

March 5, 2009

EBA File: W14101228

Government of Yukon
Department of Community Services
Community Infrastructure Branch
Box 2703
Whitehorse, Yukon
Y1A 2C6

Attention: Mr. Brian Ritchie
Program Manager

**Subject: Geotechnical Evaluation - Willow Acres Expansion Area
Haines Junction, Yukon**

At the request of Mr. Ian Robertson, MCIP of Inukshuk Planning & Development, EBA Engineering Consultants Ltd. has completed an update of all recent and previous geotechnical evaluation work completed in and around the Willow Acres Residential Expansion area. To facilitate this request, all previously completed EBA reports were reviewed (all reports prepared prior to 2001). Based on work completed to date, a geotechnical drilling project was scheduled to provide additional information for use during the current final design stage. Tasks completed and a summary of geotechnical conditions, as well as updated recommendations pertaining to geotechnical aspects of the proposed country residential expansion and residential infill development are summarized in the following sections.

1.0 EXISTING INFORMATION

Information collected and reviewed prior to completing the current borehole investigation program included:

- EBA Project No. 0201-99-14274 (two reports including the Willow Acres Expansion Area and the Concept E Area along Willow Acres Road). Seven testpits were excavated along and inside the “fire break” and three testpits were excavated in the Concept E area (along Willow Acres Road across from the water tower) by EBA in 2000 for pre-design purposes.
- EBA Project No. 0201-85-4284 (Willow Acres Subdivision - Haines Junction). Four testpits completed by EBA in 1985 verified the presence of permafrost throughout the Willow Acres Subdivision.
- J.R. Paine’s Haines Junction Subdivision Project (along Willow Acres Road and throughout the subdivision). Four boreholes were drilled along the access road into Willow Acres Subdivision and ten boreholes were drilled throughout the subdivision in 1984. Frozen soil was mentioned on the borehole logs but it was not delineated as actual permafrost.
- EBA Project No. 0201-89-10016 (Water & Sewer Installation) with eleven boreholes advanced throughout the north end of the Champagne & Aishihik village.

Along with the collection and review of geotechnical data from previously completed projects, the two December, 2008 “Willow Acres Country Residential Expansion” and “Residential Infill” concept plans prepared by Inukshuk Planning & Development were also reviewed to assess feasibility.

2.0 CURRENT BOREHOLE PROGRAMS

In January, 2009 two borehole drilling programs were completed by EBA in Haines Junction. On January 21 and 22, 2009, nine boreholes were drilled throughout the CAFN Cultural Centre located along the west side of the study area. On January 23, 2009, two additional boreholes drilled within the proposed Residential Infill area (as shown on the Inukshuk Planning & Development concept plans). Both field investigation programs were coordinated by Mr. Chad Cowan, P.Eng of EBA’s Whitehorse office. All boreholes were drilled with a Nodwell mounted CME 75 drill rig owned and operated by 15317 Yukon Inc. of Whitehorse, Yukon.

At each borehole location, detailed logs were prepared describing the geotechnical conditions encountered. Representative soil samples were collected at regular intervals throughout the depth of each borehole and upon completion, the boreholes were flagged, and UTM coordinates were recorded utilizing a hand held GPS unit.

The laboratory testing program included natural moisture content determination for all samples collected and particle size distribution testing on select samples for classification purposes.

Geotechnical conditions as determined from current and previously completed projects are described in the following section. Testhole locations are presented on Figure 1 and detailed testhole logs and associated laboratory test result report forms are presented following Figure 1.

It should be noted that information gathered from the CAFN Cultural Centre site was used in this evaluation but testhole logs and lab data are not presented in this report because the report prepared for the CAFN has been recently submitted for review and may be subject to change.

3.0 GEOTECHNICAL CONDITIONS

3.1 General Location & Conceptual Information

The study area is bordered by the Alaska Highway on the west side; the fire break on the east side (the proposed Willow Acres Expansion Area extends beyond the firebreak); and Willow Acres Road on the south side. On the north side, the two proposed concept plans stay inside the 450 m setback from the Haines Junction landfill (in the northwest corner of the proposed development area) includes two rows of country residential lots extending radially out from the existing Willow Acres Subdivision.

3.2 Terrain

In general, the existing Willow Acres Subdivision area is the high point of the study area and the area slopes downward towards the Alaska Highway. The lowest point is in the southwest corner of the site. Grades within the study area vary from relatively flat (less than 5%) to a maximum of 10%. Both concept plans propose lots to the south of the drainage channel located half way between the landfill site and Willow Acres Subdivision. This channel is likely wet during the spring thaw or during periods of heavy rain but is likely not an active water course. Areas being considered for development have minimal terrain related issues.

3.3 Geotechnical Conditions

Geotechnical conditions presented in this section are based on current and previous work completed throughout the study area. Included are the twelve boreholes drilled in January, 2009; the ten testpits and three percolation tests completed during the 2000 evaluations, the four EBA testpits excavated within the existing Willow Acres Subdivision in 1985, the eleven EBA boreholes drilled throughout the Champagne Aishihik village in 1989; and the fourteen boreholes completed during J.R. Paine's geotechnical evaluation of the Willow Acres Road and Subdivision in 1984.

The soil conditions encountered throughout the study area are indicative of much of the Haines Junction townsite. Deposition of the near surface lacustrine soils found throughout Haines Junction is the result of the Lowell Glacier damming the Alsek River. The lacustrine silt and clay soil deposited by Lake Alsek and found overlying most of the Haines Junction townsite is quite variable in thickness and is underlain by previously deposited silt till. Some sand and gravel deposits are also present throughout the area and are evidence of beach terraces from the receding Lake Alsek. Detailed soil conditions at each of the testpit locations are presented on the attached testpit logs, with accompanying laboratory test result report forms.

No groundwater has been encountered during any of the geotechnical evaluation work completed in the vicinity of the study area. However, water well records indicate that the depth to groundwater in the Haines Junction area varies from 100 to 150 m below surface elevations.

Pockets of permafrost have been noted in the majority of the previously completed projects completed by EBA and J.R. Paine in this area. The presence of permafrost still remains a potential problem as EBA is currently involved in monitoring a newly constructed residential structure which is showing distress from permafrost degradation.

The permafrost varies in classification from Nbe (no visible ice in excessively wet soil) and Nbn (no visible ice in soils that aren't excessively wet when thawed) to Vs, Vr (stratified and randomly oriented visible ice) with up to 10% ice by volume. Although permafrost is more likely to be encountered in areas with a thicker layer of organic cover, other factors, such as slope orientation, tree cover and soil moisture content contribute to the presence of permafrost. This makes it difficult to predict which areas of the study area will or will not be underlain by permafrost.

Surface vegetation throughout the site is quite variable. Portions of the site are covered with post forest-fire poplar re-growth, while low lying areas along the firebreak are covered with grasses with stands of willows. Slopes with a northerly orientation (slopes in behind the north side of the existing subdivision) have fairly dense stands of mature white spruce trees and a moss covered portion of the northeast corner of the development area has sparse stands of immature balsam spruce along with white spruce trees.

4.0 SITE SUITABILITY & DEVELOPMENT CONSTRAINTS

Considering the two concept plans prepared by Inukshuk Planning & Development and based on the existing topography and geotechnical conditions, the study area is considered acceptable for residential site development. The main development constraints are the possible presence of permafrost and fine grained soils, which will affect roadway construction and the feasibility of installing on-site sewage disposal systems.

In Concept 1, there is a 67% country residential to 33% serviced lot split compared to Concept 2 which has close to a 50%:50% split of country residential verses serviced lot development. Since there is less risk associated with country residential development (compared to the costs of constructing a serviced subdivision which may require maintenance due to damage caused by permafrost thaw), there are some obvious advantages to having a greater number of country residential lots. On the other hand, most of the ice rich permafrost noted in this area of Haines Junction seems to be located in the surficial lacustrine soils and once the water line, sewer line and service trenches have been excavated and backfilled, the majority of the permafrost may have melted out.

Recommendations for development and construction are presented in the following sections.

5.0 SUBDIVISION CONSTRUCTION CONSIDERATIONS

Aspects of construction addressed in the following sections include roadway structure design and construction; residential foundation design considerations; on-site sewage disposal system design, and recommendations for additional design level geotechnical work.

5.1 Roadways

Roadway construction is feasible throughout the study area. No terrain or topographical concerns were identified during recent or previously completed site investigations. However, there will possibly be roadway maintenance issues associated with the degradation of ice rich and non-ice rich permafrost. The following recommendations pertain to roadway construction:

- Proposed roadways should be cleared and stripped of all organic cover well in advance of any roadway construction (preferably at least one construction season). This will allow a significant percentage of the existing permafrost to thaw, minimizing the potential for settlement after construction.
- All organics removed during the stripping process must be wasted or retained in a stockpile for landscaping purposes. It is anticipated that the stripping depth will be less than 100 mm, however some isolated areas may have up to 150 mm of organics overlying the lacustrine clay and silt.
- All roadways will be constructed on a clay and silt subgrade. The moisture content of the near surface soils is fairly high (ranging in moisture from 18 to 35%), therefore the subgrade strength will range from very firm to soft. Subgrade preparation will likely require scarification, aeration, and drying in order to achieve a stable subgrade surface. If sections of subgrade are excessively wet and a stable surface can't be achieved, subcuts will be required. All subcuts should be a minimum of 600 mm in depth and backfilled with clean, well-graded pit run gravel in order to properly bridge soft spots.
- Granular structure for new roadways should be at least 500 mm thick. The gravel sub-base should be at least 450 mm thick and be comprised of well-graded pit run gravel. The sub-base can then be capped with a 150 mm thick traffic course of 20 mm crushed basecourse or surfacing gravel.
- Sub-base and basecourse gravels should be placed in lifts not exceeding 200 mm in thickness, moisture conditioned, and compacted to at least 98% of Standard Proctor maximum dry density.
- During access road construction, it is recommended that inspection and compaction testing be performed when the prepared subgrade has been constructed and again after each of the sub-base and basecourse or gravel surfacing has been placed and compacted.
- Imported granular materials should comply with the gradation specifications presented in Table 5.1, below. During roadway construction, all imported gravel should be placed, moisture conditioned and compacted to at least 98% of maximum dry density as determined by standard effort (ASTM D698).
- If alternate materials are considered, EBA will conduct particle size analysis testing and provide an opinion regarding acceptability for use in specific applications

TABLE 5.1 RECOMMENDED GRANULAR MATERIALS SPECIFICATIONS			
80 mm PIT RUN GRAVEL		20 mm BASECOURSE GRAVEL	
SIEVE SIZE (mm)	% PASSING BY MASS	SIEVE SIZE (mm)	% PASSING BY MASS
80.000	100	20.000	100
25.000	55 - 100	12.500	64 - 100
12.500	42 - 84	5.000	36 - 72
5.000	26 - 65	1.250	12 - 42
1.250	11 - 47	0.315	4 - 22
0.315	3 - 30	0.080	3 - 6
0.080	0 - 8		

Traditionally, granular materials in the Haines Junction area are from either the Pine Lake pit or the McIntosh pit. The Pine Lake pit is significantly closer to the study area (McIntosh pit is approximately 17 km from the Village of Haines Junction). Status and volume reserves are not known, however, information can be obtained from YTG – Transportation Engineering.

5.2 On-Site Sewage Disposal System Construction

The Willow Acres Subdivision expansion area is considered marginally acceptable for on-site sewage disposal. Historically, systems constructed within the existing subdivision appear to be acceptable but anecdotal information suggests that there have been challenges due to the presence of permafrost and fine grained soils. As with roadway construction, areas proposed for on-site sewage disposal system construction should be cleared of vegetation and organic soils well in advance of system construction to assist in the degradation of pockets of permafrost.

Percolation rates measured during the geotechnical evaluation completed in 2000 confirms that acceptable percolation rates can be measured in typical soils. For instance, in the lacustrine clay and silt soils encountered in testpits 14274-TP05 and -TP06, a 35 min/25 mm was measured. The underlying silt till soil was tested in testpit 14276-TP02, where a percolation rate of 20 min/25 mm was measured.

The maximum percolation rate considered acceptable by Environmental Health is 60 min/25 mm. Therefore, the results of the three tests completed confirm that the typical soils found throughout the study area are suitable for on-site sewage disposal system installation (with the exception of the permafrost areas).

The attached Figure 2, from EBA Project 0201-99-14274, presents a typical wide absorption trench design based on a 60 min/25 mm percolation rate and water use requirements equivalent to the needs of a three bedroom residential structure. This is a “worst case” system design based on the slowest percolation rate allowed by Environmental Health. Actual system sizing must be based on actual percolation test data collected for each individual lot. Figure 3, also attached, presents setback requirements for on-site sewage disposal system construction.

Granular materials for on site sewage disposal system construction must meet the gradation specifications shown in Table 5.2, below. Both products are available from Haines Junction contractors.

TABLE 5.2 DRAIN ROCK & FILTER SAND GRADATION SPECIFICATIONS			
DRAIN ROCK		FILTER SAND	
SIEVE SIZE (mm)	% PASSING BY MASS	SIEVE SIZE (mm)	% PASSING BY MASS
65.000	100	4.750	100
20.000	20 - 100	2.000	75 - 100
0.080	0 - 3	0.250	5 - 75
		0.080	0 - 15

5.3 Underground Utilities Construction

Recommendations relevant to serviced lot construction in the Residential Infill area(s) include:

Underground utilities installation, including water & sewer lines, as well as services to individual lots or structures, storm sewer system construction and shallow electrical utilities (power and communications lines) can all be constructed using conventional construction methods (tracked excavator equipped with a clean-up bucket is recommended).

Excavation of utility trenches must conform to the Yukon Occupational Health & Safety Regulations. Since the predominant soil profile will be moist to wet clay and silt soils with tills at depth, properly constructed trench walls should have no stability issues.

The recommended pipe bedding configuration includes 150 mm of compacted bedding sand below the pipe invert, along with subsequent lifts extending to 300 mm over the pipe. This insures proper protection of the buried utility lines during backfill. Bedding may be imported bedding sand or bedding stone; however, since groundwater has never been encountered in this study area, bedding stone should not be necessary. The bedding sand and stone should conform to the gradation specifications presented in Table 5.3.

TABLE 5.3 RECOMMENDED PIPE BEDDING MATERIALS SPECIFICATIONS			
BEDDING SAND		25 mm BEDDING STONE	
SIEVE SIZE (mm)	% PASSING BY MASS	SIEVE SIZE (mm)	% PASSING BY MASS
10.000	100	25.000	100
5.000	80 - 100	20.000	70 - 100
2.000	55 - 100	12.500	55 - 100
0.630	25 - 65	10.000	30 - 80
0.250	10 - 40	5.000	0 - 40
0.080	2 - 15	2.000	0 - 10

If alternate materials are being considered, EBA will conduct particle size analysis testing and provide an opinion regarding acceptability for use in specific applications.

Material excavated from the trenches is considered acceptable for use as trench backfill, extending to subgrade elevations. If any cobbles and boulders are encountered during excavation care should be taken to ensure they are not allowed close to the pipes or on the subgrade surface.

6.0 FOUNDATIONS

Locating a residential structure within the study area should be done carefully to ensure that the pockets of permafrost are avoided (if possible). Again, preclearing and stripping the building site well in advance of construction is recommended. Conventional foundation systems for residential structures, consisting of concrete strip and spread footings or monolithic slab-on-grade construction are considered feasible throughout the subject site. Footings should be designed based on an allowable static net bearing pressure of 96 kPa (2000 psf).

The main concern for shallow foundation construction is the frost heave potential of the underlying soils. The near surface clay and silt soils are considered very frost susceptible, therefore, the potential for frost heave is significant, especially if surface water runoff around footing areas is not controlled. If surface water is allowed to seep into the soils adjacent to the foundation elements, the frost heave potential increases significantly. Therefore, it is very important to control roof run-off and site drainage away from all building foundations.

Cover over footings for heated structures in the Haines Junction area should be at least 1.5 m. The 1.5 m of cover can be made up of soil cover or a combination of soil and moisture resistant, backfillable insulation, based on the premise that 25 mm of rigid insulation is the equivalent of 300 mm of soil cover.

7.0 INSPECTION & TESTING SERVICES DURING CONSTRUCTION

It is recommended that EBA be retained to provide inspection and testing services during construction. Services provided would include:

- Particle size analysis and maximum dry density determinations using standard effort (ASTM D698) of all materials being considered for use during roadway construction
- Compaction testing during underground utilities construction
- Subgrade, sub-base and basecourse inspection and compaction testing during roadway construction
- Soil bearing inspections and on-site sewage disposal system design and inspection services can also be provided upon request.

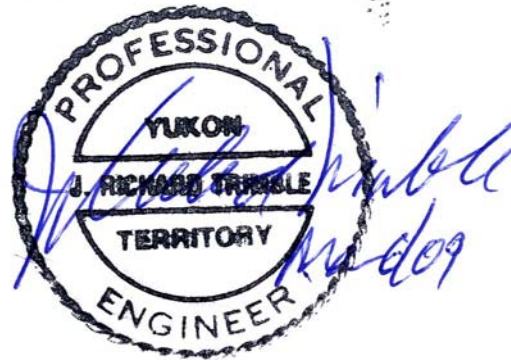
8.0 CLOSURE

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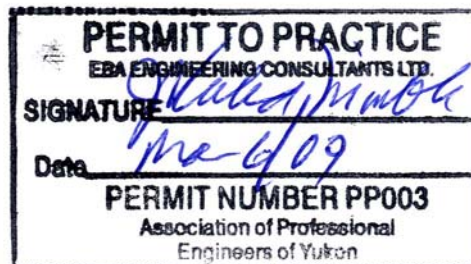
Yours truly,
EBA Engineering Consultants Ltd.

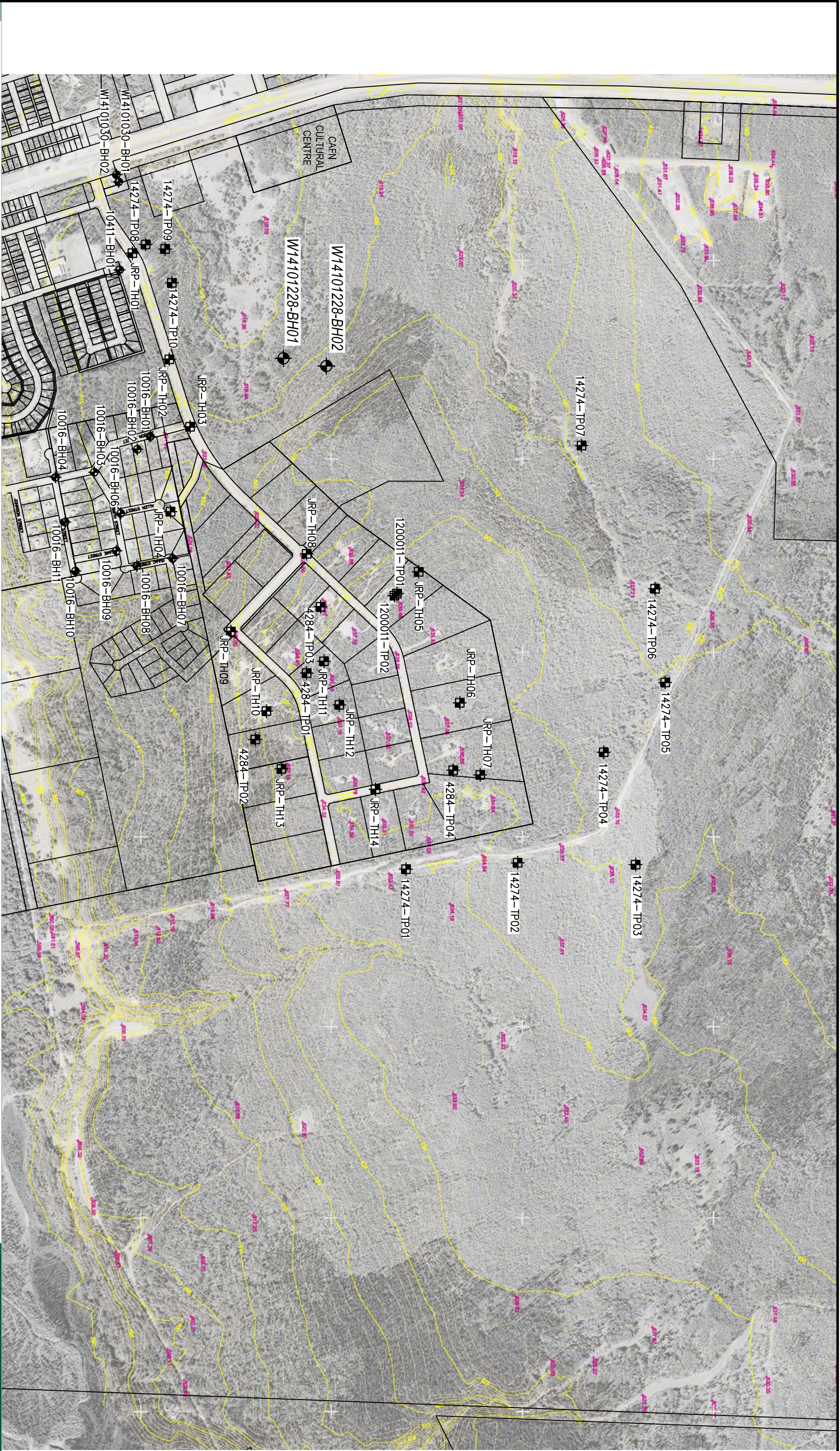


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(Email: mplaunt@eba.ca)



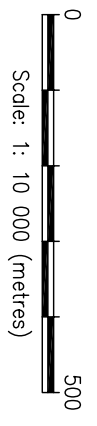
J. Richard Trimble, M.Sc. (Eng.), P.Eng.
Project Director, Arctic Region
(Direct Line: 867-668-2071 Ext. 222)
(Email: rtrimble@eba.ca)





LEGEND:
 ◆ - BOREHOLE LOCATION
 □ - MONITORING WELL LOCATION

NOTES:
 BASE PHOTO SUPPLIED CLIENT



CLIENT



WILLOW ACRES RESIDENTIAL EXPANSION
HAINES JUNCTION, YT

SITE PLAN

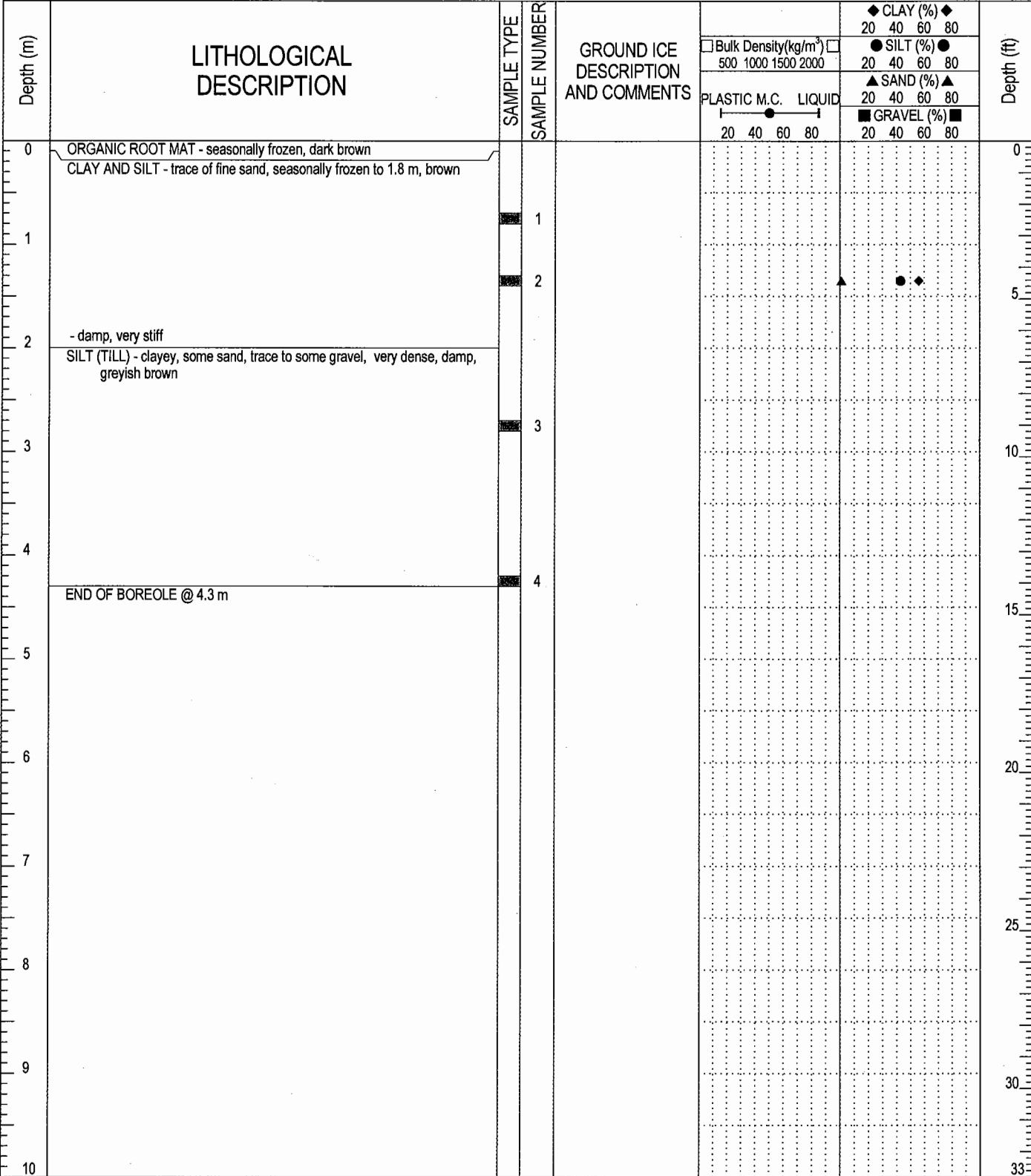
SHOWING TEST HOLE LOCATIONS

PROJECT NO.	W14101228	DWN	KJT	QCD	MCP	REV	0
OFFICE	EBA-WHSE	DATE	February 19, 2009				

Figure 1

Geotechnical Evaluation	Government of Yukon	BOREHOLE NO: W14101228 BH01
Willow Acres Residential Expansion	Drilling Method: Auger Solid Stem	PROJECT NO: W14101228
Haines Junction, YT	6738890N; 363570E; Zone 8	

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BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND

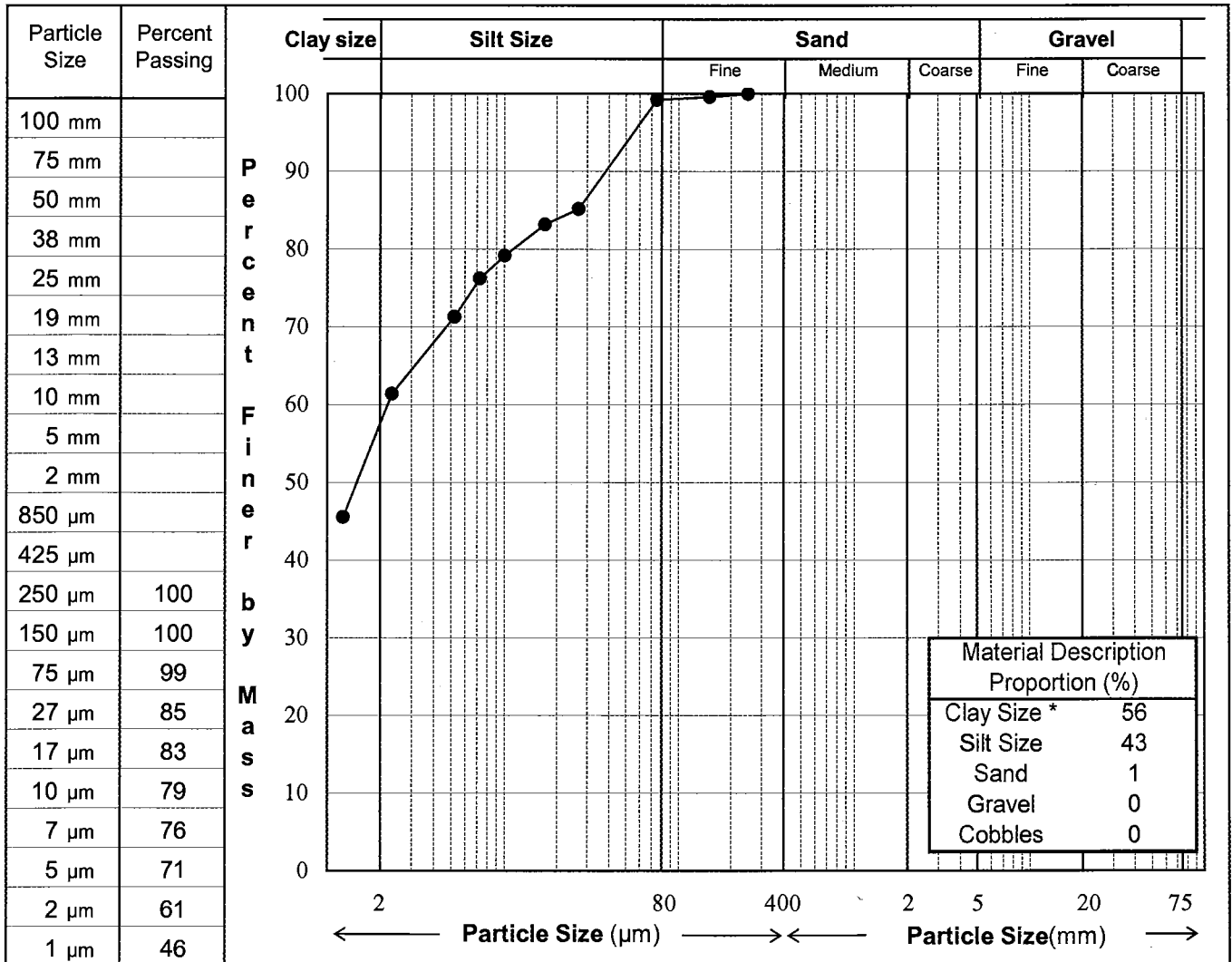


 EBA Engineering Consultants Ltd.	LOGGED BY: CPC	COMPLETION DEPTH: 4.3m
	REVIEWED BY:	COMPLETE: 1/23/2009
	DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: Willow Acres Country Residential Expansion
Client: YTG / ATTN: Brian Ritchie
Project No.: W14101228
Location:
Sample No.: BH01-02
Depth: 1.3 - 1.4 m
Description:** CLAY AND SILT - trace sand



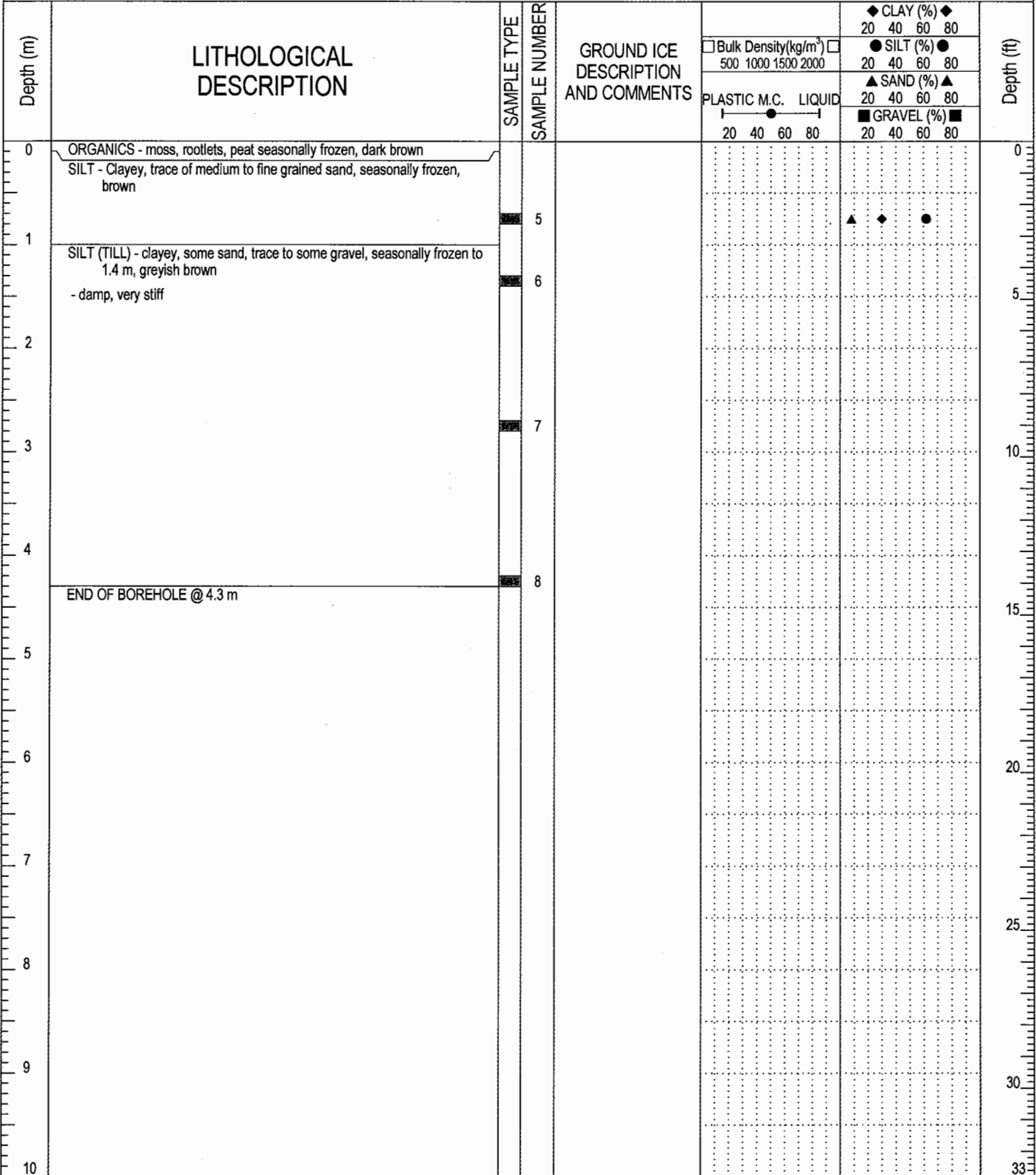
Remarks: * The upper clay size of 2 µm is as per the Canadian Foundation Manual.
 ** The description is visually based & subject to EBA description protocols.

Reviewed By: _____

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Geotechnical Evaluation	Government of Yukon	BOREHOLE NO: W14101228 BH02
Willow Acres Residential Expansion	Drilling Method: Auger Solid Stem	PROJECT NO: W14101228
Haines Junction, YT	6739005N; 363590E; Zone 8	

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BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND

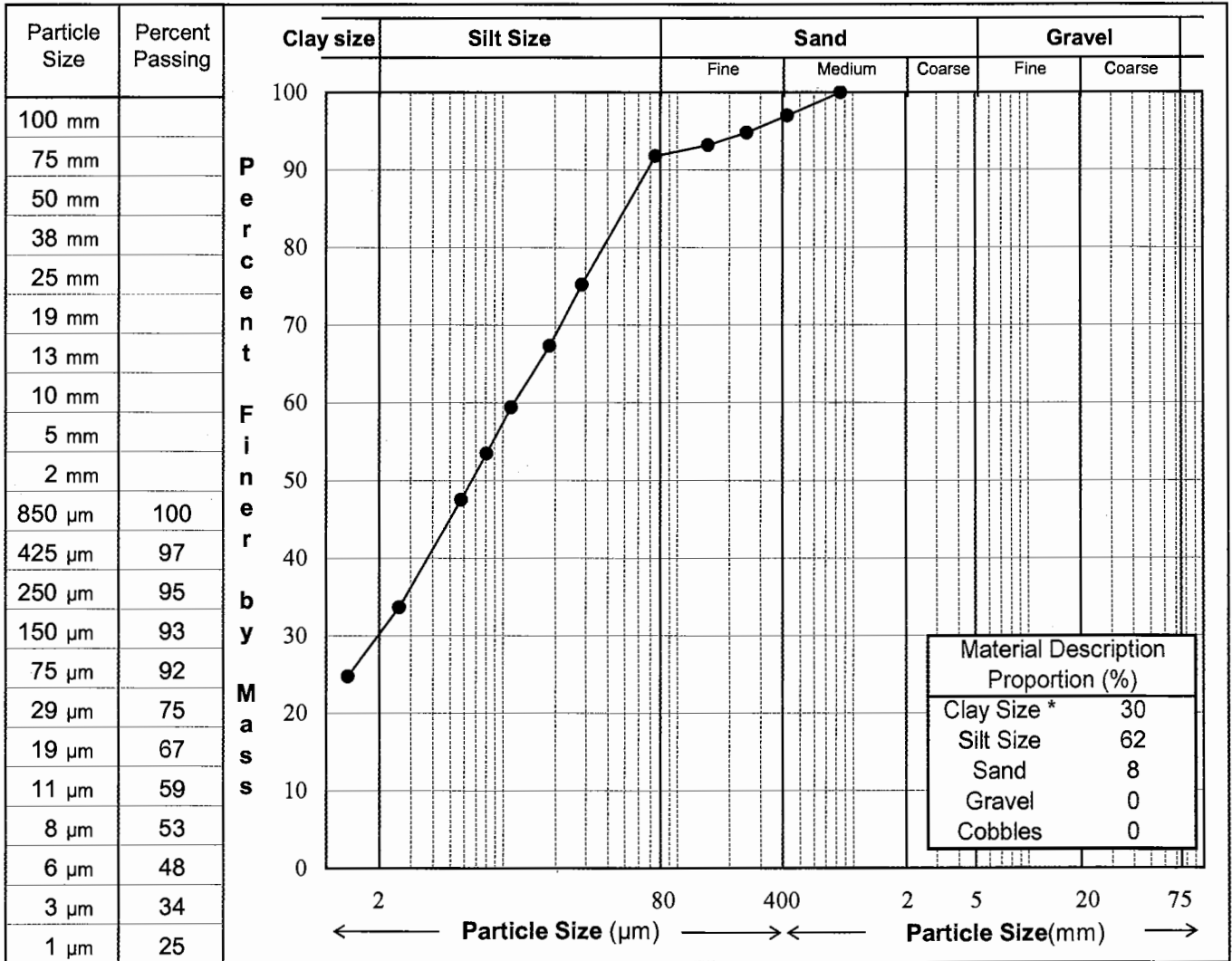


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	REVIEWED BY:	COMPLETE: 1/23/2009
	DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: Willow Acres Country Residential Expansion
Client: YTG / ATTN: Brian Ritchie
Project No.: W14101228
Location:
Sample No.: BH02-05
Depth: 0.7 - 0.8 m
Description:** SILT AND CLAY - trace sand



Remarks: * The upper clay size of 2 µm is as per the Canadian Foundation Manual.
 ** The description is visually based & subject to EBA description protocols.


Reviewed By: _____

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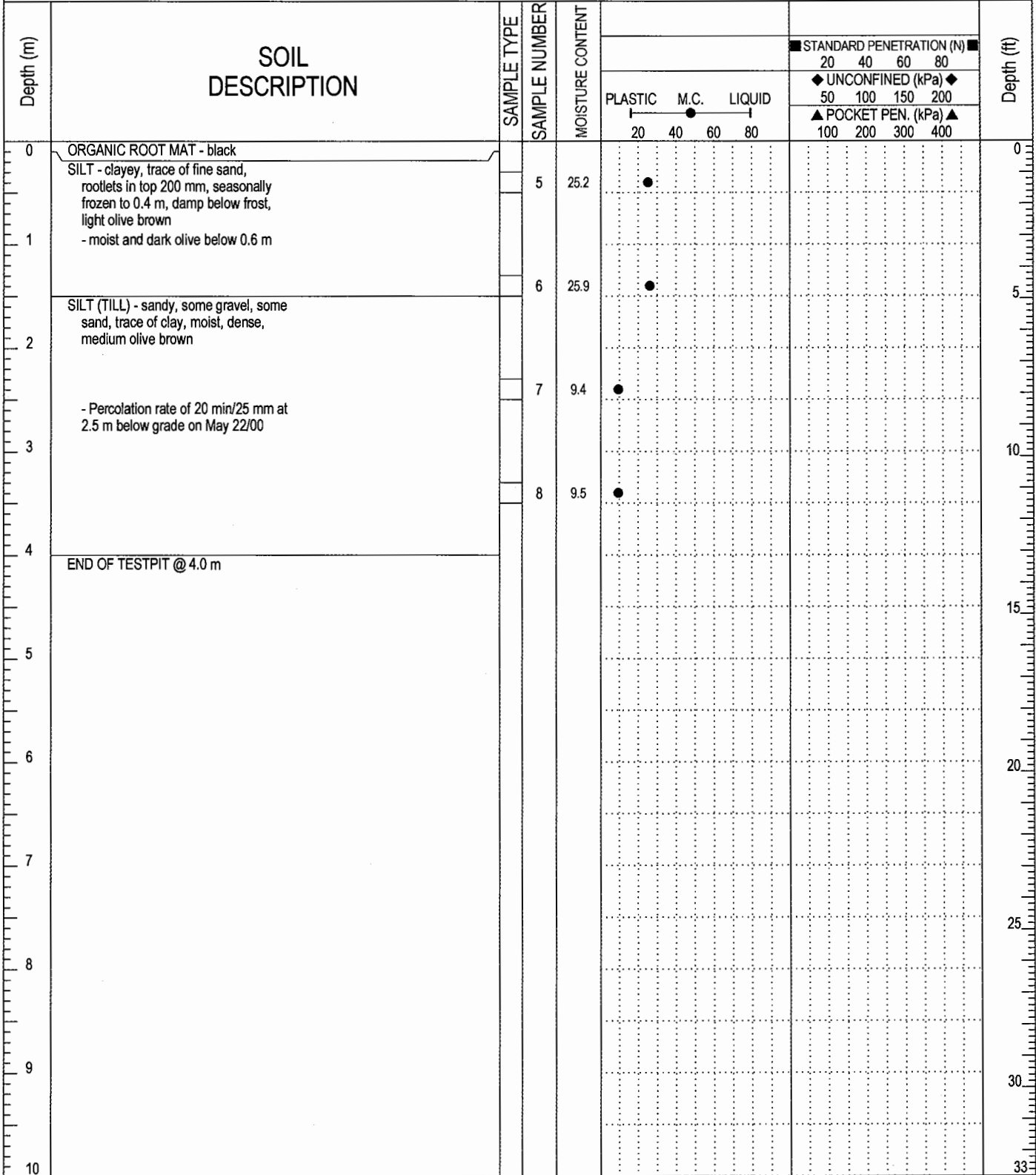
GEOTECHNICAL EVALUATION	CLIENT: YTG - ENG. & DEV.	PROJECT NO. - BOREHOLE NO.
WILLOW ACRES AREA EXPANSION	EXCAVATOR: CAT 320L	14274-TP01
HAINES JUNCTION, YUKON		


SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT	PLASTIC M.C. LIQUID			STANDARD PENETRATION (N)		Depth (ft)
					20	40	60	80	20	
0	SILT - clayey, trace of fine sand, seasonally frozen to 1.0 m, moist to wet when thawed, firm (est), dark olive		1	34.3						0
1	SILT (TILL) - sandy, some matrix supported gravel, trace of clay, moist, dense, olive brown		2	14.7						5
2			3	11.6						10
3	- more gravel in silt matrix below 2.5 m		4	9.7						15
4	END OF TESTPIT @ 4.0 m									20
5										25
6										30
7										35
8										40
9										45
10										50

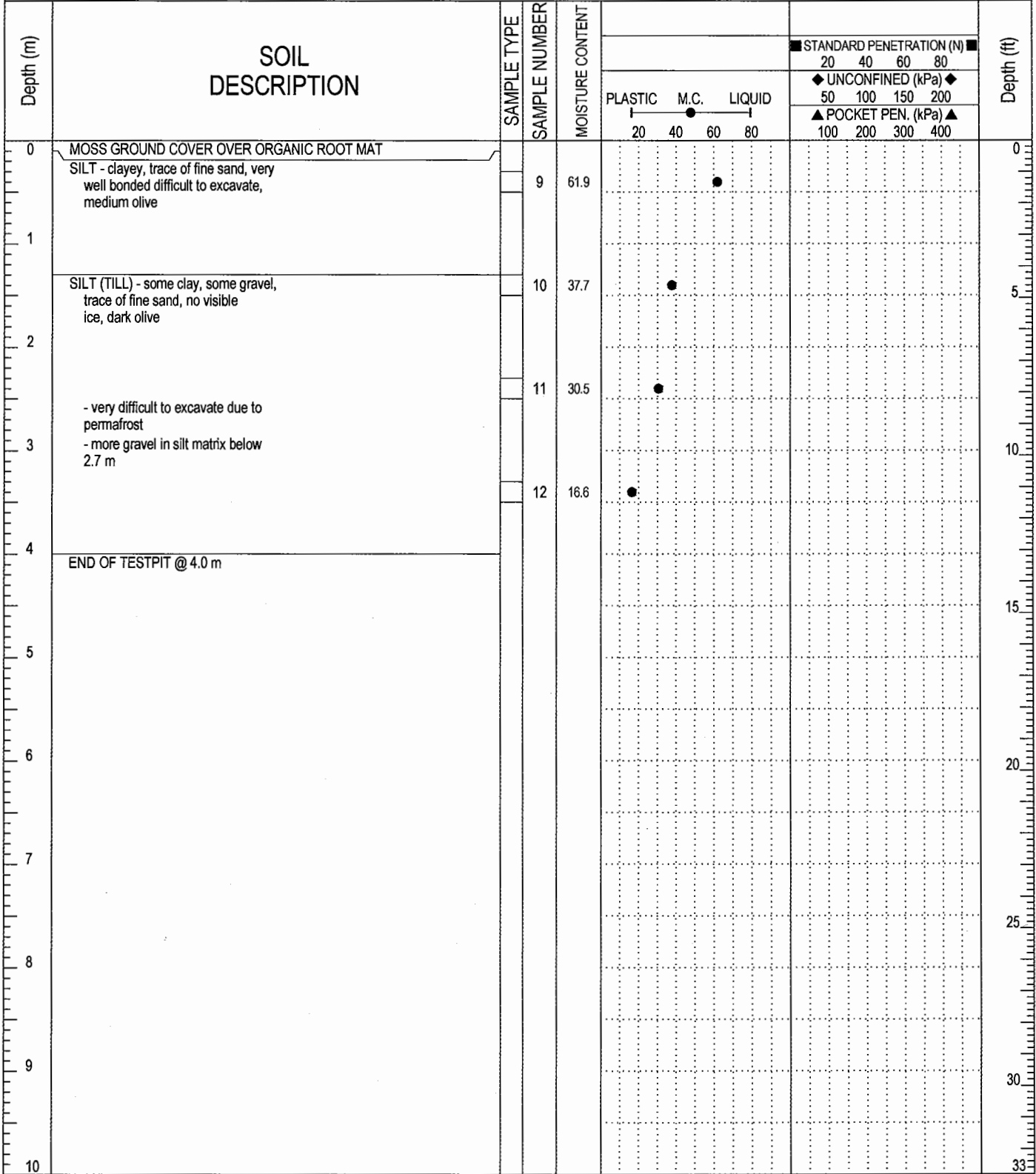
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	REVIEWED BY: JRT	COMPLETE: 6/30/2005
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GEOTECHNICAL EVALUATION		CLIENT: YTG - ENG. & DEV.		PROJECT NO. - BOREHOLE NO.		
WILLOW ACRES AREA EXPANSION		EXCAVATOR: CAT 320L		14274-TP02		
HAINES JUNCTION, YUKON						
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GEOTECHNICAL EVALUATION		CLIENT: YTG - ENG. & DEV.		PROJECT NO. - BOREHOLE NO.			
WILLOW ACRES AREA EXPANSION		EXCAVATOR: CAT 320L		14274-TP03			
HAINES JUNCTION, YUKON							
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BACKFILL TYPE		<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



EBA Engineering Consultants Ltd.

LOGGED BY: MCP

REVIEWED BY: JRT

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COMPLETION DEPTH: 4m

COMPLETE: 6/30/2005

Page 1 of 1

GEOTECHNICAL EVALUATION		CLIENT: YTG - ENG. & DEV.			PROJECT NO. - BOREHOLE NO.						
WILLOW ACRES AREA EXPANSION		EXCAVATOR: CAT 320L			14274-TP04						
HAINES JUNCTION, YUKON											
SAMPLE TYPE		<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE				
BACKFILL TYPE		<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND				
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	PLASTIC M.C. LIQUID		STANDARD PENETRATION (N)		Depth (ft)
							20 40 60 80	50 100 150 200	20 40 60 80	100 200 300 400	
0	ORGANIC ROOT MAT - black										0
	SILT - some clay to clayey, trace of fine sand, rootlets in top 300 mm, seasonally frozen to 1.3 m, dense, dark olive		13			25.2					
1											
	SILT (TILL) - sandy, gravelly, trace to some clay, olive brown		14	GM		7.1					5
2											
	- difficult to excavate		15			14.5					
3											
			16			11.3					10
4	END OF TESTPIT @ 4.0 m										15
5											20
6											25
7											30
8											33
9											
10											



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DRAWING NO:

COMPLETION DEPTH: 4m

COMPLETE: 6/30/2005

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GEOTECHNICAL EVALUATION		CLIENT: YTG - ENG. & DEV.			PROJECT NO. - BOREHOLE NO.							
WILLOW ACRES AREA EXPANSION		EXCAVATOR: CAT 320L			14274-TP05							
HAINES JUNCTION, YUKON												
SAMPLE TYPE		<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE					
BACKFILL TYPE		<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND					
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	STANDARD PENETRATION (N)				Depth (ft)	
							PLASTIC	M.C.	LIQUID	UNCONFINED (kPa)		POCKET PEN. (kPa)
							20	40	60	80		
							50	100	150	200		
							100	200	300	400		
0	ORGANIC ROOT MAT - frozen, black											0
0	SILT - some clay to clayey, trace of fine sand, rootlet to 0.6 m, seasonally frozen to 0.6 m, medium olive brown		17			18.6						0
1	- silt becomes dark olive in color											
2	SAND & SILT (TILL) - some gravel, some trace to some clay, occasional cobbles, moist, medium brown		18			9						5
2	- Percolation rate 35 min/25mm at 2.0 m - 2.3 m on Oct25/00		19			10.7						10
2	- siltier and moist below 2.3 m											
3												10
4			20	SM		8.7						15
4	END OF TESTPIT @ 4.0 m											15
5												20
6												25
7												30
8												35
9												40
10												45



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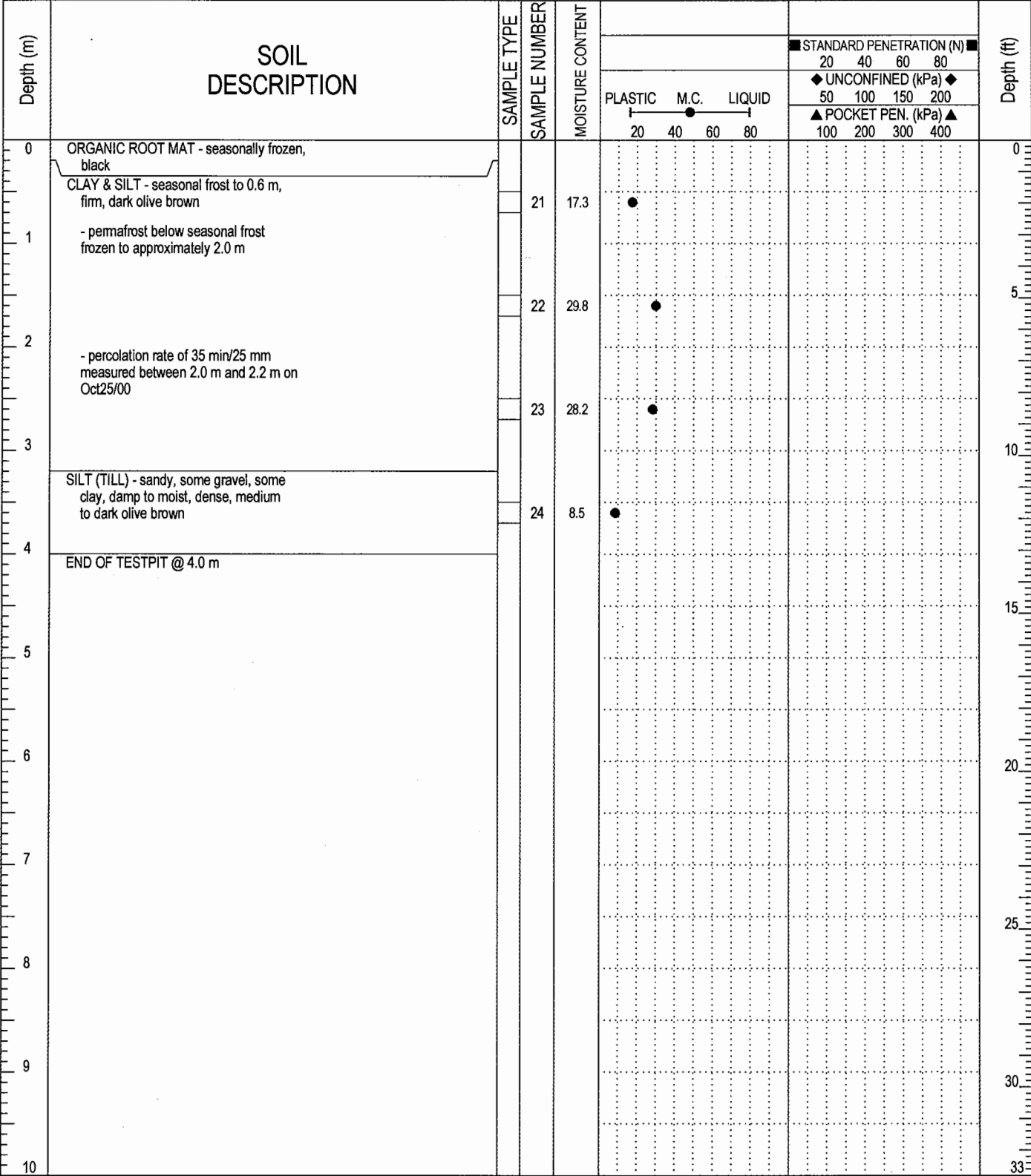
DRAWING NO:


COMPLETION DEPTH: 4m

COMPLETE: 6/30/2005

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GEOTECHNICAL EVALUATION		CLIENT: YTG - ENG. & DEV.		PROJECT NO. - BOREHOLE NO.			
WILLOW ACRES AREA EXPANSION		EXCAVATOR: CAT 320L		14274-TP06			
HAINES JUNCTION, YUKON							
SAMPLE TYPE		<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE		<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



 EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 4m
	REVIEWED BY: JRT	COMPLETE: 6/30/2005
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GEOTECHNICAL EVALUATION	CLIENT: YTG - ENG. & DEV.	PROJECT NO. - BOREHOLE NO.
WILLOW ACRES AREA EXPANSION	EXCAVATOR: CAT 320L	14274-TP07
HAINES JUNCTION, YUKON		
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE	
BACKFILL TYPE	<input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT	PLASTIC	M.C.	LIQUID	STANDARD PENETRATION (N)				Depth (ft)
								20	40	60	80	
0	ORGANIC ROOT MAT - frozen, black											0
0	SILT - some clay to clayey, trace of fine sand, seasonally frozen to approximately 1.0 m, medium to dark olive		25	25.1								0
1	- 100 mm thick lens of sandier silt, medium brown from 1.3 to 1.4 m											5
2	SILT (TILL) - sandy, some gravel, some clay, damp to moist, dense, medium to dark olive brown, sand lenses throughout		26	11								5
2			27	9.7								10
3												10
4			28	11.1								15
4	END OF TESTPIT @ 4.0 m											15
5												20
6												20
7												25
8												25
9												30
10												33

 EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 4m
	REVIEWED BY: JRT	COMPLETE: 6/30/2005
	DRAWING NO:	Page 1 of 1

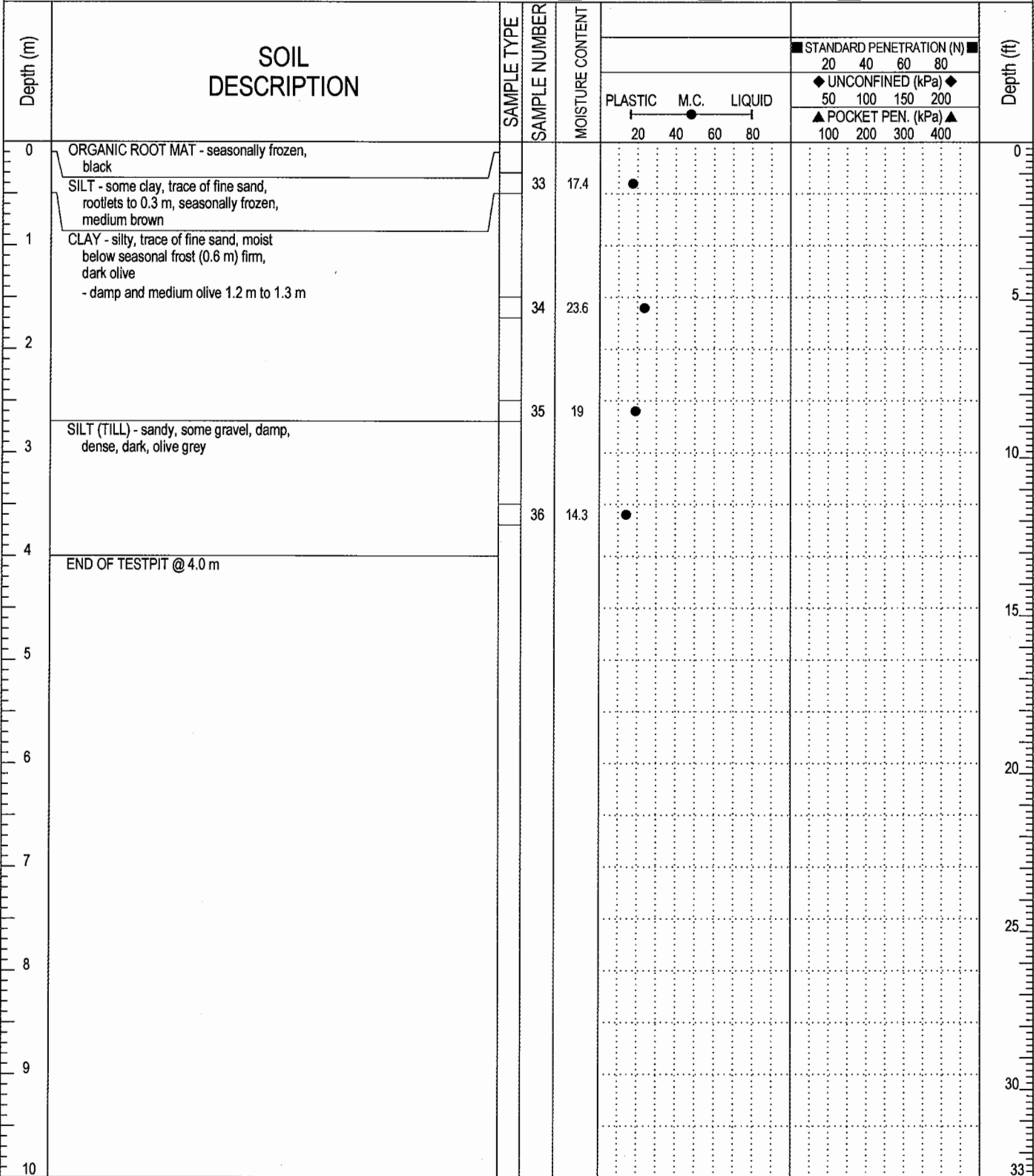
GEOTECHNICAL EVALUATION	CLIENT: YTG - ENG. & DEV.	PROJECT NO. - BOREHOLE NO.
WILLOW ACRES AREA EXPANSION	EXCAVATOR: CAT 320L	14274-TP08
HAINES JUNCTION, YUKON		
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BACKFILL TYPE	<input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT	PLASTIC M.C. LIQUID			STANDARD PENETRATION (N)				Depth (ft)
					20	40	60	80	20	40	60	
0	ORGANIC ROOT MAT - seasonally frozen, black											0
	SILT - some clay to clayey, trace of fine sand, rootlets to 0.3 m, seasonally frozen, medium olive brown		29	24	•							
1	CLAY - silty, trace of fine sand, moist, dense, dark olive brown											
			30	27.5	•							5
2												
	SILT (TILL) - sandy, clayey, some gravel, moist, dense, medium olive brown		31	16.4	•							10
3												
			32	14.6	•							15
4	END OF TESTPIT @ 4.0 m											20
5												25
6												30
7												35
8												40
9												45
10												50

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	REVIEWED BY: JRT	COMPLETE: 7/31/2005
	DRAWING NO:	Page 1 of 1

GEOTECHNICAL EVALUATION	CLIENT: YTG - ENG. & DEV.	PROJECT NO. - BOREHOLE NO.
WILLOW ACRES AREA EXPANSION	EXCAVATOR: CAT 320L	14274-TP09
HAINES JUNCTION, YUKON		

SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



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	REVIEWED BY: JRT	COMPLETE: 7/31/2005
	DRAWING NO:	Page 1 of 1

GEOTECHNICAL EVALUATION	CLIENT: YTG - ENG. & DEV.	PROJECT NO. - BOREHOLE NO.
WILLOW ACRES AREA EXPANSION	EXCAVATOR: CAT 320L	14274-TP10
HAINES JUNCTION, YUKON		
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE	
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT	PLASTIC M.C. LIQUID			STANDARD PENETRATION (N)				Depth (ft)	
					20	40	60	80	20	40	60		80
0	ORGANIC ROOT MAT - seasonally frozen, black												0
0.3	SILT - some clay, trace of fine sand, rootlets to 0.3 m, seasonally frozen, medium brown		37	26.1									0.98
0.8	CLAY - silty, trace of fine sand, seasonally frozen to 0.8 m, dark olive - permafrost below 0.8 m, very well bonded, difficult to excavate		38	24.9									2.62
1.0			39	35.3									3.28
3.5	SILT (TILL) - sandy, some clay to clayey, some gravel, frozen, very difficult to excavate, dark olive grey		40	27.8									11.48
3.5	END OF TESTPIT @ 3.5 m												11.48

 EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 4m
	REVIEWED BY: JRT	COMPLETE: 7/31/2005
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GEOTECHNICAL EVALUATION	CLIENT: STANLEY ASSOCIATES ENGINEERING	PROJECT NO. - BOREHOLE NO.
WATER AND SEWER SYSTEM INSTALLATION	TRUCK MOUNTED CME 75 c/w SOLID AUGERS	10016-01
HAINES JUNCTION INDIAN VILLAGE		ELEVATION: 621.5m
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE	
BACKFILL TYPE	<input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	STANDARD PENETRATION (N)		Elevation (m)					
							UNCONFINED (kPa)	POCKET PEN. (kPa)						
							PLASTIC	M.C.	LIQUID					
							20	40	60	80	20	40	60	80
							UNCONFINED (kPa)		POCKET PEN. (kPa)					
							50	100	150	200	100	200	300	400
0	50 mm ORGANIC VENEER CLAY(MH)-silty, trace of sand, occasional piece of matrix supported gravel, moist to wet, firm to soft, high plastic, dark olive -seasonally frozen to 0.8 m		1	MH		36								
1			2	MH		15								
2	-drilling remains easy throughout depth of borehole		3	MH		16								
3			4	MH		17								
4	END OF BOREHOLE 4.5 m													
5														
6														
7														
8														
9														
10														

	LOGGED BY: MCP	COMPLETION DEPTH: 4.5m
	REVIEWED BY: JRT	COMPLETE: 3/21/1989
	DRAWING NO:	Page 1 of 1

GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING		PROJECT NO. - BOREHOLE NO.									
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS		10016-02									
HAINES JUNCTION INDIAN VILLAGE				ELEVATION: 618.3m									
SAMPLE TYPE		NO RECOVERY		SPT									
BACKFILL TYPE		PEA GRAVEL		SLOUGH									
				A-CASING									
				SHELBY TUBE									
				CORE									
				GROUT									
				DRILL CUTTINGS									
				SAND									
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	PLASTIC	M.C.	LIQUID	STANDARD PENETRATION (N)	UNCONFINED (kPa)	POCKET PEN. (kPa)	Elevation (m)
0	ORGANIC ROOT MAT		1	MH	III	19							
0	CLAY(MH)-silty, trace of sand, occasional piece of matrix supported gravel, wet to moist, soft to firm, high plastic, dark olive												
1	-seasonally frozen to 1.0 m												
2	SAND, SILT, and GRAVEL (TILL) (SM)- proportions vary throughout depth of borehole, gravel is matrix supported, angular, up to 50 mm in size, damp, compact (est.), light olive		2	MH	III	20							
2	-quite coarse from 2.2 to 3.5 m												
3			3	SM	III	4							
3	-sandier below 3.5 m												
4			4	SM	III	4							
4	-coarse from 4.6 to 5.0 m												
5	-sandy from 5.0 to 6.0 m												
6	-no sample recovery at 6.0 m END OF BOREHOLE 6.0 m												
7													
8													
9													
10													



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REVIEWED BY: JRT

DRAWING NO:

COMPLETION DEPTH: 6m

COMPLETE: 3/21/1989

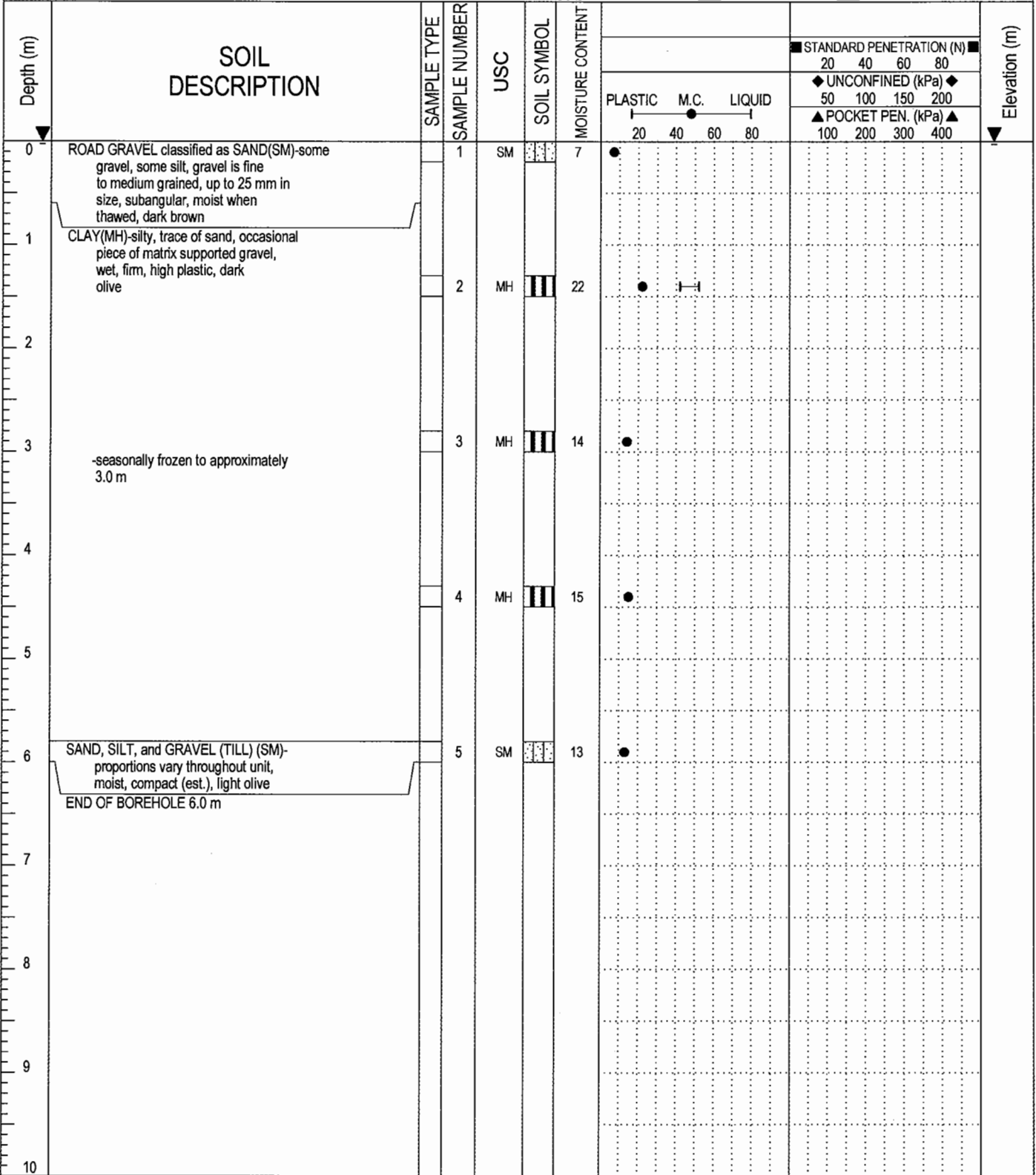
Page 1 of 1

GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING	PROJECT NO. - BOREHOLE NO.
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS	10016-03
HAINES JUNCTION INDIAN VILLAGE		ELEVATION: 615.3m	
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BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	PLASTIC M.C. LIQUID			STANDARD PENETRATION (N)		Elevation (m)
							20	40	60	80	20	
0	ROAD GRAVEL-classified as SAND(SM)-some gravel, some silt, gravel is fine to medium grained, up to 25 mm in size, subangular, moist when thawed, dark brown		1	SM		4						
1	CLAY(MH)-silty, trace of sand, occasional piece of matrix supported gravel, wet to moist, soft to firm, high plastic, dark olive		2	MH		22						
3	-seasonally frozen to approximately 2.5 m along roadway		3	MH		27						
4	-drilling remains easy below seasonal frost line		4	MH		17						
6	END OF BOREHOLE 6.0 m		5	MH		16						

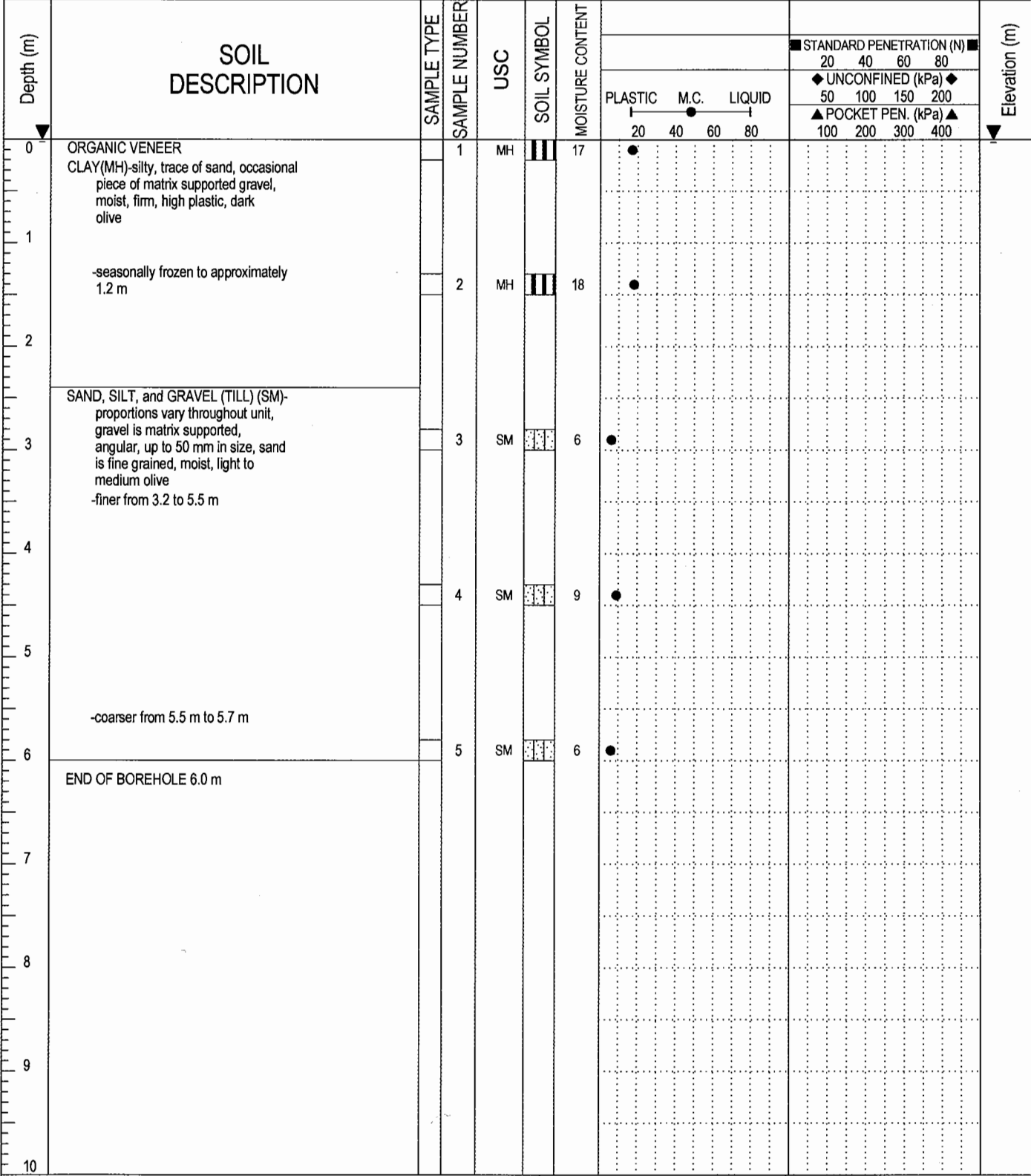
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	REVIEWED BY: JRT	COMPLETE: 3/21/1989
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GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING	PROJECT NO. - BOREHOLE NO.
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS	10016-04
HAINES JUNCTION INDIAN VILLAGE		ELEVATION: 612.8m	
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH
		<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE
		<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS
			<input type="checkbox"/> CORE
			<input type="checkbox"/> SAND



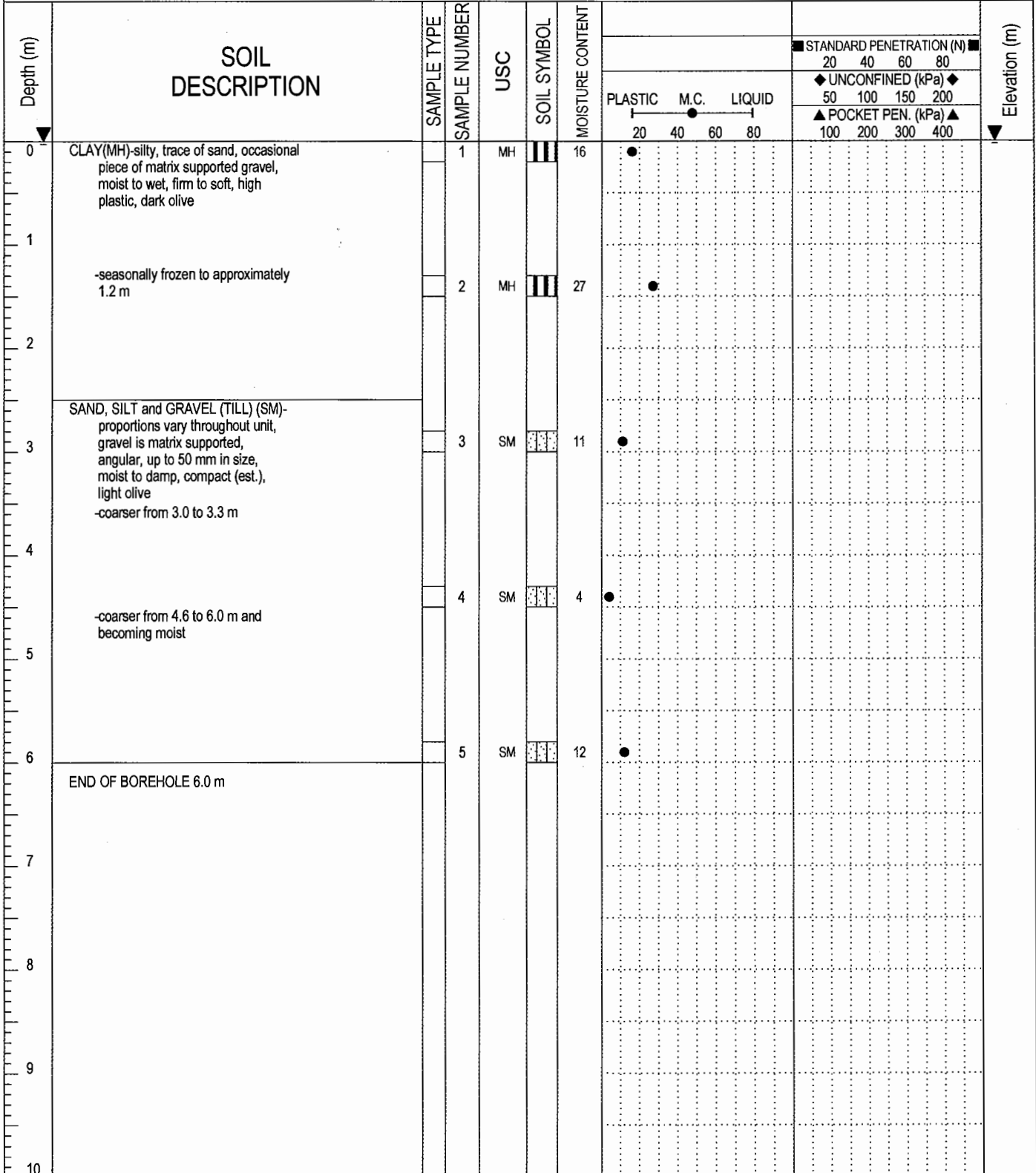
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	REVIEWED BY: JRT	COMPLETE: 3/21/1989
	DRAWING NO:	Page 1 of 1

GEOTECHNICAL EVALUATION	CLIENT: STANLEY ASSOCIATES ENGINEERING	PROJECT NO. - BOREHOLE NO.
WATER AND SEWER SYSTEM INSTALLATION	TRUCK MOUNTED CME 75 c/w SOLID AUGERS	10016-05
HAINES JUNCTION INDIAN VILLAGE		ELEVATION: 624.5m
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE	
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	



	LOGGED BY: MCP	COMPLETION DEPTH: 6m
	REVIEWED BY: JRT	COMPLETE: 3/21/1989
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GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING		PROJECT NO. - BOREHOLE NO.		
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS		10016-06		
HAINES JUNCTION INDIAN VILLAGE				ELEVATION: 618.6m		
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



	LOGGED BY: MCP	COMPLETION DEPTH: 6m
	REVIEWED BY: JRT	COMPLETE: 3/21/1989
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GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING		PROJECT NO. - BOREHOLE NO.			
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS		10016-07			
HAINES JUNCTION INDIAN VILLAGE				ELEVATION: 621.9m			
SAMPLE TYPE		<input checked="" type="checkbox"/> DISTURBED	<input checked="" type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE		<input type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	PLASTIC		M.C.	LIQUID		STANDARD PENETRATION (N)				Elevation (m)
							20	40		60	80	20	40	60	80	
0	ORGANIC ROOT MAT															
0	SILT(ML)sandy, wet when thawed, medium brown		1	ML		25										
0	CLAY(MH)-silty, trace of sand, occasional piece of matrix supported gravel, wet becoming moist with depth, soft to firm, high plastic, dark olive															
1	-seasonally frozen to 1.1 m															
2	-moisture increases from 1.5 to 2.0 m		2	MH		27										
3			3	MH		16										
4	-drier below 3.5 m															
4			4	MH		12										
5	END OF HOLE 4.5 m															
6																
7																
8																
9																
10																

	LOGGED BY: MCP	COMPLETION DEPTH: 4.5m
	REVIEWED BY: JRT	COMPLETE: 3/21/1989
	DRAWING NO:	Page 1 of 1

GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING		PROJECT NO. - BOREHOLE NO.					
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS		10016-08					
HAINES JUNCTION INDIAN VILLAGE				ELEVATION: 618.3m					
SAMPLE TYPE		NO RECOVERY		SPT					
BACKFILL TYPE		PEA GRAVEL		SLOUGH					
DISTURBED		A-CASING		SHELBY TUBE					
BENTONITE		GROUT		DRILL CUTTINGS					
CORE		SAND							
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	STANDARD PENETRATION (N)		Elevation (m)
							PLASTIC	M.C.	
0	75mm MOSS COVER CLAY(MH)-silty, trace of sand, occasional piece of matrix supported gravel, wet to very wet when thawed, soft, high plastic, dark olive -(PERMAFROST)-classified as Nbe with Vs and Vr < 5%		1	MH	III	38	20	40	618.3
1			2	MH	III	38	20	40	617.3
2	-ground temperature at 2.0 m is -0.7 degrees Celsius -permafrost ends at 2.5 m; drilling is easy below permafrost		3	MH	III	19	20	40	616.3
3	-moisture content decreasing with depth		4	MH	III	17	20	40	615.3
4			5	SM	III	12	20	40	614.3
5	SAND, SILT and GRAVEL (TILL) (SM)- proportions vary throughout unit, gravel is matrix supported, angular, up to 50 mm in size, moist, medium olive -refusal on cobble at 5.5 m END OF BOREHOLE 6.0 m,								613.3
6									612.3
7									611.3
8									610.3
9									609.3
10									608.3



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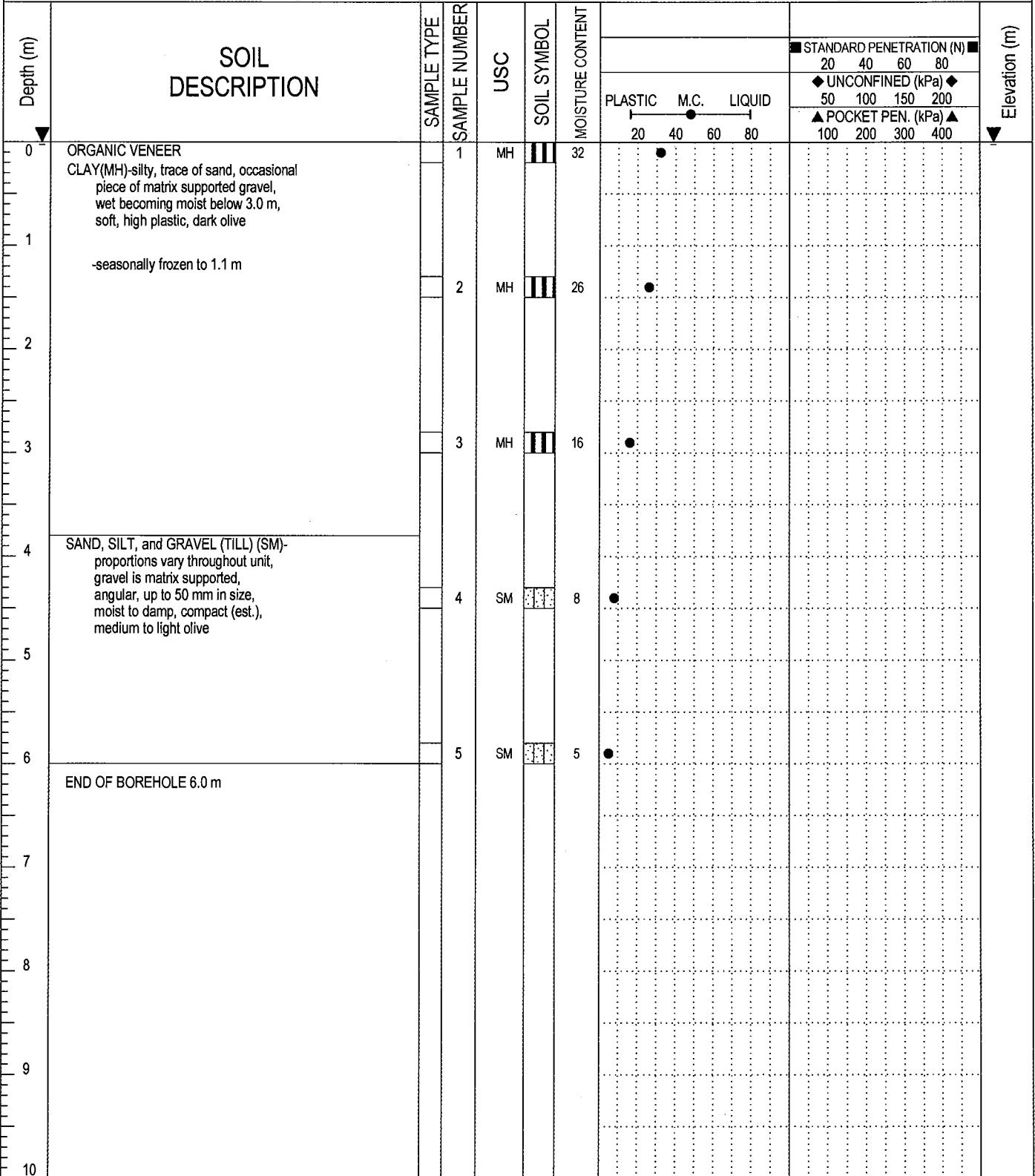
DRAWING NO:

COMPLETION DEPTH: 5.5m

COMPLETE: 3/21/1989

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GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING		PROJECT NO. - BOREHOLE NO.		
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS		10016-09		
HAINES JUNCTION INDIAN VILLAGE				ELEVATION: 617.9m		
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



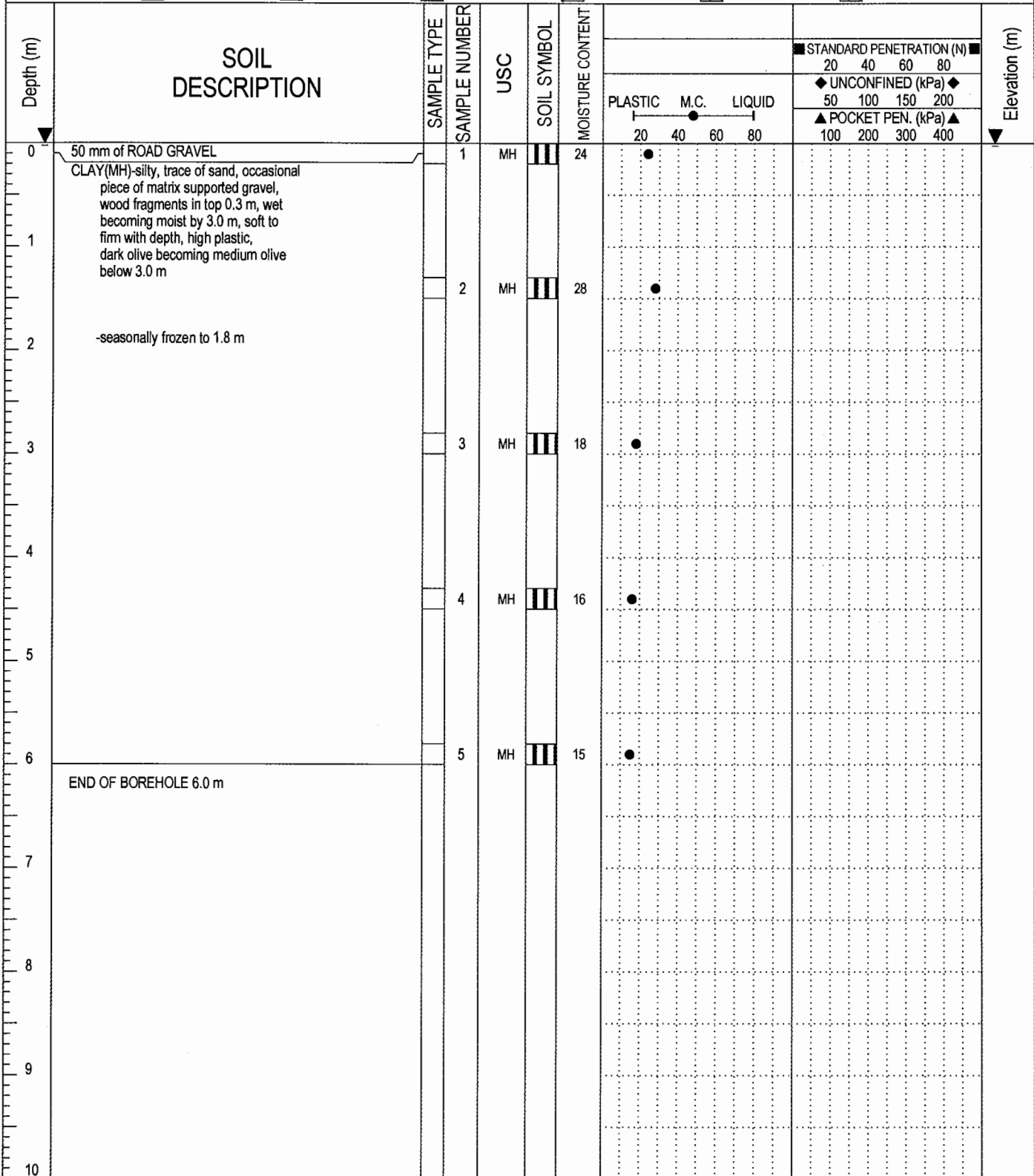
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	REVIEWED BY: JRT	COMPLETE: 3/21/1989
	DRAWING NO:	Page 1 of 1

GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING	PROJECT NO. - BOREHOLE NO.
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS	10016-10
HAINES JUNCTION INDIAN VILLAGE		ELEVATION: 611.8m	
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH
		<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS
		<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE
			<input type="checkbox"/> CORE
			<input type="checkbox"/> SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	USC	SOIL SYMBOL	MOISTURE CONTENT	PLASTIC M.C. LIQUID			STANDARD PENETRATION (N)		Elevation (m)			
							20	40	60	80	20		40	60	80
0	ORGANIC VENEER CLAY(MH)-silty, trace of sand, occasional piece of matrix supported gravel, wet becoming moist below 2.5 m, soft becoming firm below 2.5 m, high plastic, dark to medium olive		1	MH	III	26	20	40	60	80	50	100	150	200	
1	-seasonally frozen to 1.2 m		2	MH	III	24	20	40	60	80	50	100	150	200	
2			3	MH	III	13	20	40	60	80	50	100	150	200	
3			4	MH	III	14	20	40	60	80	50	100	150	200	
4			5	MH	III	13	20	40	60	80	50	100	150	200	
5	END OF BOREHOLE 6.0 m														
6															
7															
8															
9															
10															

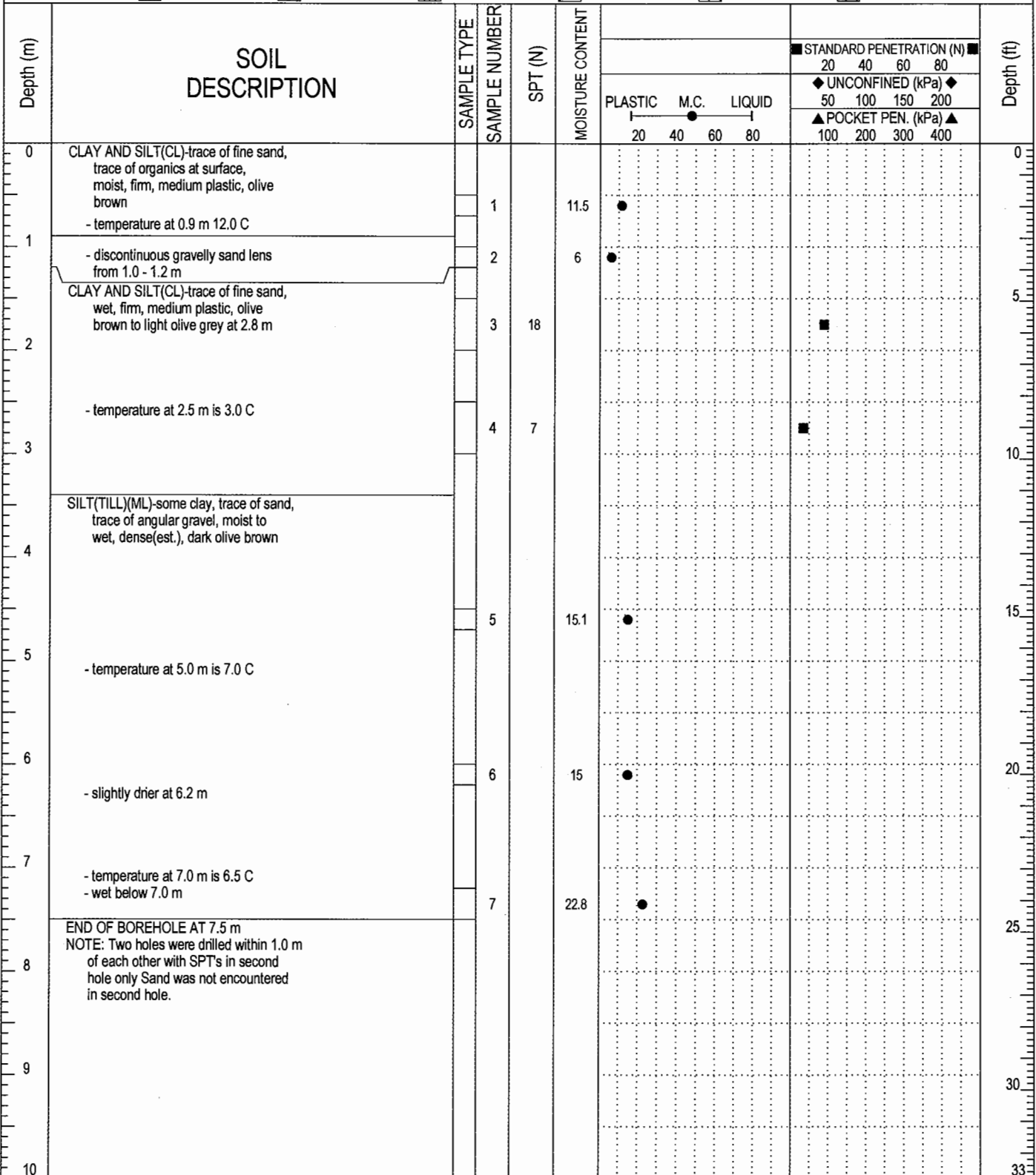
 EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 6m
	REVIEWED BY: JRT	COMPLETE: 3/21/1989
	DRAWING NO:	Page 1 of 1

GEOTECHNICAL EVALUATION		CLIENT: STANLEY ASSOCIATES ENGINEERING	PROJECT NO. - BOREHOLE NO.
WATER AND SEWER SYSTEM INSTALLATION		TRUCK MOUNTED CME 75 c/w SOLID AUGERS	10016-11
HAINES JUNCTION INDIAN VILLAGE		ELEVATION: 612.3m	
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH
		<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS
		<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE
			<input type="checkbox"/> CORE
			<input type="checkbox"/> SAND

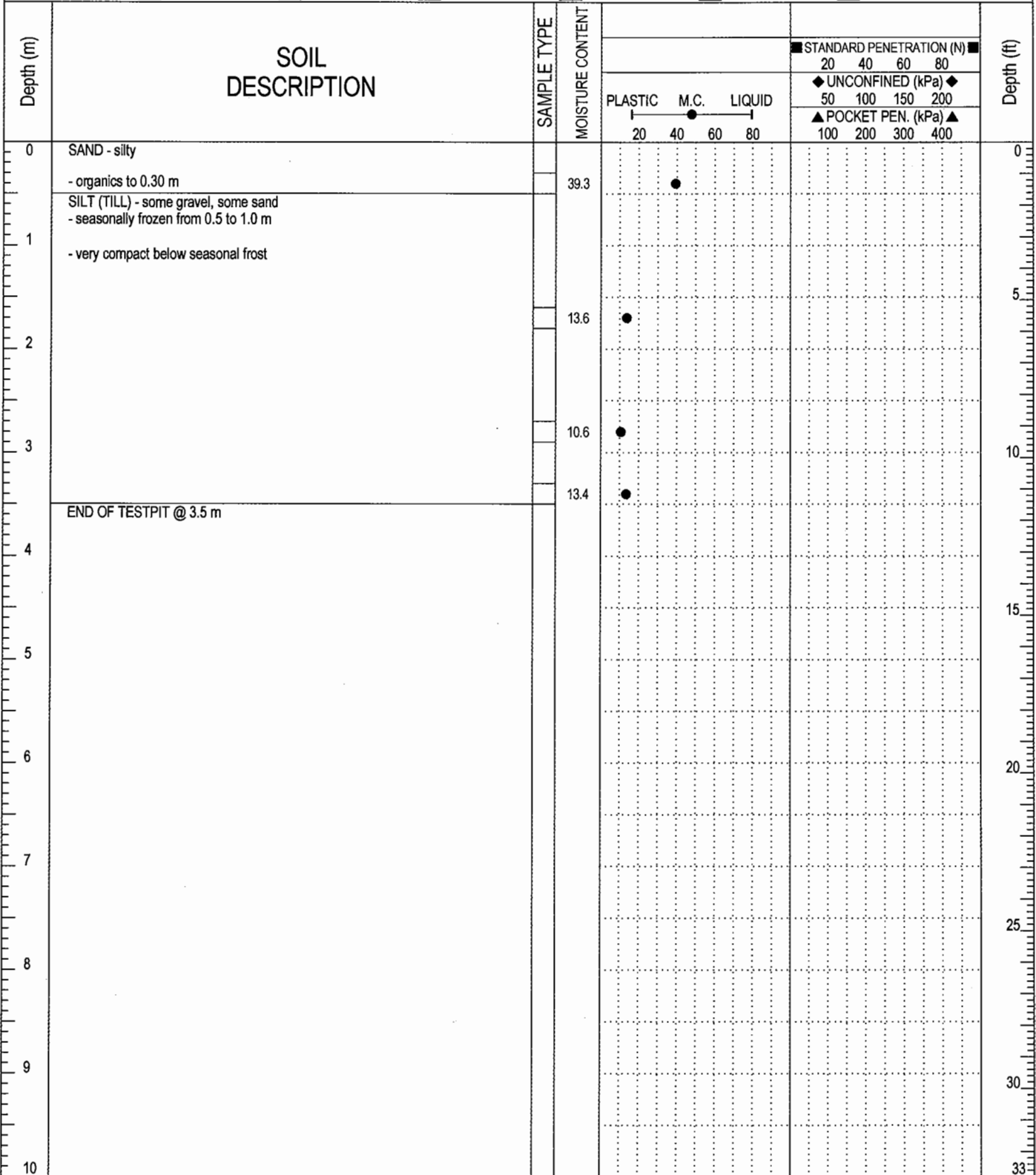



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	REVIEWED BY: JRT	COMPLETE: 3/21/1989
	DRAWING NO:	Page 1 of 1

SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND

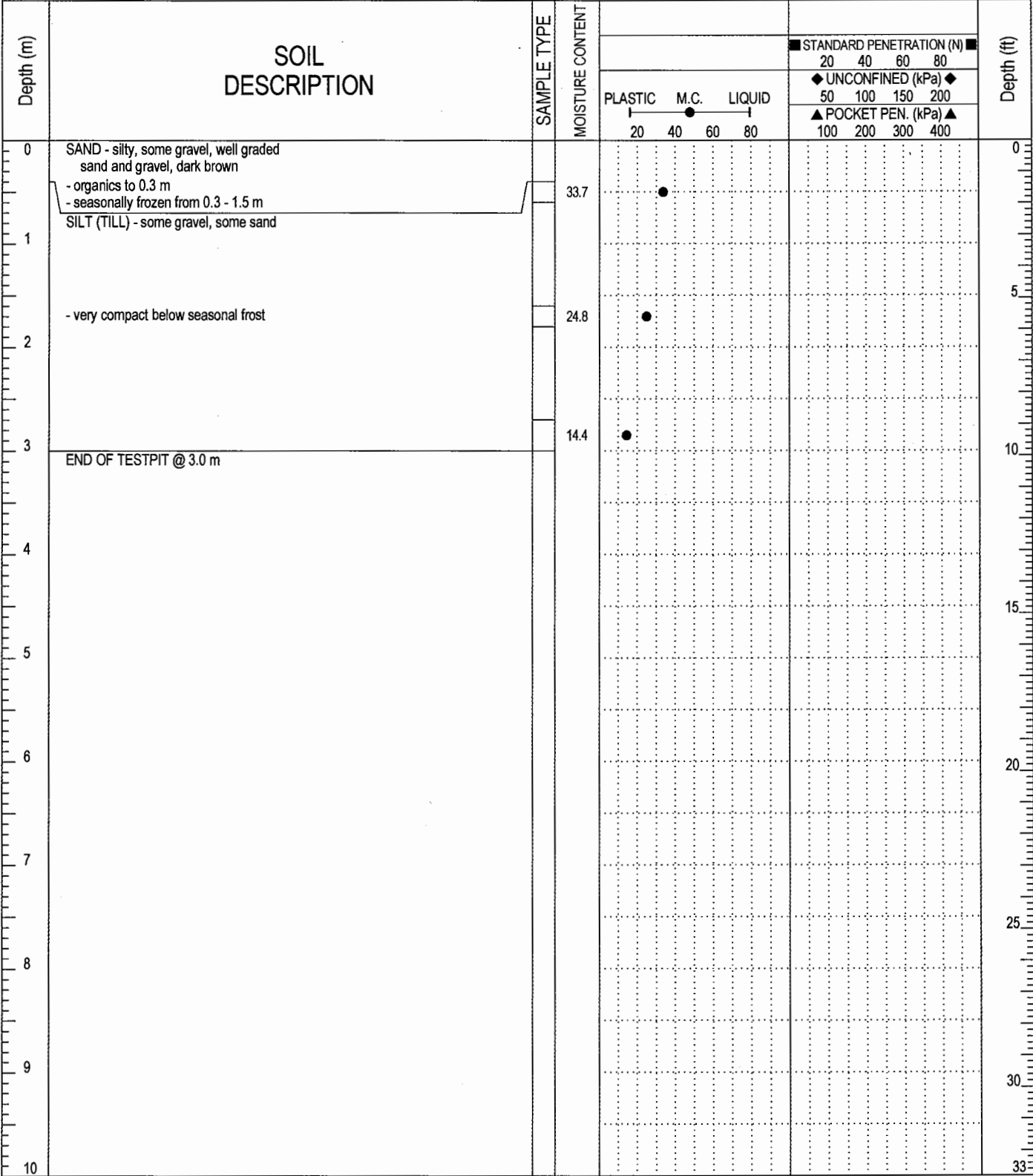


Geotechnical Evaluation	CLIENT: Champagne and Aishihik FN	PROJECT NO. - BOREHOLE NO.
Elder's Complex Addition	EXCAVATOR: John Deere Rubber-Tired Hoe	1200011-TP01
Haines Junction, YT		
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE	
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	



 EBA Engineering Consultants Ltd.	LOGGED BY: JSB	COMPLETION DEPTH: 3.5m
	REVIEWED BY: JRT	COMPLETE: 5/2/2003
	DRAWING NO:	Page 1 of 1

Geotechnical Evaluation	CLIENT: Champagne and Aishihik FN	PROJECT NO. - BOREHOLE NO.
Elder's Complex Addition	EXCAVATOR: John Deere Rubber-Tired Hoe	1200011-TP02
Haines Junction, YT		
SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/> NO RECOVERY <input checked="" type="checkbox"/> SPT <input type="checkbox"/> A-CASING <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE	
BACKFILL TYPE	<input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND	




EBA Engineering Consultants Ltd.	LOGGED BY: JSB	COMPLETION DEPTH: 3m
	REVIEWED BY: JRT	COMPLETE: 5/2/2003
	DRAWING NO:	Page 1 of 1

WILLOW ACRES SUBDIVISION	CLIENT:	PROJECT NO. - BOREHOLE NO.
LOT 11 OF CENTRE BLOCK	JCB BACKHOE	4284-01
HAINES JUNCTION, YUKON		

SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND


Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT	PLASTIC M.C. LIQUID		STANDARD PENETRATION (N)		Depth (ft)
					20	40	60	80	
0	ORGANIC COVER(PT) - moist, black								0
0	CLAY(TILL)(CL) - silty, trace of gravel rootlets to 0.8 m, moist, medium olive		1	25					
1	- T= +5.3 C								
1	- T= +3.1 C								
1	- T= -0.6 C								
2	- larger cobbles and boulders present sub-rounded to sub-angular to 200 mm in diameter		2	11					5
2	- T= -1.1 C								
2	- T= -1.2 C								
3	- T= -1.3 C		3	15					10
3	- T= -1.3 C		4	15					10
3	END OF TESTPIT AT 3.0 m								
4									15
5									20
6									25
7									30
8									33
9									
10									

 EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 3m
	REVIEWED BY: MCP	COMPLETE: 8/2/1985
	DRAWING NO:	Page 1 of 1

WILLOW ACRES SUBDIVISION	CLIENT:	PROJECT NO. - BOREHOLE NO.
LOT 3 OF SOUTH BLOCK	JCB BACKHOE	4284-02
HAINES JUNCTION, YUKON		

SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND


Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	MOISTURE CONTENT	PLASTIC		M.C.	LIQUID		STANDARD PENETRATION (N)				Depth (ft)
				20	40	60	80	20	40	60	80	UNCONFINED (kPa)	
0	ORGANIC COVER(PT) - heavy moss cover, roots and rootlets, very wet, black												0
	CLAY - silty, very wet, medium brown												
	- T= +0.9 C												
	- T= -0.7 C												
1	END OF TESTPIT AT 0.8 m												5
	NOTE: Frozen at 0.8 m (Vx) ice crystals and lenses throughout.												
2													10
3													15
4													20
5													25
6													30
7													33
8													
9													
10													

 EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 0.8m
	REVIEWED BY: MCP	COMPLETE: 8/2/1985
	DRAWING NO:	Page 1 of 1

WILLOW ACRES SUBDIVISION	CLIENT:	PROJECT NO. - BOREHOLE NO.
WELL SITE ON LOT 2	JCB BACKHOE	4284-03
OF CENTRE BLOCK	HAINES JUNCTION, YUKON	

SAMPLE TYPE	<input checked="" type="checkbox"/> DISTURBED	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> SPT	<input type="checkbox"/> A-CASING	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND

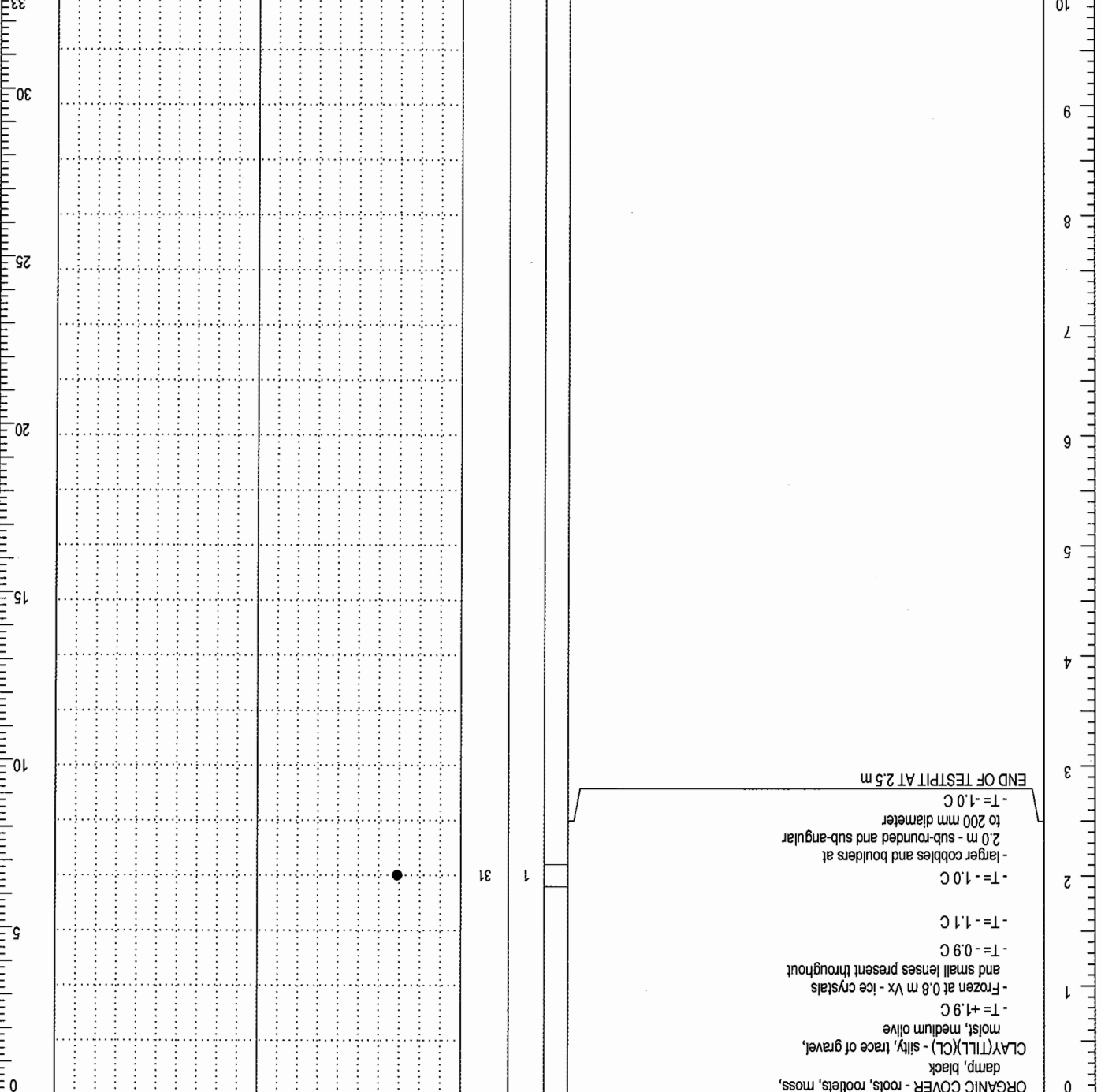
Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	MOISTURE CONTENT	STANDARD PENETRATION (N)		Depth (ft)
				UNCONFINED (kPa)	POCKET PEN. (kPa)	
			PLASTIC	M.C.	LIQUID	
			20	40	60	80
			50	100	150	200
			100	200	300	400
0	ORGANIC COVER - moss, roots and rootlets, moist, black					0
0.7	CLAY(TILL)(CL) - silty, trace of gravel, rootlets to 0.7 m, moist, medium olive					0.7
0.7	- T= +8.7 C					0.7
0.7	- T= +4.9 C					0.7
1.9	- T= +1.9 C					1.9
2.0	- T= +0.7 C					2.0
2.0	- Frozen at 1.8 m (Vx) ice crystals and small lenses throughout					2.0
2.0	- T= -0.9 C					2.0
2.0	- larger cobbles and boulders at 2.0m sub-rounded and sub-angular to 200 mm in diameter					2.0
3.0	- T= -1.0 C					3.0
3.0	- T= -1.2 C					3.0
3.0	END OF TESTPIT AT 3.0 m					3.0
4						4
5						5
6						6
7						7
8						8
9						9
10						10
						15
						20
						25
						30
						33

 EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 3m
	REVIEWED BY: MCP	COMPLETE: 8/2/1985
	DRAWING NO:	Page 1 of 1



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LOGGED BY: MCP
 REVIEWED BY: MCP
 DRAWING NO:
 COMPLETE: 8/2/1985
 COMPLETION DEPTH: 2.5m
 Page 1 of 1



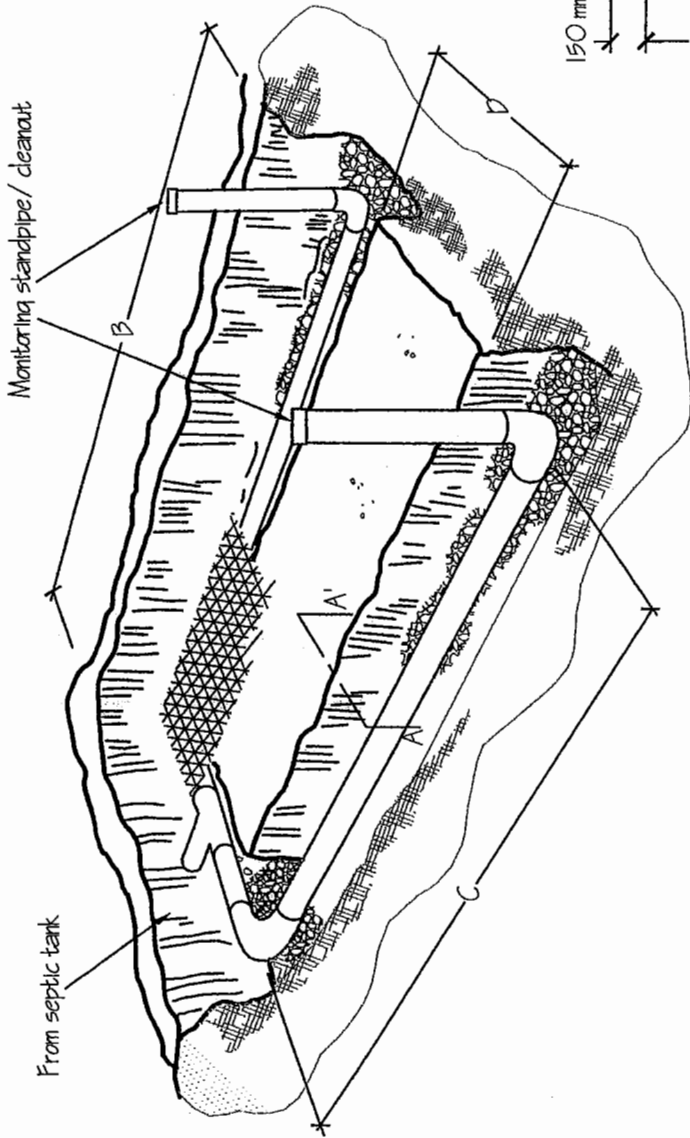
Depth (m)	Depth (ft)	STANDARD PENETRATION (N)	UNCONFINED (kPa)	POCKET PEN. (kPa)
0	0	20	50	100
1	3	40	100	200
2	6	60	150	300
3	9	80	200	400

MOISTURE CONTENT	PLASTIC M.C.	LIQUID
	40	60
	20	80

DEPTH (m)	DEPTH (ft)	SOIL DESCRIPTION
0	0	ORGANIC COVER - roots, rootlets, moss, damp, black
1	3	CLAY(TLL)(CL) - silty, trace of gravel, moist, medium olive
1	3	- T= +1.9 C
1	3	- Frozen at 0.8 m Vx - ice crystals and small lenses present throughout
1	3	- T= -0.9 C
1	3	- T= -1.1 C
2	6	- T= -1.0 C
2	6	- larger cobbles and boulders at 2.0 m - sub-rounded and sub-angular to 200 mm diameter
2	6	- T= -1.0 C
3	9	END OF TEST PIT AT 2.5 m

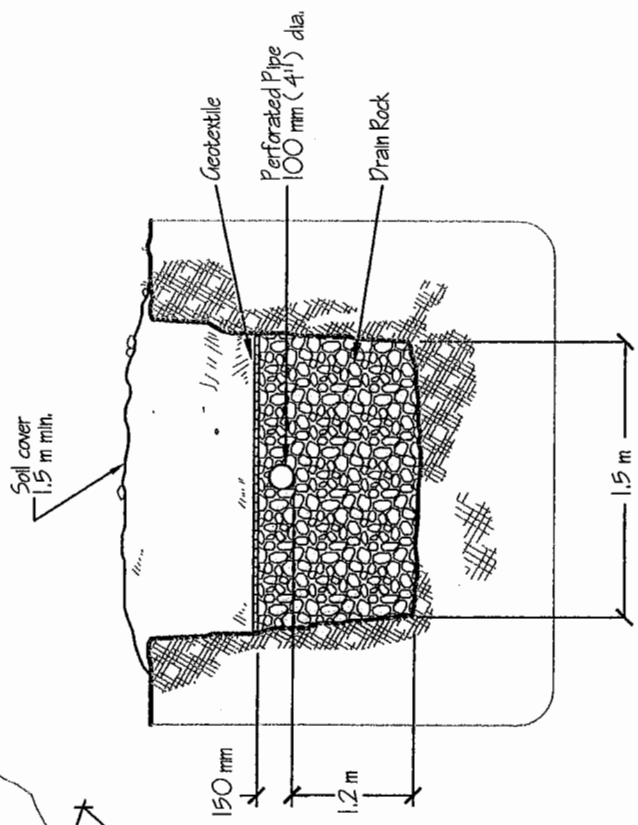
CLIENT:	PROJECT NO. - BOREHOLE NO.
WILLOW ACRES SUBDIVISION	4284-04
JCB BACKHOE	
HAINES JUNCTION, YUKON	

BACKFILL TYPE	BENTONITE	PEA GRAVEL	SLOUGH	GROUT	DRILL CUTTINGS	SAND
SAMPLE TYPE	DISTURBED	NO RECOVERY	SPT	A-CASING	SHELBY TUBE	CORE



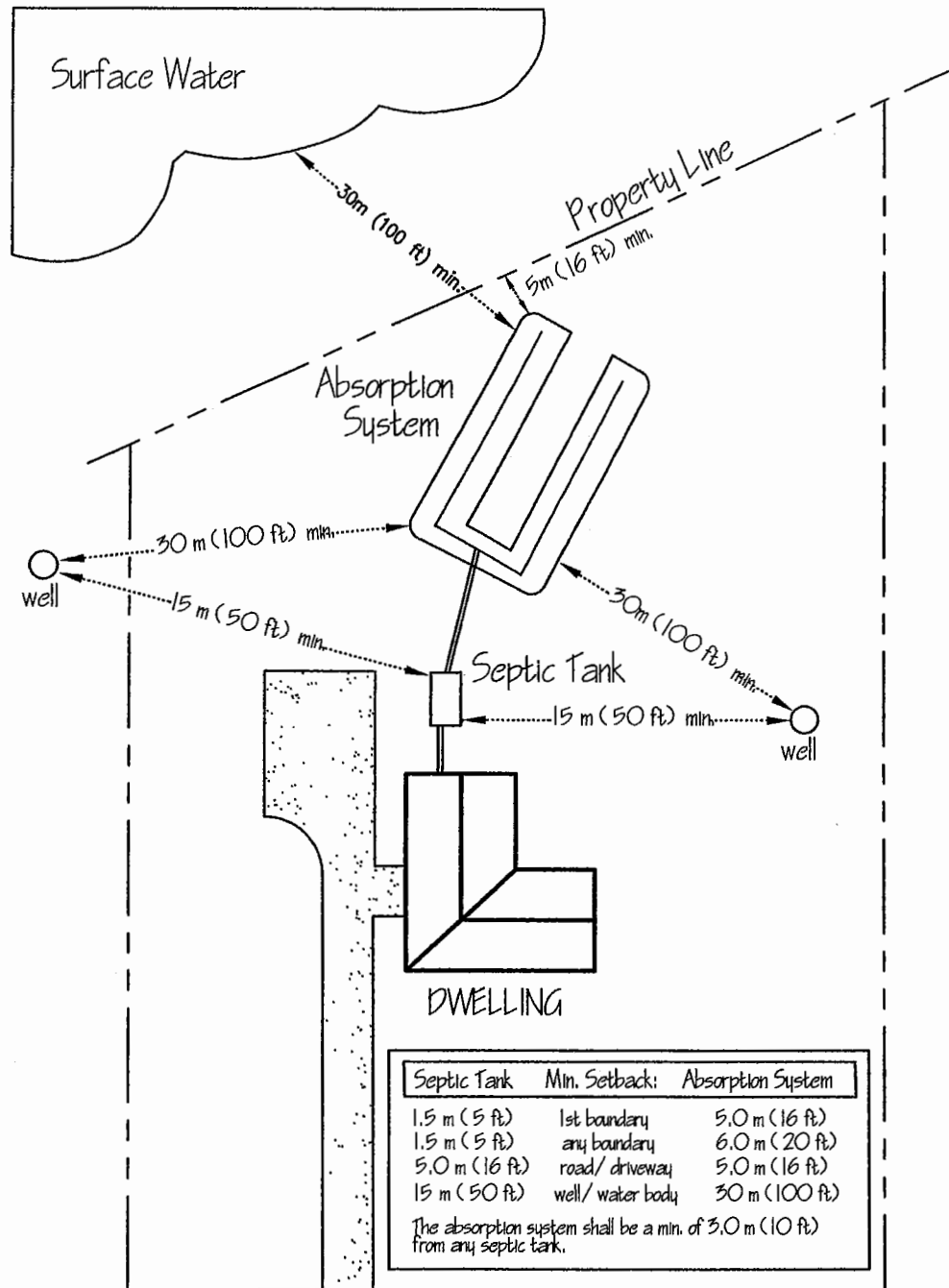
- B - Length of trench 22.5 m
- C - Length of perforated pipe 21.0 m
- D - Separation between trench walls 3.6 m

BASE PLAN ADAPTED FROM "SEPTIC SYSTEMS IN THE YUKON" HANDBOOK



SECTION A-A'
N.T.S.

		PROJECT: WILLOW ACRES EXPANSION AREA HAINES JUNCTION, YUKON	
CLIENT: GOVERNMENT OF YUKON		TITLE: TYPICAL WIDE ABSORPTION TRENCH DESIGN FOR THREE BEDROOM HOUSE	
DATE: MAY 11, 2000	DWN.: JSB	CHKD.: MCP	FILE NO.: 0201-00-14274
		DRWG.:	FIGURE 2



EBA Engineering Consultants Ltd.

PROJECT

WILLOW ACRES EXPANSION AREA
HAINES JUNCTION, YUKON

CLIENT

GOVERNMENT OF YUKON

TITLE

MINIMUM SETBACK REQUIREMENTS
FOR ON-SITE SEWAGE DISPOSAL SYSTEMS

DATE MAY 11, 2000

DWN.

JSB

CHKD.

MCP

FILE NO.

0201-00-14274

DRWG.

FIGURE 3