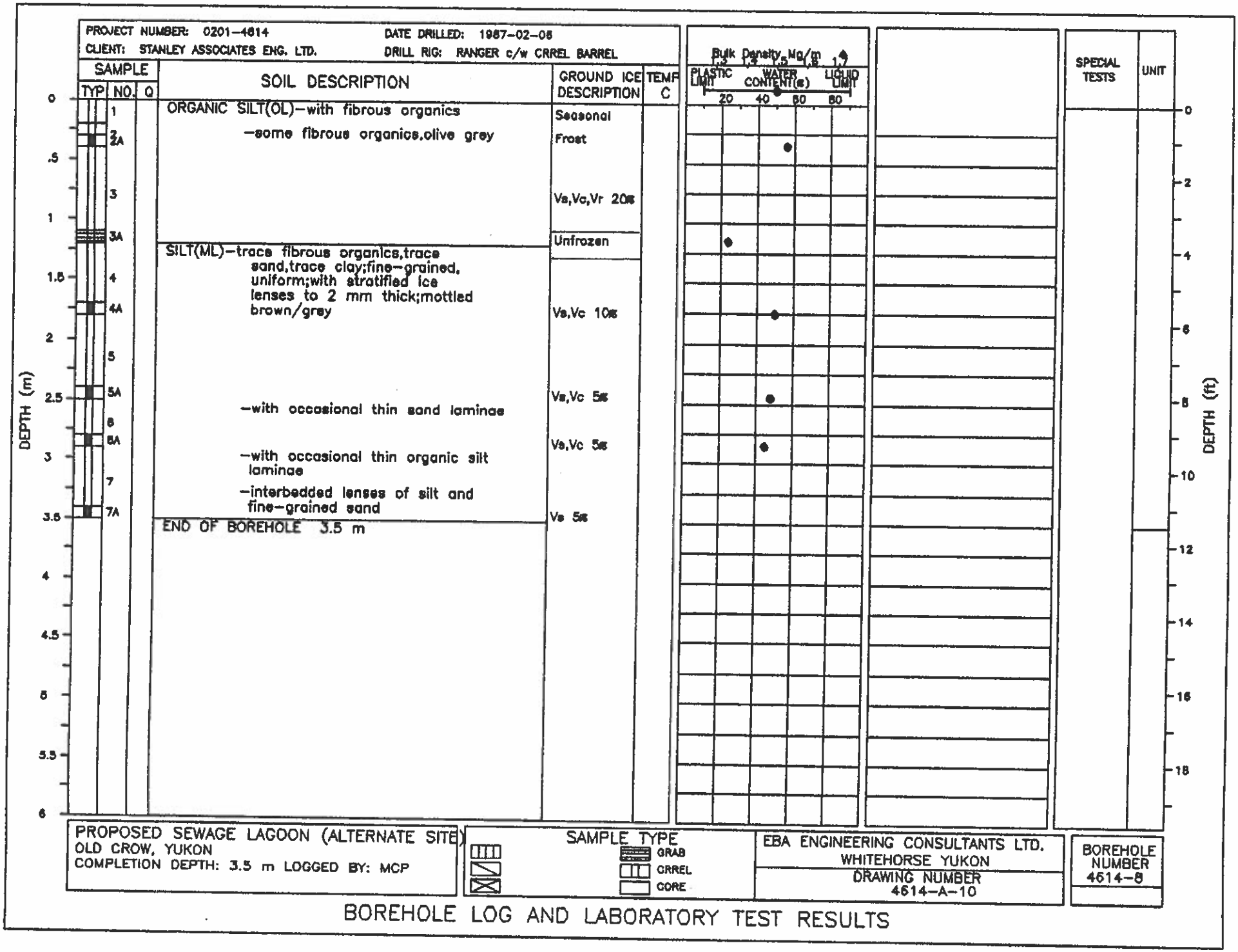
SAMPLE TYPE
GRAB
CRREL
CORE

EBA ENGINEERING CONSULTANTS LTD.
WHITEHORSE YUKON

DRAWING NUMBER
4614-A-8

BOREHOLE NUMBER
4614-6

BOREHOLE LOG AND LABORATORY TEST RESULTS



BOREHOLE LOG AND LABORATORY TEST RESULTS

PROJECT NUMBER: 0201-4614 DATE DRILLED: 1987-02-08

CLIENT: STANLEY ASSOCIATES ENG. LTD. DRILL RIG: RANGER c/w CRREL BARREL

SAMPLE TYP	SAMPLE NO.	SAMPLE Q	SOIL DESCRIPTION	GROUND ICE DESCRIPTION	TEMP C
			GRAVEL(GP)—sandy,trace silt;coarse to (FILL) fine—grained gravel,subrounded to subangular;coarse to fine—grained sand;dark brown —hard drilling due to frozen gravel	Seasonal Frost Nbn	
			END OF BOREHOLE 1.2 m AUGER REFUSAL DUE TO FROZEN GRAVEL		

Bulk Density Mg/m³ 1.3 1.5 1.7 1.9

PLASTIC LIMIT — WATER CONTENT(%) — LIQUID LIMIT

20 40 60 80

SPECIAL TESTS

UNIT

DEPTH (m): 0 .5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6

DEPTH (ft): 0 2 4 6 8 10 12 14 16 18

PROPOSED SEWAGE LAGOON
OLD CROW, YUKON
COMPLETION DEPTH: 1.2 m LOGGED BY: MCP

SAMPLE TYPE
AUGER
GRAB
CRREL
CORE

EBA ENGINEERING CONSULTANTS LTD.
WHITEHORSE YUKON
DRAWING NUMBER
4614-A-11

BOREHOLE NUMBER
4614-9

BOREHOLE LOG AND LABORATORY TEST RESULTS