



Geotechnical Evaluation
 Proposed North End Subdivision
 Dawson City, Yukon – 2016

Figure 10
 Development Potential





Geotechnical Evaluation
North End Subdivision
Table I - Stratigraphic Summary

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
1	64	0.1	37.1	NA	NA	NA	ORG	Organics & Organic Silt
	65	0.15	5.6	13.8	45.2	40.9	FILL	Gravelly Sand some Silt
	End of Hole	0.25	Center of Block on fill.					Refusal

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
2	66	0.15	70.6	NA	NA	NA	ORG	Organics & Organic Silt
	67	0.3	11.4	NA	NA	NA	FILL	Sandy Gravel some Silt
	End of Hole	0.45	South half of block on fill.					Refusal

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
3	NA	0.02	NA	NA	NA	NA	ORG	Moss & Lichen
	68	0.4	44.4	NA	NA	NA	FILL	Silt trace Gravel
	69	0.45	92.7	7.5	13.2	79.3	OL	Organics & Organic Silt
	End of Hole	0.85	Edge of treeline.					Refusal - Possibly Frozen

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
4	NA	0.02	NA	NA	NA	NA	ORG	Grass
	70	0.08	175.0	NA	NA	NA	OL	Organics & Organic Silt
	End of Hole	0.1	Toe of Slide Debris					Refusal

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
5	NA	0.02	NA	NA	NA	NA	ORG	Grass
	71	0.43	42.6	NA	NA	NA	OL	Organic Silt with odd Gravel
	72	0.3	150.0	NA	NA	NA	OL	Organic Silt
	End of Hole	0.75	Toe of Slide Debris					Refusal - Possibly Frozen

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
6	NA	0.02	NA	NA	NA	NA	ORG	Grass
	73	0.08	9.3	5.3	43.1	51.6	FILL	Sandy Gravel trace Silt
	End of Hole	0.10	West of Dike on old road near Yukon River					Refusal

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
7	74	0.25	25.7	NA	NA	NA	ORG	Organics & Organic Silt
	75	0.3	16.0	NA	NA	NA	GM	Silty Sandy Gravel w/ Detritus
	End of Hole	0.55	Intersection of George and Steele Street					Refusal

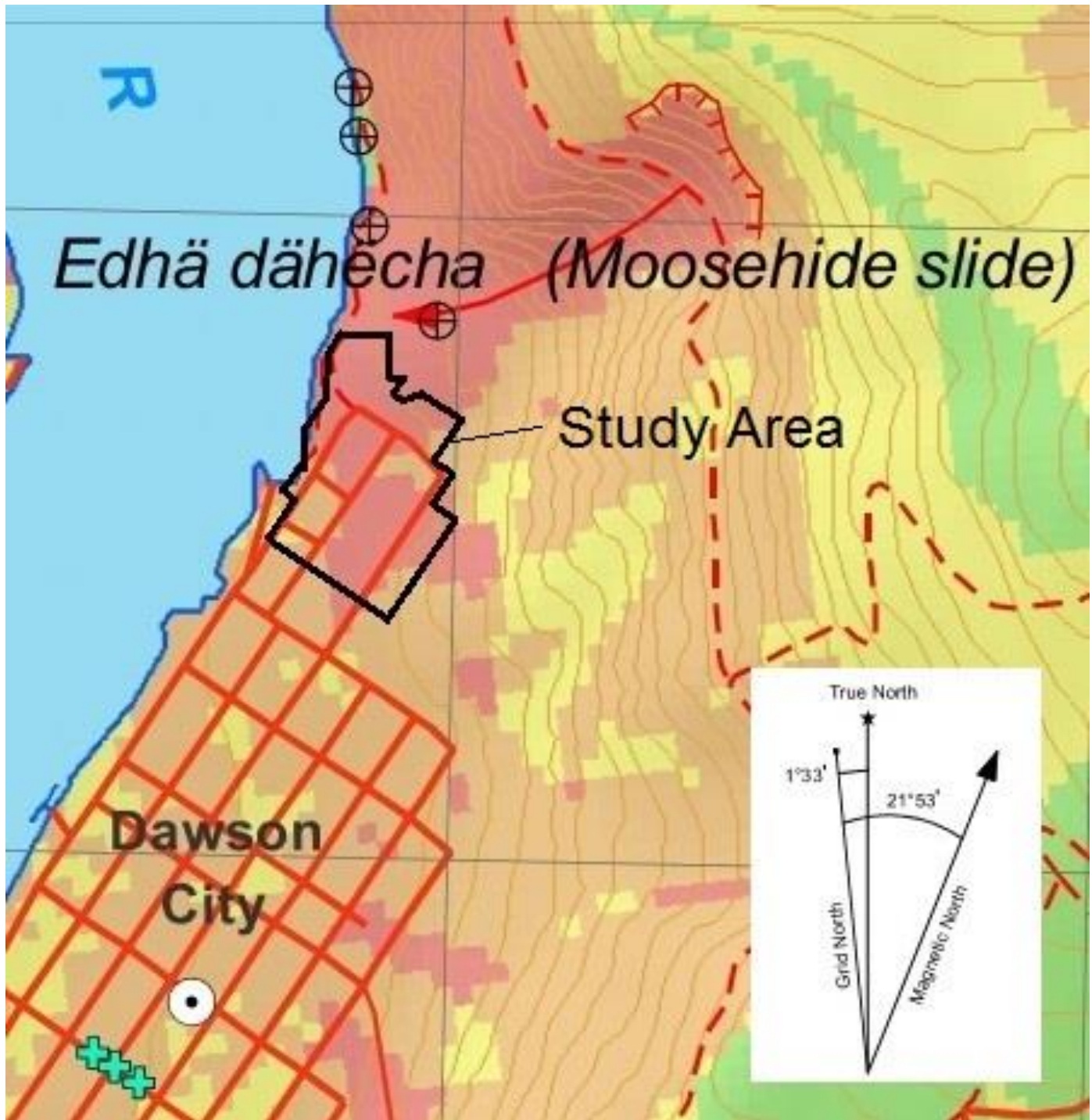
Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
8	NA	0.1	NA	NA	NA	NA	ORG	Organics & Organic Silt
	NA	0.1	NA	NA	NA	NA	GM	Silty Sandy Gravel w/ Detritus
	End of Hole	0.2	Near abandoned cabins					Refusal

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
9	76	0.2	37.8	NA	NA	NA	SM	Sand Silt w/ Organic Inclusions
	77	0.3	133.4	NA	NA	NA	ORG	Organics & Organic Silt
	End of Hole	0.5	East of 2nd Avenue					Refusal - Possible Detritus

Auger Hole	Sample	Thickness (m)	Moisture (%)	Fines (%)	Sand (%)	Gravel (%)	USCS/NRC	Description
10	78	0.3	393.7	NA	NA	NA	ORG	Organics & Organic Silt
	79	0.25	404.3	NA	NA	NA	Nbe	Frozen Organic Silt - visible ice
	End of Hole	0.55	East of 2nd Avenue					Refusal



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Appendix A
Natural Hazard Risk Map from *North Climate ExChange*

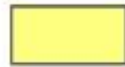




HAZARD CLASSIFICATIONS



Low risk. Characterized by flat to gently sloped terrain, with south and west-facing slopes. Low-risk terrain is found above modern floodplains, and is often comprised of well-drained gravel or weathered bedrock surface materials. Low-risk terrain may contain permafrost, but is less likely to be ice rich compared with more hazardous terrain.



Moderate risk. Characterized by gentle to moderate slopes, and occurs more commonly on west and south-facing slopes. Moderate-risk terrain is found on the steep edges and cold aspects of low-risk landforms (*i.e.* fluvial terraces and north-facing, high-elevation slopes). Moderate-risk terrain also occurs in coarse-grained (gravel) surficial materials that may be affected by ice-rich permafrost (*i.e.* downtown Dawson).



Moderately high risk. Characterized by moderate to steep slopes, and east to north-facing slopes. Moderately high-risk terrain is found on all aspects in the study area and is common in narrow, steep-sided valleys and on more gentle slopes where permafrost is more likely to be present. The difference between moderate and moderately high-risk terrain in the study area is often based on changes in slope angle and slope aspect.



High risk. Characterized by moderate to steep slopes and coldest east and north-facing slopes. Much of the high-risk terrain in the study area is defined by geological boundaries containing high-hazard processes such as landslides, thermokarst, and active floodplains that may be subject to flooding. High-risk terrain in the study area occurs in valley bottoms (flood risk and high permafrost probabilities), on steep north-facing valley slopes, and where landslide processes have affected large areas of terrain (*i.e.* landslides on the north side of the Klondike Valley).

LEGEND

GROUND OBSERVATION SITES



geological field station



permafrost borehole



electrical resistivity tomography (ERT) profile station

GEOLOGICAL FEATURES



collapsed open system pingo
thermokarst pond



landslide escarpment



direction of landslide movement

TOPOGRAPHIC FEATURES



roads



trails



transmission line



limit of mapping



contours



streams



waterbodies



wetlands



METHODS

This map was produced for the purposes of community landscape hazard assessment and climate change adaptation planning for the Dawson region. An accompanying report provides additional detail on local surficial geology, stratigraphy, glacial history and landscape hazards (Benkert et al., 2015). The report is published by Yukon College's Northern Climate ExChange and is available for download at yukoncollege.yk.ca/research.

Landscape hazards for the Dawson region are modelled using a Geographic Information System (GIS) to generate an integrated risk ranking for each landscape 'unit' (defined by 30 m x 30 m pixels). Input data for the model include the following datasets: slope angle (steepness); slope aspect (directionality and exposure to sunlight); surface materials (derived from geological maps); and permafrost probability (see Benkert et al., 2015 for additional details).

Attributes of the individual datasets are classified on a 0-9 scale of potential risk, where zero represents low hazard risk and nine represents high hazard risk. High-risk areas include steep or unstable slopes, low-lying areas subject to flooding or inundation by water, and landscape units with a high likelihood of being affected by ice-rich or thaw-unstable permafrost. Low-risk areas are predicted to have favourable conditions for landscape development and include well-drained soils, gentle or moderate slopes, and a low likelihood of containing ice-rich or thaw-unstable permafrost.

Each of the input datasets is assigned a unique weighting value in the model that reflects the degree to which they control cumulative hazard risk. For this model, slope angle was given a weighting of 10%. Slope aspect was also given a weighting of 10%. Surface materials have a significant impact on landscape stability, and this input dataset was given a weighting of 50%. The likelihood of permafrost occurring on the landscape was given a relative weighting of 30% in the model (recognizing that slope aspect also contributes to permafrost presence).

Cumulative Ranking = 0.1(slope angle) + 0.1(slope aspect) + 0.5(materials) + 0.3(probability of permafrost)

By combining the individual rankings of each input raster according to their unique weighting, a cumulative risk ranking for each pixel in the map area is generated. Risk rankings range from 0 (low) to 9 (high). The cumulative rankings are reclassified into four categories (Low, Moderate, Moderately High and High) that represent potential hazard risk due to permafrost, slope stability, and flooding in the map area. The model represents current conditions, and does not integrate any potential changes to landscape stability associated with a changing climate.

LIMITATIONS TO THE MAP

The Dawson hazards map is meant to be used as a preliminary assessment of potential ground conditions in the study area, and does not replace detailed on-site investigations. Cumulative hazard rankings are highly dependent on rankings assigned to surface material units, and both the boundaries of the units and the materials assigned to those units are highly subjective and based on limited field checking conducted during surficial geological mapping studies (see map by McKenna and Lipovsky (2014) in Benkert et al., 2015 for more detail).

Additionally, flood hazard mapping does not yet exist for the study area and flood potential is based on geological units mapped as active floodplains or as being subject to periodic inundation. These units likely represent areas that are subject to regular annual or decadal flooding, but are unlikely to represent the highest and most catastrophic floods with lower recurrence intervals. See Figures 10 and 11 in Benkert et al. (2015) for preliminary flood risk mapping. (Note: this mapping has not been integrated into the hazard risk assessment presented here.)

Finally, the resolution of this map is limited by the 30 m x 30 m pixel size used to calculate slope, aspect, and permafrost probability, and the 1:25 000-scale mapping used to identify surficial materials and landforms. Local variations in all model inputs should be expected, and will be more pronounced for surface materials and permafrost probability.

It is important to note that cumulative hazard rankings are based on general observations of surface materials, drainage, slope angle, vegetation and the presence of permafrost landforms, as well as subsurface information provided by ERT and GPR profiles, drilling and probing of permafrost, and textural analyses of surficial and borehole samples. This has resulted in a projected risk ranking that will require geotechnical and/or engineering analyses to quantify.

CITATION

Benkert B.E., Kennedy, K., Fortier, D., Lewkowicz, A.G., Roy, L.-P., Grandmont, K., de Grandpré, I., Laxton, S., McKenna, K., Moote, K., Bond, J., 2015. Dawson City Landscape Hazards: Geoscience Mapping for Climate Change Adaptation Planning. Northern Climate ExChange, Yukon Research Centre, Yukon College. 166 p and 2 maps.

Digital cartography and risk modeling by K. Kennedy, B. Elliot and P. Lipovsky, Yukon Geological Survey.



APPENDIX B

Borehole Soil Logs



NOTES ON SOIL LOGS

Soil Description

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

<u>Percent of Component</u>	<u>Modifier</u>
> 15 %	XXX - ey
11% to 15%	some XXX
5% to 10%	trace XXX

Examples;

<u>SILT</u>	<u>SAND</u>	<u>GRAVEL</u>	<u>Description</u>
6	32	62	Sandy Gravel trace Silt
55	6	39	Gravelly Silt trace Sand
43	36	21	Silty Gravelly Sand

Note: In the cases where the coarse fraction (sand & gravel) comprise > 50% of the sample, then the larger component of the coarse fraction becomes the principal component.

Undrained Shear Strength of Cohesive Soils

Consistency	Undrained Shear Strength	
	p.s.f	kN/m ²
Very Soft	< 375	<20
Soft	375-750	20-40
Firm	750-1500	40-75
Stiff	1500-3000	75-150
Very Stiff	3000-6000	150-300
Hard	>6000	<300



Relative Density (Qualitative Classification)

Cohesive Soils

- Very Soft - Exudes between fingers when squeezed by hand
- Soft - Moulded by light finger pressure
- Firm - Moulded by strong finger pressure
- Stiff - Cannot be moulded by fingers – Can be indented by thumb
- Very Stiff - Can only be indented by thumbnail
- Hard - Cannot be indented by thumbnail

Granular Soils

- Very Loose - Considerable sidewall sloughage noted
- Loose - Some sidewall sloughage noted – Easy digging
- Compact/
Medium-Dense - Unimpeded excavation – little to no sidewall sloughage
- Dense - Considerable effort required during excavation – Stable vertical sidewalls
- Very Dense - Extreme difficulty in excavation

Soil Log - Sample Type

Symbol

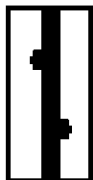
Test Pitting

Drilling



Grab Sample
Retained from
excavation sidewall
or base

Auger Sample
Retained from
Auger flighting



Bucket Sample
Retained from
leading edge of
excavator bucket

Split-Spoon Sample
Retained from
Split-Spoon Sampler
tube



Relative Moisture

Described as - *dry, damp, moist, wet* or *saturated* - relative to the principal soil matrix.

For example, a moisture content of 10 percent may be classified as '*moist*' for a coarse grained soil (sand or gravel) but '*damp*' for a fine grained (silt) soil.

The moisture content is recorded as a percentage (%) of the weight of water within the soil sample relative to the dry weight of the sample.

Recovery

Refers to the (linear) amount of sample retained after driving the Split Spoon (SPT) sampler tube 18 inches.

Recorded as a percentage (i.e. 12 inch sample/18 drive = 66 %)

N-Value

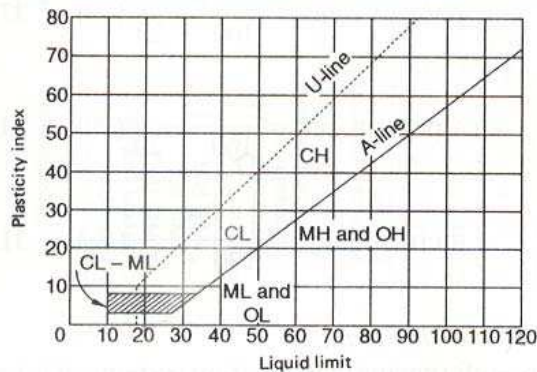
Refers to the total number of blows required to drive the Split Spoon sampler tube the final 12 inches of the 18 inch drive.

Relative Density based upon SPT 'N' Value

Non-cohesive (Granular) Soil		Cohesive (Clayey) Soils	
Relative Density	Blows per Foot (N-value)	Consistency	Blows per Foot (N-value)
<i>Very Loose</i>	< 5	<i>Very Soft</i>	0 to 2
<i>Loose</i>	5 to 9	<i>Soft</i>	3 to 4
<i>Compact</i>	10 to 29	<i>Firm</i>	5 to 8
<i>Dense</i>	30 to 50	<i>Stiff</i>	9 to 15
<i>Very Dense</i>	> 50	<i>Very Stiff</i>	16 to 30
		<i>Hard</i>	> 30

Unified Soil Classification System
(ASTM Designation D-2487)

Major division	Group Symbols	Typical Names	Classification Criteria	
Coarse-grained soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	GW Well-graded gravels and gravel-sand mixtures, little or no fines GP Poorly graded gravels and gravel-sand mixtures, little or no fines GM Silty gravels, gravel-sand-silt mixtures GC Clayey gravels, gravel-sand-clay mixtures	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting both criteria for GW Atterberg limits plot below "A" line or plasticity index less than 4 Atterberg limits plot above "A" line and plasticity index greater than 7
		Gravels with fines	SW Well-graded sands and gravelly sands, little or no fines SP Poorly graded sands and gravelly sands, little or no fines SM Silty sands, sand-silt mixtures SC Clayey sands, sand-clay mixtures	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting both criteria for SW Atterberg limits plot below "A" line or plasticity index less than 4 Atterberg limits plot above "A" line and plasticity index greater than 7
		Clean sands	ML Inorganic silts, very fine sands, rock flour, silty or clayey fine sands CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays OL Organic silts and organic silty clays of low plasticity MH Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts CH Inorganic clays of high plasticity, fat clays OH Organic clays of medium to high plasticity	Check plasticity chart
	Sands More than 50% of coarse fraction passes No. 4 sieve	Sands with fines	Silty and Clays Liquid limit 50% or less	Silty and Clays Liquid limit greater than 50%
		Sands with fines		
	Fine-grained soils 50% or more passes No. 200 sieve	Silty and Clays Liquid limit 50% or less		
		Silty and Clays Liquid limit greater than 50%		
	Highly organic soils	Pt	Peat, muck and other highly organic soils	Fibrous organic matter; will char, burn, or glow



Plasticity chart for the classification of fine-grained soils.
Tests made on fraction finer than No. 40 sieve.

Unified Soil Classification System

Figure 18. UNIFIED SOIL CLASSIFICATION SYSTEM

Table 1.2 Description and classification of frozen soils (adapted from Linnell and Kaplar, 1966)

I: Description of soil phase (independent of frozen state)	Classify soil phase by the unified soil classification system				Classify soil phase by the unified soil classification system				Thaw characteristics
	Major group		Subgroup		Field identification	Pertinent properties of frozen materials which can be measured by physical tests to supplement field identification	Thaw characteristics		
	Description	Designation	Description	Designation					
II: Description of frozen soil	Segregated ice not visible by eye	N	Poorly bonded or friable	Nf	Identify by visual examination; to determine presence of excess ice, use procedure under note (3) and hand magnifying lens as necessary; for soils not fully saturated estimate degree of ice saturation (medium, low); note presence of crystals or of ice coatings around larger particles	In-place temperature Density and void ratio a. In frozen state b. After thawing in place Water content (total H ₂ O, including ice) a. Average b. Distribution Strength a. Compressive b. Tensile c. Shear d. Adfreeze Elastic properties Plastic properties Thermal properties Ice crystal structure (using optical instruments) a. Orientation of axes b. Crystal size c. Crystal shape d. Pattern of arrangement	Usually thaw-stable		
			Well bonded	Nb					
	Segregated ice visible by eye (ice 25 mm or less thick)	V	Individual ice crystals or inclusions	Vx	For ice phase, record the following as applicable Location Orientation Thickness Length Spacing Hardness Structure } per part III below Color	Elastic properties Plastic properties Thermal properties Ice crystal structure (using optical instruments) a. Orientation of axes b. Crystal size c. Crystal shape d. Pattern of arrangement	Usually thaw-unstable		
			Ice coatings on particles	Vc					
III: Description of substantial ice strata	Ice greater than 25 mm thick	ICE	Pandom or irregularly oriented ice formations	Vr	Estimate volume of visible segregated ice present as percent of total sample volume	Same as part II above, as applicable, with special emphasis on ice crystal structure			
			Straatified or dismetely oriented ice formations	Vs					
			Ice with soil inclusions	ICE + soil type			Designate material as ice and use descriptive terms as follows, usually one item from each group, as applicable: Hardness: hard, soft (of mass, not of individual crystals) Structure: clear, cloudy, porous, candled, granular, stratified Color: colorless, gray, blue Admixtures: contains few thin silt inclusions		
			Ice without soil inclusions	ICE					

(see notes on p. 32)



Front Street Area (2016)

CHILKOOT GEOLOGICAL ENGINEERS LTD.

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BOREHOLE LOG

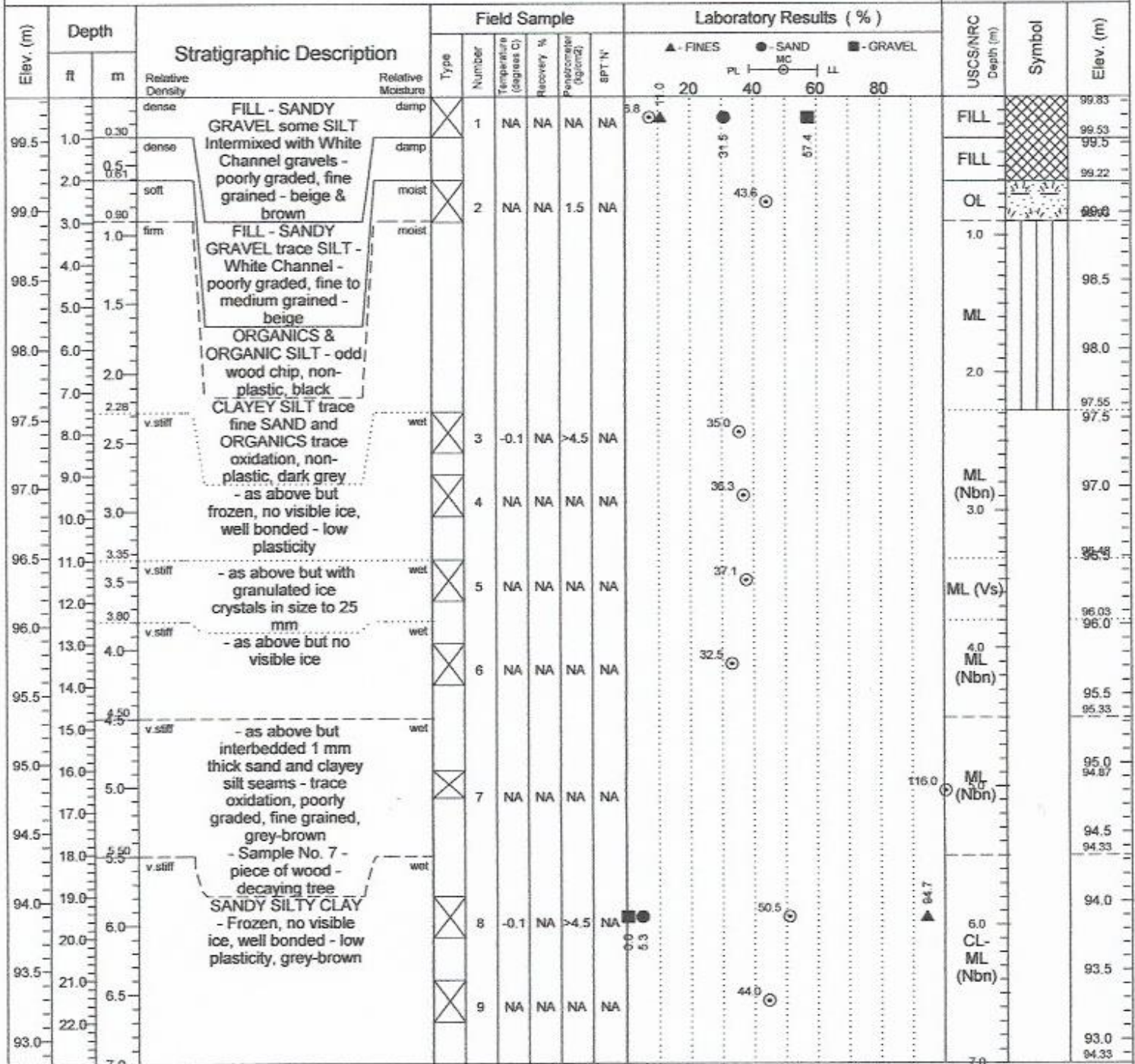
Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled: July 25, 2016

Elevation : 99.83 meters
BH Termination Depth: 10.51 meters
Instrumentation: NA
Weather: 22 C

BOREHOLE

1-16

Sheet 1 of 2



Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem
Bit Type : Fish Tail

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : July 25, 2016

Data Entry By : T.Dhara, P.Eng.
Date : Aug 13-16, 2016

Reviewed By:
Date : Aug. 17, 2016

CHILKOOT GEOLOGICAL ENGINEERS LTD.

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BOREHOLE LOG

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Date Drilled: July 25, 2016

Elevation : 99.83 meters
BH Termination Depth: 10.51 meters
Instrumentation: NA
Weather: 22 C

BOREHOLE

1-16

Sheet 2 of 2

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)		
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Penetration (kg/cm ²)	SPT 'N'	▲ - FINES	● - SAND	■ - GRAVEL				PL	MC
92.5	24.0	7.5	v. stiff (continued) SANDY SILTY CLAY - Frozen, no visible ice, well bonded - low plasticity, grey-brown - as above but possible cobbles and boulders - odd gravel v. stiff Relative Density: wet (continued) / moist	⊗	10	NA	NA	NA	NA							92.73 (continued)	
92.0	25.0	8.0															92.5
91.5	27.0	8.23	v. dense SANDY GRAVEL - Frozen, no visible ice, well bonded - poorly graded, medium to coarse grained, fractured gravel in size to 30 mm, grey-brown - Hard Grindy Drilling @ 8.5 m - possible cobbles and boulders moist	⊗	11	NA	NA	NA	NA							91.8	
91.0	28.0	8.5															91.5
90.5	29.0	9.0															91.33
90.0	30.0	9.5	- As Above No groundwater encountered Borehole terminated at 10.51 m. below the existing ground surface.	⊗	12	NA	NA	NA	NA							91.0	
89.5	31.0	9.5															90.5
89.0	32.0	10.0														90.0	
88.5	33.0	10.6														90.0	
88.0	34.0	10.6														89.46	
87.5																89.32	
87.0																89.0	
86.5																88.5	
86.0																88.0	
																87.5	
																87.0	
																86.5	
																86.0	

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

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BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled: July 25, 2016

Elevation : 100.32 meters
BH Termination Depth: 8.23 meters
Instrumentation: NA
Weather: 22 C - Showers

BOREHOLE

2-16

Sheet 1 of 2

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)	
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Penetrometer (kg/cm2)	SPT N	▲ - FINES	● - SAND	■ - GRAVEL				PL
100.0	1.0		FILL - SANDY GRAVEL some SILT - White Channel - poorly graded, fine to medium grained, beige	X	14	NA	NA	NA	NA	48	11.0	38.4	50.7	92.1	FILL	100.32
99.5	2.0	0.76														soft
99.0	3.0		ORGANICS & ORGANIC SILT - non-plastic, black	X	15	NA	NA	NA	NA	NA	NA	55.5	52.1	92.1	ORG	99.0
98.5	4.0	1.52														moist
98.0	5.0		CLAYEY SILT trace fine SAND trace rootlets - non-plastic, dark-grey - As above but Frozen, no visible ice, well bonded - silt in thin laminate bedding up to 1 mm thick	X	16	0.0	NA	1.0	NA	NA	NA	55.5	52.1	92.1	ML	98.5
97.5	6.0	1.83														v.stiff
97.0	7.0		- As above but some fine SAND and less CLAY - no rootlets - grey	X	17	-0.1	NA	3.0	NA	NA	NA	52.1	52.1	92.1	ML	97.5
96.5	8.0	2.0														v.stiff
96.0	9.0		- As above but trace oxidation - grey-brown	X	18	NA	NA	NA	NA	NA	NA	38.7	36.7	92.1	ML (Nbn)	96.0
95.5	10.0	3.0														v.stiff
95.0	11.0		- As above but with visible ice lenses up to 2 mm thick	X	19	NA	NA	NA	NA	NA	NA	36.7	36.7	92.1	ML (Nbn)	95.5
94.5	12.0	3.5														
94.0	13.0		- As above but with visible ice lenses up to 2 mm thick	X	20	-0.1	NA	>4.5	NA	NA	NA	31.9	36.9	92.1	ML (Vx)	94.5
93.5	14.0	4.5														
93.0	15.0		- As above but with visible ice lenses up to 2 mm thick	X	21	-0.1	NA	NA	NA	NA	NA	29.3	36.9	92.1	ML (Vx)	93.5
92.5	16.0	5.0														
92.0	17.0		- As above but with visible ice lenses up to 2 mm thick	X	22	NA	NA	NA	NA	NA	NA	29.3	36.9	92.1	ML (Vx)	92.0
91.5	18.0	5.5														
91.0	19.0		- As above but with visible ice lenses up to 2 mm thick	X												91.0
90.5	20.0	6.0														
90.0	21.0		- As above but with visible ice lenses up to 2 mm thick	X												90.0
89.5	22.0	6.80														
89.0	7.0															89.0

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem
Bit Type : Fish Tail

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Reviewed By:
Date : Aug. 17, 2016

CHILKOOT GEOLOGICAL ENGINEERS LTD.

5B Bennett Road, Whitehorse, Yukon
(867) 335-5804 chilkoot@northwestel.net



BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled: July 25, 2016

Elevation : 100.32 meters
BH Termination Depth: 8.23 meters
Instrumentation: NA
Weather: 22 C - Showers

BOREHOLE

2-16

Sheet 2 of 2

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)		
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Penetration (kg/cm ²)	SPT N	▲ - FINES	● - SAND	■ - GRAVEL				PL	MC
93.0	24.0	7.5	v. stiff (continued) - No visible ice, well bonded - Interbedded medium grained SAND seams up to 1 cm thick. wet (continued)	⊗	23	NA	NA	NA	NA	25.1						ML (Nbn)	93.0
92.5	26.0	8.62	v. stiff - As above but trace GRAVEL wet	⊗	24	NA	NA	NA	NA	36.3						Caved To 7.92	92.52
92.0	27.0	8.23	v. dense - SILTY GRAVELLY SAND - poorly graded, fine to medium grained, grey - Refusal - Possible boulder No groundwater encountered Borehole terminated at 8.23 m. below the existing ground surface. wet	⊗	25	NA	NA	NA	NA	13.1	23.8	37.3	49.6				SM (Nbn)
92.0																	92.09
91.5																	91.5
91.0																	91.0
90.5																	90.5
90.0																	90.0
89.5																	89.5
89.0																	89.0
88.5																	88.5
88.0																	88.0
87.5																	87.5
87.0																	87.0
86.5																	86.5

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem
Bit Type : Fish Tail

Water Level(s)
 ▽ During Drilling ▽ After Drilling
 ▽ At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : July 25, 2016

Date Entry By : T.Dhara, P.Eng.
Date : Aug 13-16, 2016

Reviewed By: *TD*
Date : Aug. 17, 2016

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5B Bennett Road, Whitehorse, Yukon
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BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled : July 25, 2016

Elevation : 100.27 meters
BH Termination Depth: 6.55 meters
Instrumentation: 2" Monitoring Well
Weather: 22 C - Showers

BOREHOLE

3-16

Sheet 1 of 1

Elev. (m)	Depth		Stratigraphic Description	Field Sample						Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)	
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Penetration (kg/cm2)	SPT 'N'	▲ - FINES	● - SAND	■ - GRAVEL	PL				MC
100.6	1.0	0.5	- Hard Grindy Drilling - Possible Cobbles														100.0
99.5	2.0	1.0															99.5
99.0	3.0	1.5															99.0
98.5	5.0	1.97	compact FILL - SANDY GRAVEL - White Channel - poorly graded, fine to medium grained, beige	damp	26	NA	10	NA	24	5.6							98.75
98.0	6.0	2.0															98.5
97.5	7.0	2.5															98.3
97.0	10.0	3.0	firm SANDY SILT trace Rootlets and thin seams of black ORGANICS - trace oxidation - non-plastic, grey	damp	27	0.6	78	1.0	8	74.2	27.8						97.22
96.5	11.0	3.5															97.0
96.0	12.0	4.0															96.77
95.5	15.0	4.5	firm SANDY SILT less Rootlets and odd 2 mm thick seams of black Organic Silt - trace oxidation - non-plastic, grey	damp	28	0.2	100	0.5	6	38.3							96.5
95.0	16.0	5.0															96.0
94.5	17.0	5.5															95.7
94.0	20.0	6.0	v.saff SILT trace SAND odd Rootlet - Frozen, no visible ice, well bonded - non-plastic, grey	wet	29	-0.2	100	>4.5	30	81.8	50.9						95.5
93.5	21.0	6.55	Groundwater Encountered - Monitoring Well installed to 5.93 m														95.25

Borehole terminated at 6.55 m. below the existing ground surface.

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 200 mm Hollow Stem
Bit Type : Carbide Cutter

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : July 25, 2016

Data Entry By : T.Dhara, P.Eng.
Date : Aug 13-16, 2016

Reviewed By :
Date : Aug. 17, 2016

CHILKOOT GEOLOGICAL ENGINEERS LTD.

5B Bennett Road, Whitehorse, Yukon
(867) 335-5804 chilkoot@northwestel.net



BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled: July 26, 2016

Elevation : 109.45 meters
BH Termination Depth: 5.94 meters
Instrumentation: 2" Monitoring Well
Weather: 22 C - Showers

BOREHOLE

4-16

Sheet 1 of 1

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)			USCS/NRC Depth (m)	Symbol	Elev. (m)		
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Parachlorophenol (ppm)	SPT 'N'	PL	MC				LL	
109.6	0.5		FILL - SANDY SILTY GRAVEL - fine to medium grained, poorly graded, grey-brown	X	30	NA	NA	NA	NA	5.4	21.6	28.8	48.6			109.0
108.5	1.0	1.0														108.5
108.0	5.0	1.67	ORGANICS AND ORGANIC SILT - non-plastic, black SLIDE RUBBLE - SANDY SILTY GRAVEL - trace oxidation - fractured serpentinized rock in size to 30 mm - poorly graded, fine to medium grained, grey-brown	moist damp	31	NA	56	NA	NA	30	10.8	18.8	34.9	48.3		108.0
107.5	6.0	1.97														107.5
107.0	7.0	2.0	SLIDE RUBBLE - GRAVELLY SILTY SAND trace Rootlets and Organics - trace oxidation - fractured serpentinized rock in size to 30 mm - poorly graded, fine to medium grained, dark-brown	moist	32	NA	NA	NA	NA	5.1	9.0					107.0
106.5	8.0	2.5														106.5
106.0	10.0	3.0	SLIDE RUBBLE - Decomposed Serpentinized Rock - GRAVELLY SAND some SILT - trace oxidation - fractured gravel in size to 30 mm - poorly graded, fine to medium grained, fibrous - greenish-white	dry-damp	33	NA	100	NA	50+	2.4	11.4	40.6	47.7			106.0
105.5	11.0	3.50														105.5
105.0	13.0	4.0	Refusal - No Sample Retained - Possible Cobbles - Hard Grindy Drilling - Assumed Slide Rubble based upon auger action.		34	NA	0	NA	50+	5.82						105.0
104.5	14.0	4.5														104.5
104.0	16.0	5.82	Refusal - No Sample Retained - Possible Cobbles - Hard Grindy Drilling - Assumed Slide Rubble based upon auger action.		35	NA	0	NA	50+	5.94						104.0
103.5	17.0	5.94														103.5
103.0	18.0	5.5	Refusal - No Sample Retained - Possible Cobbles - Hard Grindy Drilling - Assumed Slide Rubble based upon auger action.													103.0
102.5	19.0	5.94														102.5

No groundwater encountered -
Monitoring Well installed to 5.77 m
Borehole terminated at 5.94 m
below the existing ground surface.

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 200 mm Hollow Stem
Bit Type : Carbide Cutter

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : July 26, 2016

Data Entry By : T.Dhara, P.Eng.
Date : Aug 13-16, 2016

Reviewed By:
Date : Aug. 17, 2016

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BOREHOLE LOG

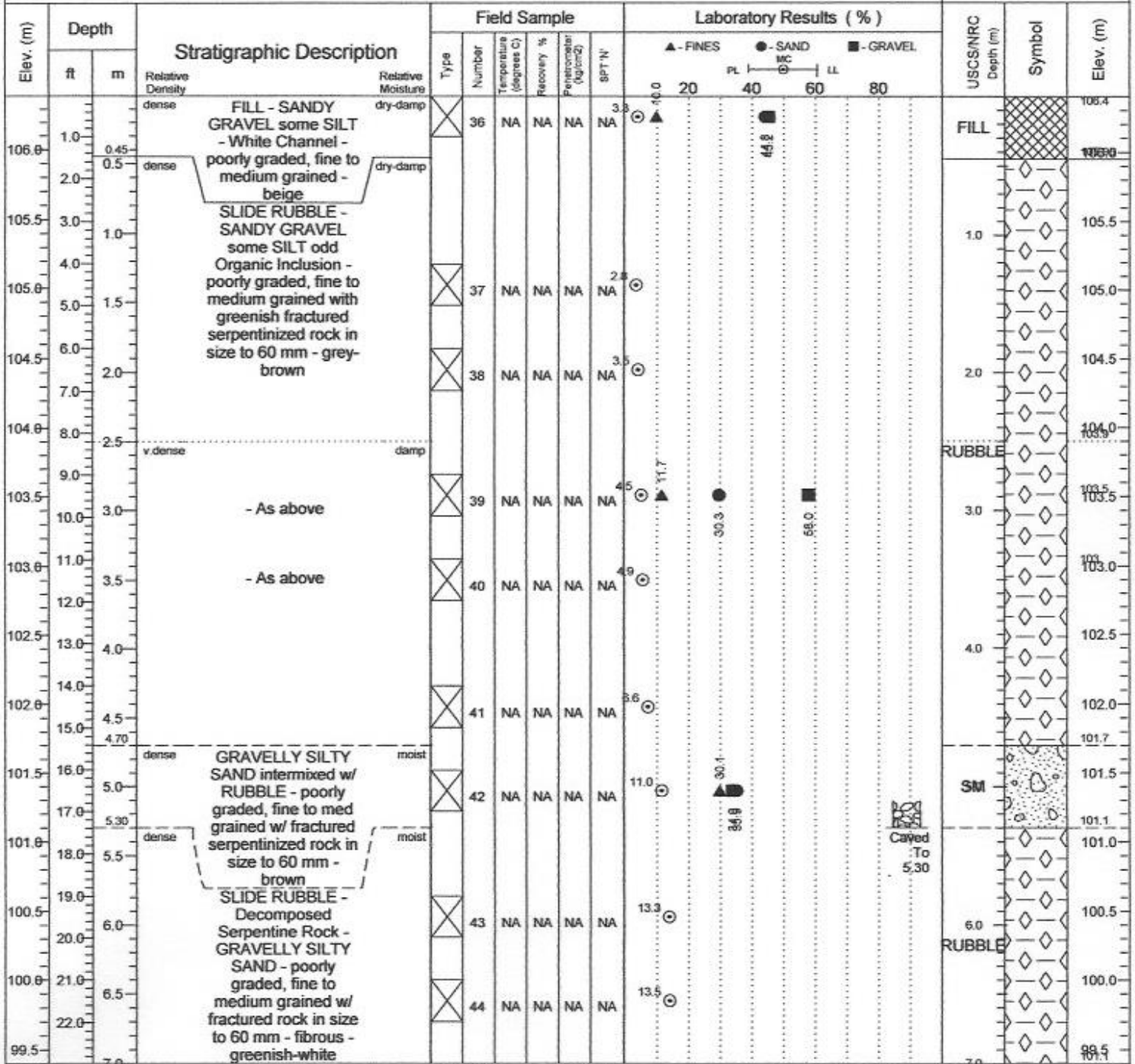
Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled: July 26, 2016

Elevation : 106.40 meters
BH Termination Depth: 9.12 meters
Instrumentation: NA
Weather: 22 C

BOREHOLE

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Sheet 1 of 2



Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem
Bit Type : Fish Tail

Caved To 5.30

Water Level(s)
 ▽ During Drilling ▽ After Drilling
 ▽ At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : July 26, 2016

Data Entry By : T.Dhara, P.Eng.
Date : Aug 13-16, 2016

Reviewed By:
Date : Aug. 17, 2016

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BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled: July 26, 2016

Elevation : 101.34 meters
BH Termination Depth: 10.67 meters
Instrumentation: NA
Weather: 22 C - Showers

BOREHOLE

6-16

Sheet 1 of 2

Elev. (m)	Depth		Stratigraphic Description	Field Sample						Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)			
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Penetrometer (kg/cm ²)	SPN	PL	MC	LL	20				40	60	80
101.6	1.0		FILL - SANDY GRAVEL some SILT - White Channel - poorly graded, fine to medium grained - beige	X	50	NA	NA	NA	2.6	2.6							FILL	101.34	
101.0	0.5																	101.0	
100.5	2.0		SLIDE RUBBLE - SANDY GRAVEL some SILT odd Organic Inclusion - poorly graded, fine to medium grained with fractured serpentinized rock in size to 60 mm - green-white	X	51	NA	NA	NA	NA	10.1	22.9	29.8	47.3				RUBBLE	100.5	
100.0	4.0																	100.0	
99.5	6.0		ORGANICS & ORGANIC SILT - odd wood chip, non-plastic, black	X	52	NA	NA	NA	NA	4.5	32.2	39.8	43.6				ORG	99.5	
99.0	8.0																	99.0	
98.5	9.0		SILT trace SAND with wood chips and interbedded decaying ORGANICS - Frozen, no visible ice, well bonded - non-plastic, grey-black	X	53	-0.1	NA	NA	NA	6.0	7.6	40.3	40.3				ML (Nbn)	98.5	
98.0	10.0																	98.0	
97.5	11.0		- As above but less Organics - trace oxidation - grey-brown	X	54	0.1	NA	NA	NA	NA	43.6	40.3	40.3				ML (Nbn)	97.5	
97.0	12.0																	97.0	
96.5	13.0		CLAYEY SILT - Frozen, no visible ice, well bonded - low plasticity, grey-brown	X	55	-0.1	NA	NA	NA	NA	40.3	40.3	40.3				ML (Nbn)	96.5	
96.0	14.0																	96.0	
95.5	15.0		SANDY SILT - Frozen, no visible ice, well bonded - non-plastic, grey	X	56	NA	NA	NA	NA	NA	22.1	35.2	40.0	40.2			ML (Nbn)	95.5	
95.0	16.0																	95.0	
94.5	17.0		CLAYEY SILT trace SAND - Frozen, no visible ice, well bonded - low plasticity, grey-brown	X	57	NA	NA	NA	NA	NA	40.0	40.0	40.2				6.0 ML (Nbn)	94.5	
94.0	18.0																	94.0	
93.5	19.0			X	58	NA	NA	NA	NA	NA	40.0	40.0	40.2					93.5	
93.0	20.0																	93.0	
92.5	21.0																	92.5	
92.0	22.0																		92.0
91.5	7.0																		91.5

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem
Bit Type : Fish Tail

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : July 26, 2016

Data Entry By : T.Dhara, P.Eng.
Date : Aug 13-16, 2016

Reviewed By: *TD*
Date : Aug. 17, 2016

CHILKOOT GEOLOGICAL ENGINEERS LTD.

5B Bennett Road, Whitehorse, Yukon
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BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - North End Subdivision
Date Drilled: July 26, 2016

Elevation : 101.34 meters
BH Termination Depth: 10.67 meters
Instrumentation: NA
Weather: 22 C - Showers

BOREHOLE

6-16

Sheet 2 of 2

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)				USCS/MRC Depth (m)	Symbol	Elev. (m)		
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Penetrometer (kg/cm ²)	SPT N'	▲ - FINES	● - SAND MC	■ - GRAVEL				PL	LL
94.0	24.0	7.40	stiff (continued)														
		7.5	dense	SANDY SILTY GRAVEL - Frozen - no visible ice - poorly graded, fine to medium grained, grey-brown													
93.5	25.0																
		26.0	stiff	SILT some CLAY trace SAND and GRAVEL - frozen, no visible ice, well bonded - low plasticity, grey-brown - possible cobbles and boulders @ 8.9 m													
93.0	27.0																
		28.0															
92.5	29.0																
		30.0															
92.0	31.0																
		31.0	dense	GRAVELLY SILTY SAND - Frozen, no visible ice, well bonded - poorly graded, medium to coarse grained, fractured gravel in size to 30 mm, grey													
91.5	32.0																
		33.0															
91.0	34.0																
		35.0															
90.5				Borehole terminated at 10.67 m. below the existing ground surface.													

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem
Bit Type : Fish Tail

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : July 26, 2016

Date Entry By : T.Dhara, P.Eng.
Date : Aug 13-16, 2016

Reviewed By:
Date : Aug. 17, 2016



2nd Avenue (2014)

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BOREHOLE LOG

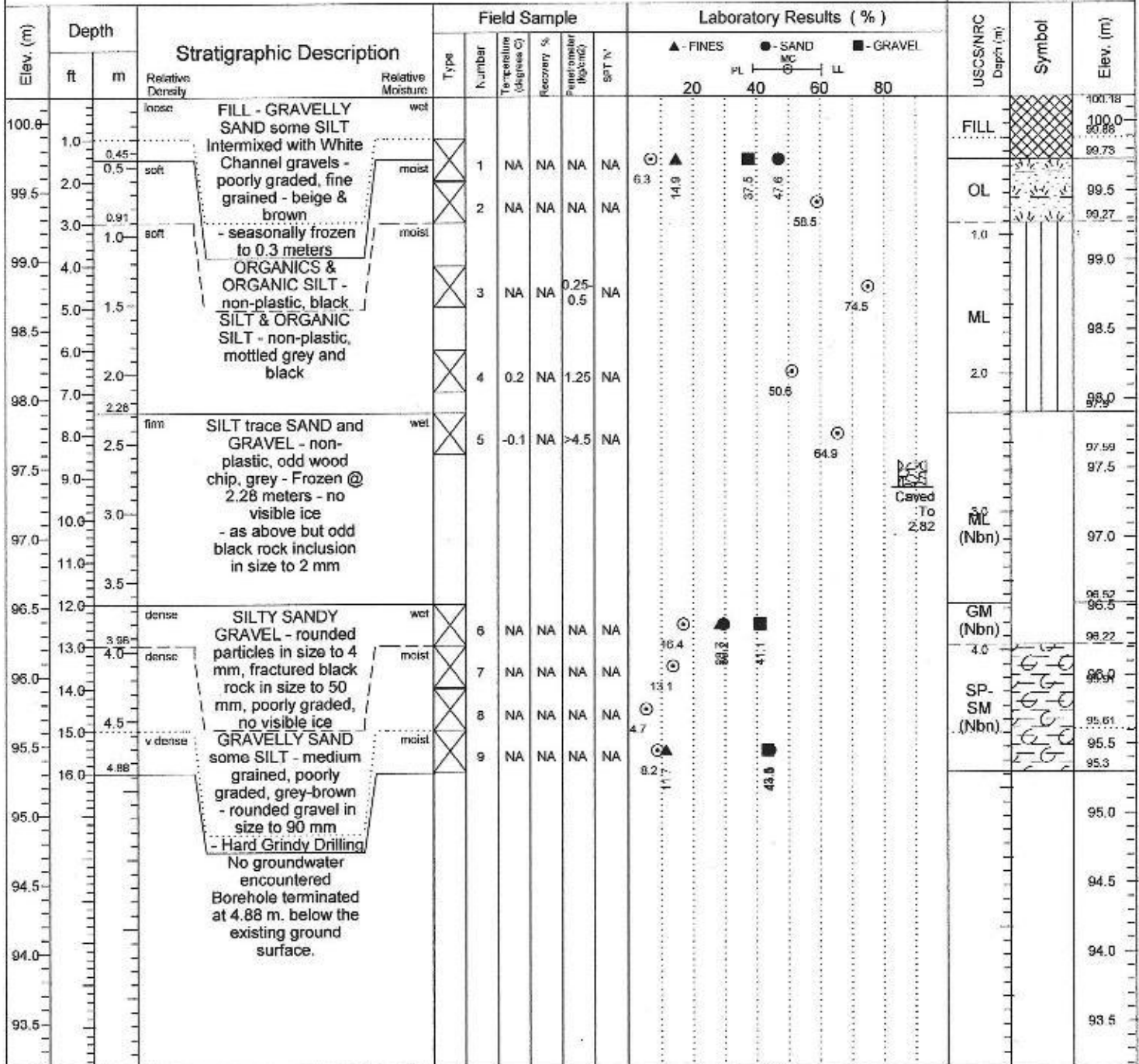
Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - 2nd Ave Upgrades
Chilkoot Project No. : 200-003-14

Date Drilled: Oct.16, 2014
Elevation : 100.18 meters
Depth of BH: 4.88 meters
Instrumentation: NA

BOREHOLE

1-14

Sheet 1 of 1



Drilled By : Donjek Services

Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem

Bit Type : Fish Tail

Water Level(s)

During Drilling After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.

Date : Oct.16, 2014

Data Entry By : T.Dhara, P.Eng.

Date : Nov.6-7, 2014

Reviewed By: *TD*

Date : Nov.10, 2014

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5B Bennett Road, Whitehorse, Yukon
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BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - 2nd Ave Upgrades
Chilkoot Project No. : 200-003-14

Date Drilled: Oct 16, 2014
Elevation : 100.62 meters
Depth of BH: 5.49 meters
Instrumentation: NA

BOREHOLE

2-14

Sheet 1 of 1

Elev. (m)	Depth		Stratigraphic Description	Relative Density	Relative Moisture	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)
	ft	m				Type	Number	Temperature (degrees C)	Recovery %	Penetrometer (kg/cm2)	SPT 'N'	PL	MC	LL			
100.5			FILL - SANDY GRAVEL some SILT - poorly graded, grey-brown	dense	wet												100.62
	1.0	0.45															100.5
		0.5															100.32
	2.0	0.76															100.17
100.0			- seasonally frozen to 0.3 meters		wet												100.0
	3.0	1.0	ORGANICS & ORGANIC SILT - non-plastic, black		wet												99.66
	4.0	1.37	SILT & ORGANIC SILT - non-plastic, mottled grey and black		wet												99.5
99.5		1.52			wet												99.25
	5.0	1.52			wet												99.1
99.0			SILT w/ trace fine SAND - non-plastic, grey		wet												99.0
	6.0	2.0															98.5
98.5			Frozen @ 1.52 meters - Visible ice inclusions in size to 2 mm, odd organic/wood inclusions in size to 10 mm, trace oxidation, grey-brown														98.5
	7.0	2.5															98.0
98.0																	98.0
	8.0	3.0															97.5
97.5																	97.5
	9.0	3.5															97.0
97.0																	97.0
	10.0	3.86															96.5
96.5			- as above but with some SAND and odd rounded gravel in size to 7 mm - possible cobbles - odd organic inclusions		wet												96.5
	11.0	4.0															96.0
96.0																	96.0
	12.0	4.5															95.74
96.0																	95.74
	13.0	4.69															95.5
95.5			SILTY SANDY GRAVEL - fine to medium grained, poorly graded, grey-brown		moist												95.5
	14.0	5.0															95.13
95.0																	95.13
	15.0	5.49															95.0
95.0			No groundwater encountered Borehole terminated at 5.49 m. below the existing ground surface.														95.0
	16.0																94.5
94.5																	94.5
	17.0																94.0
94.0																	94.0

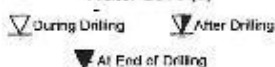
Drilled By : Donjek Services

Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem

Bit Type : Fish Tail

Water Level(s)



Logged By : T.Dhara, P.Eng.

Data Entry By : T.Dhara, P.Eng.

Reviewed By: *[Signature]*

Date : Oct.16, 2014

Date : Nov.6-7, 2014

Date : Nov.10, 2014

CHILKOOT GEOLOGICAL ENGINEERS LTD.

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BOREHOLE LOG

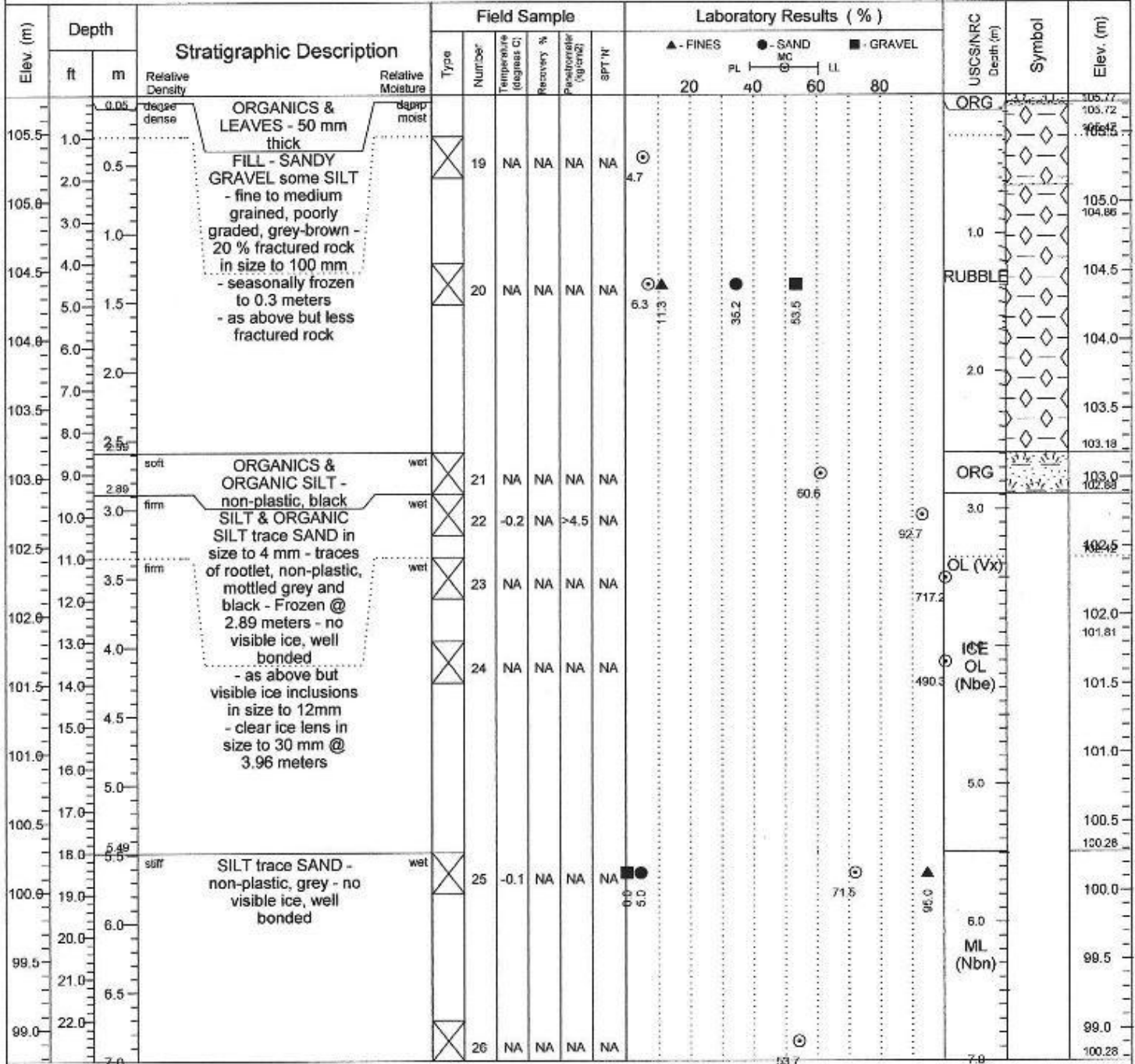
Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - 2nd Ave Upgrades
Chilkoot Project No. : 200-003-14

Date Drilled: Oct.17, 2014
Elevation : 105.77 meters
Depth of BH: 10.36 meters
Instrumentation: 2" Monitoring Well

BOREHOLE

3-14

Sheet 1 of 2



Drilled By : Donjek Services

Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem

Bit Type : Fish Tail

Water Level(s)

During Drilling After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : Oct.17, 2014

Data Entry By : T.Dhara, P.Eng.
Date : Nov.6-7, 2014

Reviewed By:
Date : Nov.10, 2014

CHILKOOT GEOLOGICAL ENGINEERS LTD.

5B Bennett Road, Whitehorse, Yukon
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BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - 2nd Ave Upgrades
Chilkoot Project No. : 200-003-14

Date Drilled: Oct. 17, 2014
Elevation : 105.77 meters
Depth of BH: 10.36 meters
Instrumentation: 2" Monitoring Well

BOREHOLE

3-14

Sheet 2 of 2

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)	
	ft	m		Type	Number	Temperature (deg. C)	Recovery %	Penetration (kg/cm ²)	SPT 'N	▲ - FINES	● - SAND MC	■ - GRAVEL				PL
98.5	24.0	7.5	stiff (continued) SILT trace SAND - non-plastic, grey - no visible ice, well bonded													(continued)
98.0	25.0	8.0														
97.5	27.0	8.5														
97.0	28.0	9.0	- as above but no SAND	X	27	NA	NA	NA	NA							
96.5	29.0	9.5														
96.0	30.0	10.0														
95.5	31.0	10.6														
95.0	32.0	10.36	No groundwater encountered - Monitoring Well installed to 9.64 meters Borehole terminated at 10.36 m. below the existing ground surface.	X	28	NA	NA	NA	NA	●						
95.4										▲						

Drilled By : Donjek Services

Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem

Bit Type : Fish Tail

Water Level(s)

During Drilling After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.

Date : Oct. 17, 2014

Data Entry By : T.Dhara, P.Eng.

Date : Nov. 6-7, 2014

Reviewed By:

Date : Nov. 10, 2014

CHILKOOT GEOLOGICAL ENGINEERS LTD.

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BOREHOLE LOG

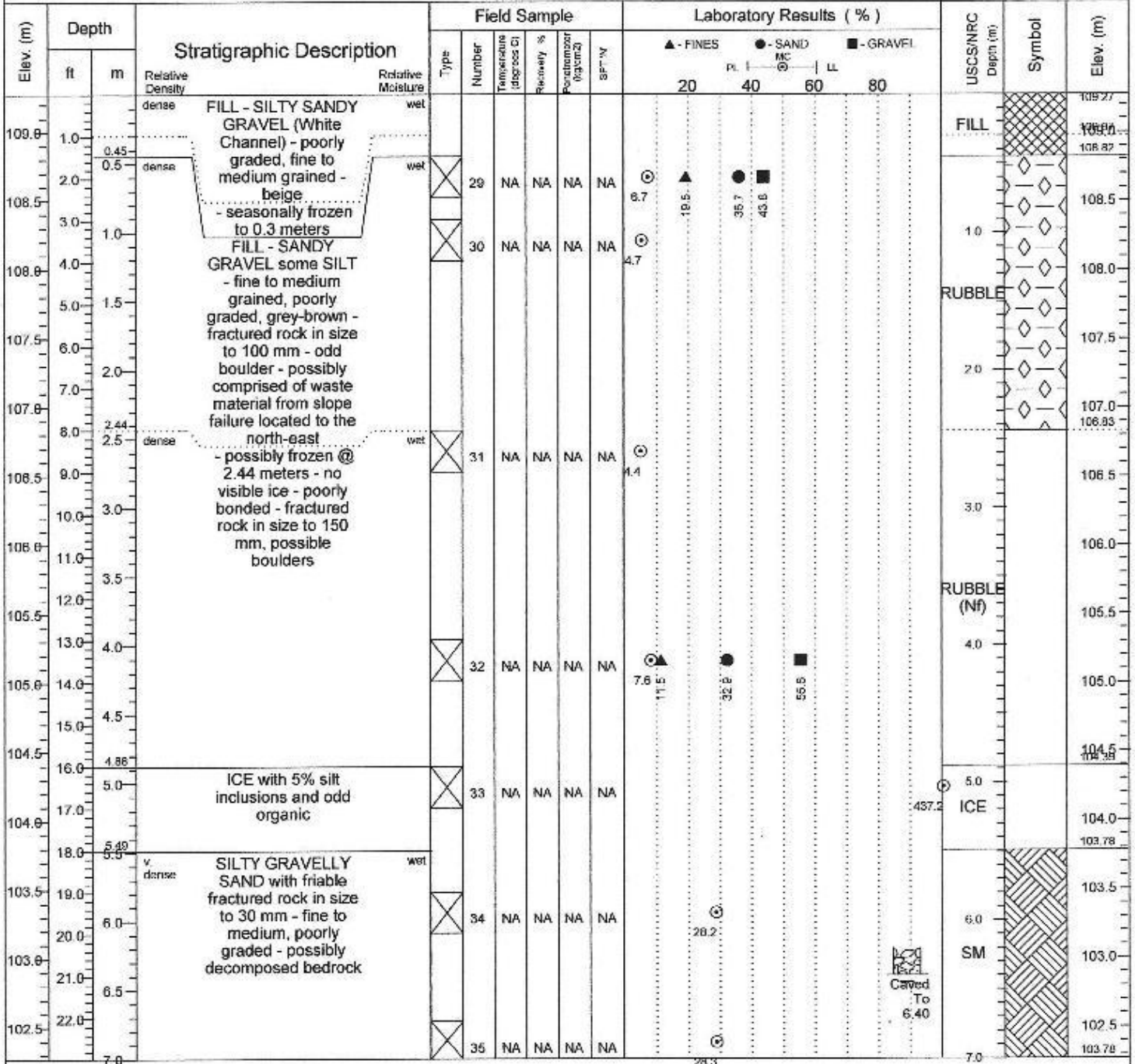
Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - 2nd Ave Upgrades
Chilkoot Project No. : 200-003-14

Date Drilled: Oct.17, 2014
Elevation : 109.27 meters
Depth of BH: 7.62 meters
Instrumentation: NA

BOREHOLE

4-14

Sheet 1 of 2



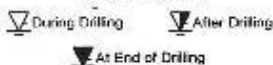
Drilled By : Donjek Services

Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem

Bit Type : Fish Tail

Water Level(s)



Logged By : T.Dhara, P.Eng.
Date : Oct.17, 2014

Data Entry By : T.Dhara, P.Eng.
Date : Nov.6-7, 2014

Reviewed By :
Date : Nov.10, 2014

CHILKOOT GEOLOGICAL ENGINEERS LTD.

5B Bennett Road, Whitehorse, Yukon
(867) 335-2085 chilkoot@northwestel.net



BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation - 2nd Ave Upgrades
Chilkoot Project No. : 200-003-14

Date Drilled: Oct 17, 2014
Elevation : 109.27 meters
Depth of BH: 7.62 meters
Instrumentation: NA

BOREHOLE

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Sheet 2 of 2

Elev. (m)	Depth		Stratigraphic Description	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)	
	ft	m		Type	Number	Temperature (degrees C)	Recovery %	Penetration (kg/cm ²)	SPT N'	▲ - FINES	● - SAND	■ - GRAVEL				FL
102.0	24.0		v. dense (continued)													(continued)
101.5	25.0	7.62	No groundwater encountered Borehole terminated at 7.62 m. below the existing ground surface.	X	36	NA	NA	NA	NA							102.0
101.5																
101.0																101.5
100.5																101.0
100.0																100.5
99.5																100.0
99.0																99.5
98.5																99.0
98.0																98.5
97.5																98.0
97.0																97.5
96.5																97.0
96.0																96.5
95.5																96.0

Drilled By : Donjek Services

Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem

Bit Type : Fish Tail

Water Level(s)
 During Drilling After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : Oct.17, 2014

Data Entry By : T.Dhara, P.Eng.
Date : Nov.6-7, 2014

Reviewed By:
Date : Nov.10, 2014

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BOREHOLE LOG

Client : Yukon Government - Energy, Mines & Resources
Location : Dawson, Yukon
Project : Geotechnical Evaluation Lot 8 - 2nd Avenue
Chilkoot Project No. : 200-002-14

Date Drilled: July 23, 2014
Elevation : 99.00 meters
Depth of BH: 4.57 meters
Instrumentation: Monitoring Well

BOREHOLE

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Sheet 1 of 1

Elev. (m)	Depth		Stratigraphic Description	Relative Density	Relative Moisture	Field Sample					Laboratory Results (%)				USCS/NRC Depth (m)	Symbol	Elev. (m)
	ft	m				Type	Number	Temperature (logpass C)	Recovery %	Penetration (opt/mg)	SP TN	PL	FL	LL			
98.5	1.0	0.45	FILL - SANDY SILTY GRAVEL (White Channel) - poorly graded, fine grained - beige - road sub-base	dense	damp	1	NA	NA	NA	NA	5.5	14.7	28.4	58.9	FILL	98.55	
98.0	2.0	0.61	FILL - SILTY GRAVELLY SAND - poorly graded, grey with oxidized orange-brown silt inclusions	compact	damp	2	NA	NA	NA	NA			45.8	FILL	98.5		
97.5	3.0	0.91	ORGANICS - Organic Silt and Rootlets, non-plastic, black	soft	moist	3	NA	NA	NA	NA			55.1	ORG	98.09		
97.0	4.0	1.0	ORGANIC SILT some Rootlets - non-plastic, black - as above but	firm	moist	4	0.0	NA	NA	NA			37.3	OL	97.9		
96.5	5.0	1.52	Frozen - no visible ice	stiff	moist	5	-0.1	NA	NA	NA			13.7	Nbn	96.58		
96.0	6.0	2.0	SANDY GRAVELLY SILT - non-plastic, grey - Frozen - no visible ice	stiff	moist	6	-0.1	NA	NA	NA			24.0	Nbn	96.5		
95.5	7.0	2.44	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	7	0.0	NA	NA	NA			27.3	Nbn	96.0		
95.0	8.0	2.5	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	8	0.0	NA	NA	NA			19.1	Nbn	95.5		
94.5	9.0	2.5	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	8	0.0	NA	NA	NA			51.5	Nbn	95.34		
94.0	10.0	3.0	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	8	0.0	NA	NA	NA			5.5	Nbn	95.0		
93.5	11.0	3.5	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	8	0.0	NA	NA	NA			5.5	Nbn	94.5		
93.0	12.0	3.66	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	8	0.0	NA	NA	NA			5.5	Nbn	94.0		
92.5	13.0	4.0	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	8	0.0	NA	NA	NA			5.5	Nbn	93.5		
92.0	14.0	4.57	GRAVELLY SILTY SAND - poorly graded, fine to medium grained, grey-brown - hard grindy drilling - possible cobbles - Frozen - no visible ice	stiff	moist	8	0.0	NA	NA	NA			5.5	Nbn	93.0		
			Lot 8 Block 2 End of Borehole No Groundwater Encountered Monitoring well installed to 3.61 meters Borehole terminated at 4.57 m. below the existing ground surface.														

Drilled By : Donjek Services

Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid Stem

Bit Type : Fish Tail

Water Level(s)

During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.

Date : July 23, 2014

Data Entry By : T.Dhara, P.Eng.

Date : August 10, 2014

Reviewed By : T.Dhara

Date : August 14, 2014



7th Avenue (2009)



Geotechnical Evaluation
7th Avenue Utility Upgrades – Dawson City, Yukon – 2014
Borehole Locations



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BOREHOLE LOG

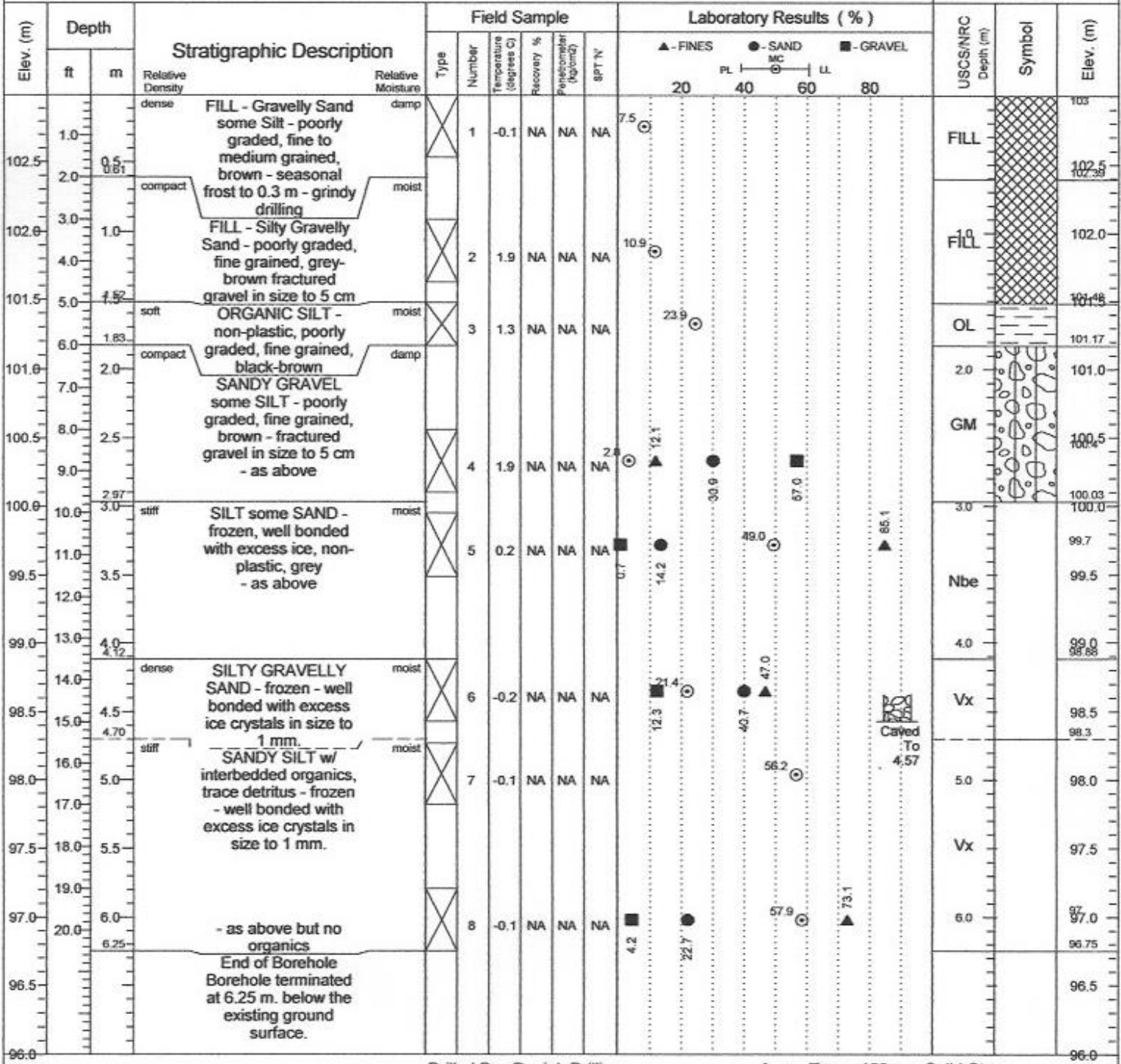
Client : City of Dawson
Location : 7th Avenue - Dawson City, Yukon
Project : Geotechnical Investigation - Proposed Utility Expansion
Date Drilled: Oct. 19, 2009

Elevation : 103.0 meters
BH Termination Depth: 6.25 meters
Instrumentation: NA
Weather:

BOREHOLE

1-09

Sheet 1 of 1



Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid-Stem
Bit Type : Carbide-Button

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : Oct. 19, 2009

Data Entry By : T.Dhara, P.Eng.
Date : Feb.28-Mar.9, 2010

Reviewed By:
Date : March 10, 2010

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BOREHOLE LOG

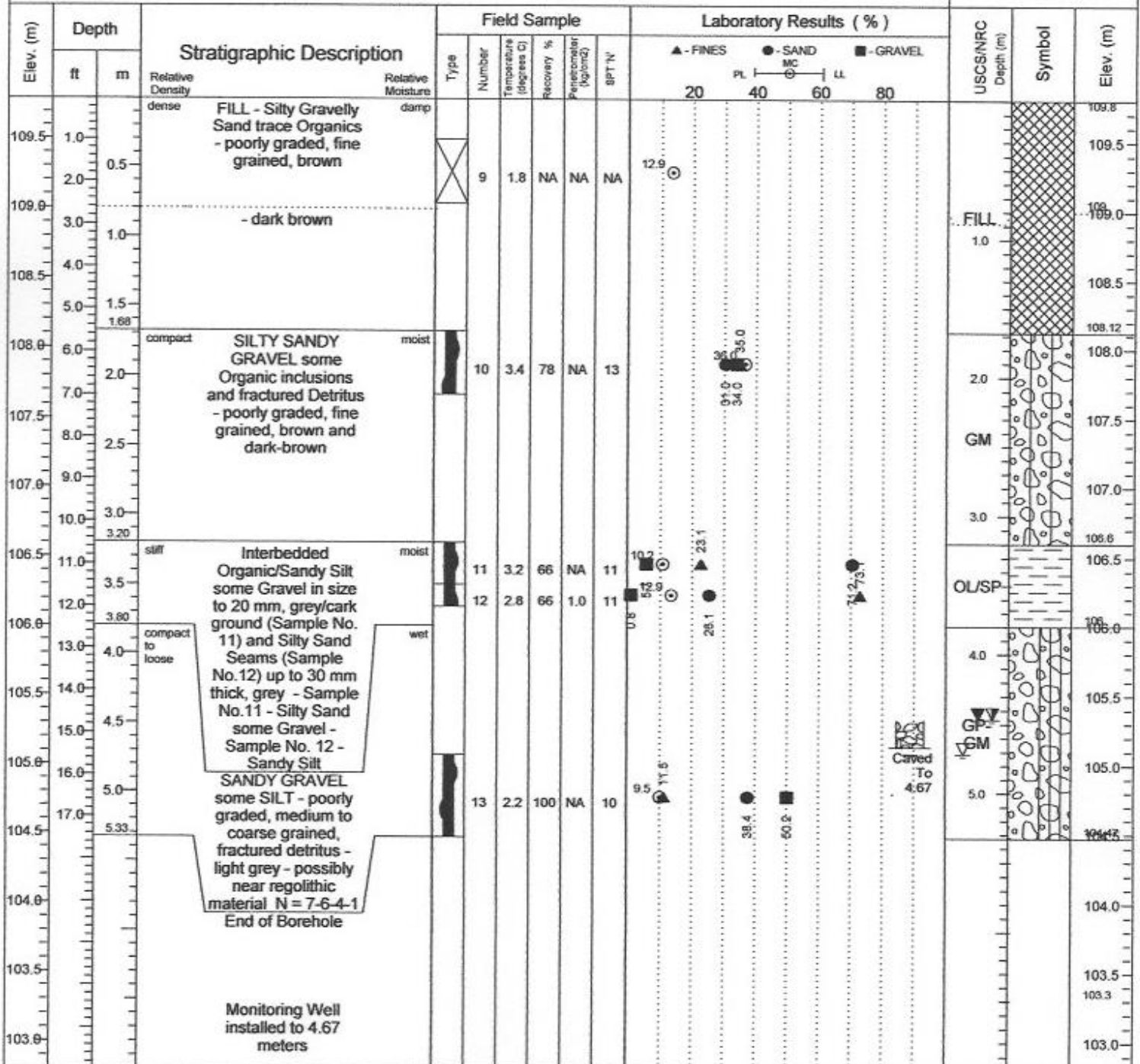
Client : City of Dawson
Location : 7th Avenue - Dawson City, Yukon
Project : Geotechnical Investigation - Proposed Utility Expansion
Date Drilled: Oct. 19, 2009

Elevation : 109.8 meters
BH Termination Depth: 5.33 meters
Instrumentation: Monitoring Well
Weather:

BOREHOLE

2-09

Sheet 1 of 1



Borehole terminated at 5.33 m. below the existing ground surface.

Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 200 mm Hollow-Stem
Bit Type : Carbide-Button

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T. Dhara, P. Eng.
Date : Oct. 19, 2009

Data Entry By : T. Dhara, P. Eng.
Date : Feb. 28-Mar. 9, 2010

Reviewed By:
Date : March 10, 2010

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BOREHOLE LOG

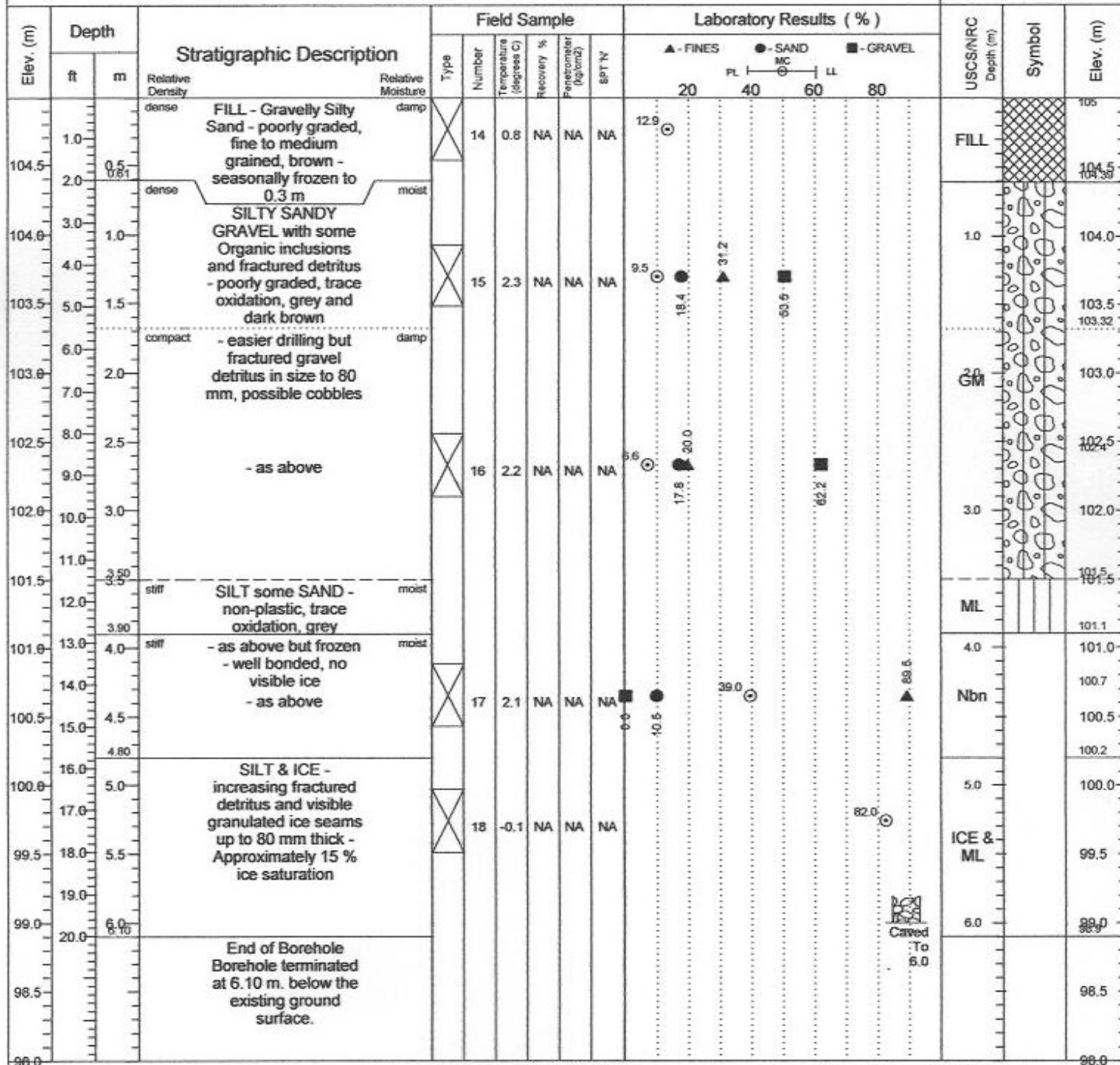
Client : City of Dawson
Location : 7th Avenue - Dawson City, Yukon
Project : Geotechnical Investigation - Proposed Utility Expansion
Date Drilled: Oct.19, 2009

Elevation : 105.0 meters
BH Termination Depth: 6.1 meters
Instrumentation: NA
Weather:

BOREHOLE

3-09

Sheet 1 of 1



Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid-Stem
Bit Type : Carbide-Button

Water Level(s)
 During Drilling After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : Oct.19, 2009

Data Entry By : T.Dhara, P.Eng.
Date : Feb.28-Mar.9, 2010

Reviewed By: *PD*
Date : March 10, 2010

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BOREHOLE LOG

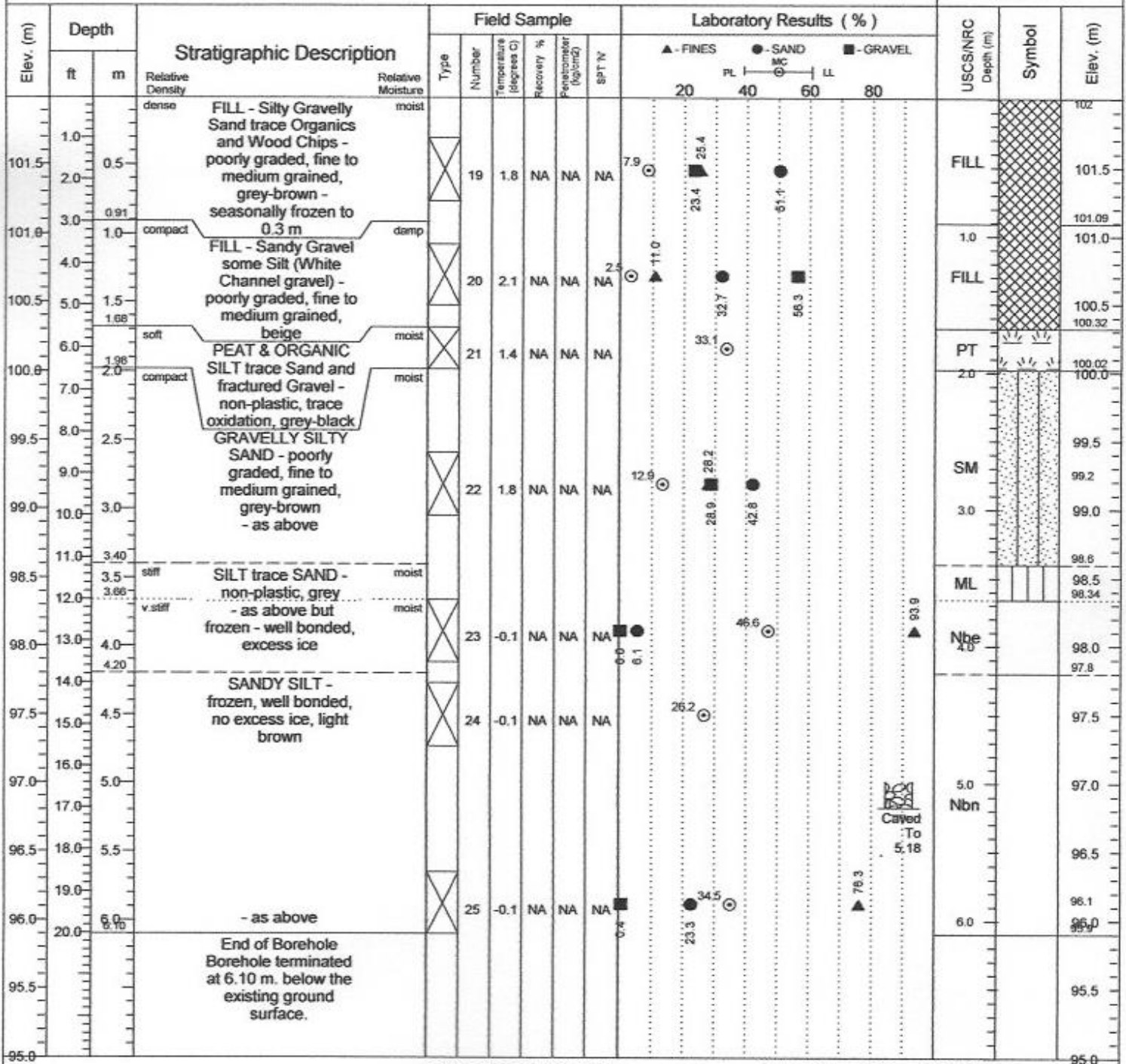
Client : City of Dawson
Location : 7th Avenue - Dawson City, Yukon
Project : Geotechnical Investigation - Proposed Utility Expansion
Date Drilled: Oct.20, 2009

Elevation : 102.0 meters
BH Termination Depth: 6.1 meters
Instrumentation: NA
Weather:

BOREHOLE

4-09

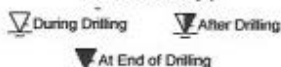
Sheet 1 of 1



Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 150 mm Solid-Stem
Bit Type : Carbide-Button

Water Level(s)



Logged By : T.Dhara, P.Eng.
Date : Oct.20, 2009

Data Entry By : T.Dhara, P.Eng.
Date : Feb.28-Mar.9, 2010

Reviewed By:
Date : March 10, 2010

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BOREHOLE LOG

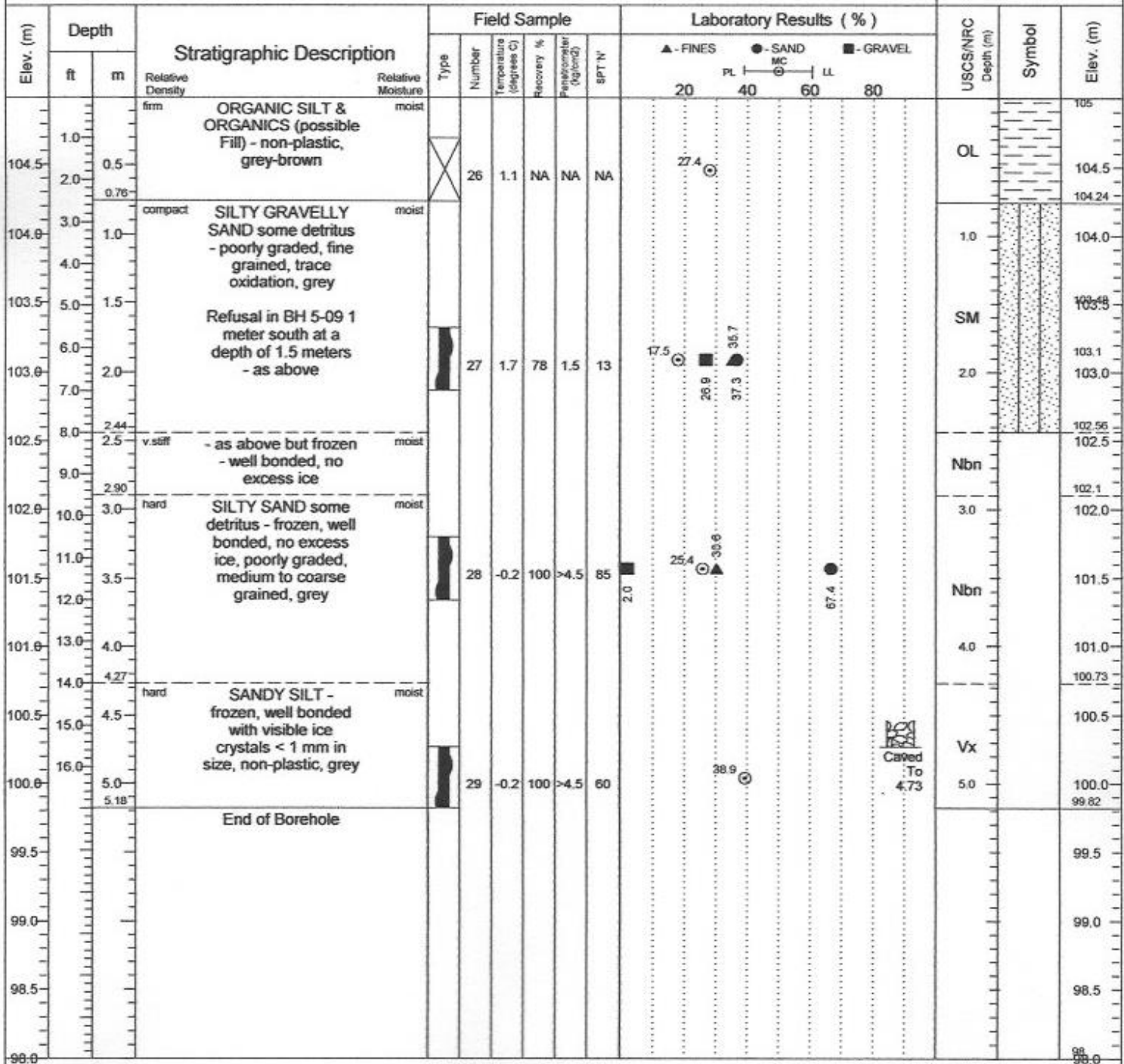
Client : City of Dawson
Location : 7th Avenue - Dawson City, Yukon
Project : Geotechnical Investigation - Proposed Utility Expansion
Date Drilled: Oct.20, 2009

Elevation : 105.0 meters
BH Termination Depth: 5.18 meters
Instrumentation: Monitoring Well
Weather:

BOREHOLE

5-09

Sheet 1 of 2



Drilled By : Donjek Drilling
Drill Type : CME 750 (FN60)

Auger Type : 200 mm Hollow-Stem
Bit Type : Carbide-Button

Water Level(s)
 During Drilling
 After Drilling
 At End of Drilling

Logged By : T.Dhara, P.Eng.
Date : Oct.20, 2009

Data Entry By : T.Dhara, P.Eng.
Date : Feb.28-Mar.9, 2010

Reviewed By:
Date : March 10, 2010

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Appendix C

Recommended Grain Size Distribution for Imported Fill

Gran E Pit Run	
Sieve Size (mm)	% Passing By Wt
200	100
80	75-100
25	55-100
12.5	42-84
5	26-65
1.25	11-47
0.315	3-30
0.08	2-13
LA Abrasion 35 % Max Loss	

80 mm minus Sub-base	
Sieve Size (mm)	% Passing By Wt
80	100
25	60-100
12.5	40-90
5	20-65
1.25	9-35
0.315	3-15
0.08	0-8
LA Abrasion 35 % Max Loss	

Clear Stone	
Sieve Size (mm)	% Passing By Wt
28	100
20	70-100
12.5	55-100
10	30-80
5	0-40
2	0-10
NA	NA
LA Abrasion 35 % Max Loss	

Bedding Sand	
Sieve Size (mm)	% Passing By Wt
10	100
5	80-100
2	55-100
0.63	25-65
0.25	10-40
0.08	2-10

20 mm minus Base Course	
Sieve Size (mm)	% Passing By Wt
20	100
12.5	64-100
5	36-72
1.25	12-42
0.315	4-22
0.08	3-6

Class I Rip-Rap	
Sieve Size (mm)	% Passing By Wt
450	100
350	80
300	50
200	20

Class II Rip-Rap	
Sieve Size (mm)	% Passing By Wt
800	100
600	80
500	50
300	20

Class III Rip-Rap	
Sieve Size (mm)	% Passing By Wt
1200	100
900	80
800	50
500	20