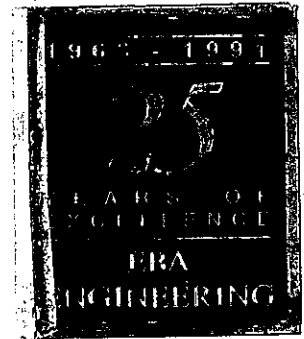


EBA Engineering Consultants Ltd.

Civil, Geotechnical and Materials Engineers



**GRANULAR BORROW INVESTIGATION
SNOWDRIFT AIRPORT
SNOWDRIFT, N.W.T.**

**GRANULAR BORROW INVESTIGATION
SNOWDRIFT AIRPORT
SNOWDRIFT, N.W.T.**

April, 1992

0701-10609

**GRANULAR BORROW INVESTIGATION
SNOWDRIFT AIRPORT
SNOWDRIFT, N.W.T.**

Submitted to:

**GOVERNMENT OF THE NORTHWEST TERRITORIES
DEPARTMENT OF TRANSPORTATION
YELLOWKNIFE, N.W.T.**

Prepared by:

**EBA ENGINEERING CONSULTANTS LTD.
YELLOWKNIFE, N.W.T.**

April, 1992

0701-10609

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1.0 INTRODUCTION

During March, 1992, EBA Engineering Consultants Ltd. (EBA) undertook a granular investigation for the proposed airstrip and access road in the community of Snowdrift, N.W.T. The investigation was at the request of Mr. Mikko Nyyssonen, P.Eng., Geotechnical Engineer, Department of Transportation, Government of the Northwest Territories. The work was carried out under Work Order No. 92002; Contract Agreement No. 295248.

The purpose of the investigation was to identify sufficient quantities of crushable granular material (14,000 cu.m.), embankment fill (30,000 cu.m.) and blend sand (5,000 cu.m.) for the construction of the airstrip and access road, as well as to perform general terrain mapping along the winter haul route from Snowdrift to borrow sources along the Snowdrift River.

2.0 REVIEW OF EXISTING INFORMATION

A preliminary review of existing information was conducted prior to commencement of the field program. Material reviewed consisted of the following (supplied by GNWT Transportation):

- Aerial photos (Roll # A26547, photos #43 to 68, scale 1:20,000)
- Report of Transport Canada gravel search - 1983
- Report of GNWT DPW investigation of Site 6 - 1990
- Report of GNWT Transportation investigation of Site 5 1991
- Report of GNWT Transportation investigation of potential quarry rock sources - 1991
- Topographic map # 75 L/7, scale 1:50,000.
- Specifications for airport surface material

3.0 FIELD WORK

The investigation was undertaken with the understanding that the only available equipment for excavation of test pits would be a Caterpillar D-6 bulldozer operated by the Lutzels Economic Development Corporation in Snowdrift. EBA's field representative was Mr. T.L. Jordan, Senior Technologist. The following is a description of field activities.

3.1 Site 5

Work commenced on March 11, 1992. Test pits were attempted at three locations at Site 5, identified as EBA-1 to EBA-3, on Figure 1, Appendix A. The material encountered was frozen coarse

gravel. The bulldozer was unable to excavate deeper than about 0.1 metre at any of the three locations. Therefore Site 5 was abandoned and the bulldozer was moved to Site 4.

3.2 Site 4

On March 12, test pits were attempted at five locations at Site 4, identified as EBA-4 to EBA-8, on Figure 1, Appendix A. Findings were as follows:

EBA-4: The bulldozer was unable to penetrate the frozen organic material on the surface. No test pit was possible at this location.

EBA-5: At least one metre depth of silty sand, some cobble and gravel, was found at this site. The bulldozer was unable to excavate deeper than 1 metre in the frozen ground.

EBA-6: The bulldozer was able to dig only to a depth of 0.8 metre at this location. Material encountered was similar to that at EBA-5.

EBA-7: Material just below the organic layer was a well-graded clean sand. After excavating to a depth of about 0.1 metre it was discovered that one section of cutting edge had been lost. The investigation in Site 4 was abandoned and field activities were delayed pending delivery of a new cutting edge.

EBA-8: A test pit was attempted at this location prior to EBA-7. The bulldozer was unable to penetrate the frozen organic surface material.

Samples were obtained from EBA-5 and EBA-6 and transported to EBA's Yellowknife laboratory. Washed sieve analyses were performed on these two samples. Results are presented in Appendix B.

3.3 Site 6

The investigation was resumed on March 17, 1992. During March 17th and 18th, the bulldozer travelled up the trail adjacent to the Snowdrift River to Sites 6 and 7. On March 19th, three test pits were excavated at Site 6. These pits are identified as EBA-9 to EBA-11, on Figure 2, Appendix A. A composite sample of the granular material was retrieved from each test pit and sent to EBA's Yellowknife laboratory. Laboratory testing consisted of washed sieve analyses of pitrun, laboratory crushing followed by washed sieve analyses, Los Angeles abrasion tests and fractured face counts. Logs of these test pits and results of laboratory testing are included in Appendix B.

3.4 Site 7

On March 20, 1992, three test pits were excavated at Site 7. These are identified as EBA-12 to EBA-14, on Figure 3, Appendix A. Sampling and testing was the same as for Site 6. Logs of these test pits and results of laboratory testing are included in Appendix B.

4.0 SITE DESCRIPTIONS

4.1 Site 4

Site 4 comprises an area of approximately 300 by 1400 metres to the north of the Snowdrift Airport runway, between the runway and the lower Snowdrift River, which runs from Stark Lake into Great Slave Lake. The area is a flood plain, heavily treed with black spruce. It is bounded on the southeast by the runway and descends in a series of shallow terraces down to muskeg areas along the river on the northwest. The area to the west of Site 4 has been used as a source of limited amounts of borrow material in the past.

4.2 Site 5

Site 5 lies along a narrow ridge extending west from the base of an exposed bedrock knob, comprising an area of approximately 150 by 650 metres. It is southeast of the runway and separated from it by a small pond and muskeg area. The area has been investigated by GNWT Transportation and found to contain sand and gravel to a depth of up to two metres, underlain by permafrost.

4.3 Site 6

Site 6 is located along the west shore of the upper Snowdrift River approximately four kilometres upstream from the entrance to Stark Lake. The site area is a river terrace about three to four metres above the present river level, and about 7000 square metres in area. It is lightly treed with jackpine. Site 6 was found to contain excellent quality gravel with some sand and cobble to a depth of at least 2.5 metres. It is surrounded to the south, east and west by higher terraces composing part of a much larger glacial wash deposit containing gravelly sand to a similar depth.

4.4 Site 7

Site 7 is a gravel bar slightly higher than the present river level. The total area of the gravel bar is in excess of 100,000 square metres. Except for a small island within the downstream end of the bar, it has virtually no vegetation. The extended area researched upstream along the left bank of the river is fairly heavily treed with jackpine. Previous investigations had found cobbly gravel to a depth of at least 1.5 metres in the gravel bar itself. The island and the left bank were found to contain one metre depth of excellent quality gravel with slightly more cobble than at Site 6.

5.0 DISCUSSION

5.1 Overland Route

An area map showing the route and all four borrow sites is presented in Figure 4, Appendix A. The alignment of the route shown on this map was taken from a survey traverse performed by Mr. Wayne Nesbitt of GNWT Department of Public Works, for the section from Station 2+000 to 8+000, and from aerial photos for the remainder of the route.

Appendix C of this report contains a narrative description of the terrain encountered along the route to Sites 6 and 7, including information about soils and vegetation. Locations of photographs are noted. The photographs are included in Appendix D.

5.2 Sites 4 and 5

Due to the difficulties encountered in attempting to excavate test pits in Sites 4 and 5, we were unable to prove quantities of material in these areas. It is recommended that a backhoe be hired during the summer months to investigate these sites.

From the limited information acquired at Site 4, it appears probable that sufficient blend material does exist. Results of gradation tests on samples from locations EBA-5 and EBA-6 indicate that the material is suitable for blending with crushed rock to produce a suitable surface material. However both test pits contained about 20% of gravel, to a maximum size of 60 mm.

5.3 Site 6

Previous quantity estimates for Site 6 (GNWT-1990) have assumed a gravel thickness of 1.5 metres. Based on results of the present investigation it is reasonable to assume a depth of 2.5 metres

over the area previously proven. Also, stripping losses can be reduced by limiting stripping to the organic peat and tree roots, leaving in place as much as possible of the silt which overlies the gravel. This silt will mix with the gravel during handling and processing, bringing up the quantity of fines in the product.

Assuming 7000 square metres at a depth of 2.5 metres results in an estimated volume of 17,500 cubic metres minus 700 cubic metres organic overburden, or 16,800 cubic metres proven. The test pit at EBA-11 indicates that the material in the upper terrace surrounding Site 6 contains a greater percentage of gravel sizes than was previously assumed. Therefore it is probable that Site 6 and the region around it contain considerably more material that can be made suitable by crushing and/or screening.

5.4 Site 7

Excavation of the main gravel bar at Site 7 proved to be impossible with the bulldozer at this time of year. Because of this, test pits were attempted on the island at the downstream end of the bar and on the left shore upstream of the gravel bar, with a view to extending knowledge of the deposit to a greater area.

EBA-12, on the island, indicated at least one metre thickness of crushable granular material underlain by frozen saturated gravel of undetermined depth. Results of test pitting at EBA-13 and EBA-14 indicate a thickness of about one metre of granular material overlain by from 0.2 to 1.2 metres of silt and silty sand.

Previous reports have not given a quantity estimate for Site 7, but have assumed a depth of 1.5 metres of recoverable material. Assuming a usable area of 20,000 square metres, this results in a proven volume of approximately 30,000 cubic metres, in excess of project requirements. The present investigation indicates that probably a much larger quantity of crushable material is available, considering the extended area investigated.

Transport Canada's 1983 report indicated that material would be hauled for the most part over ice roads on the river and lake. From this point of view they concluded that there was little difference between Sites 6 and 7, aside from the slightly greater distance to Site 7 and slightly more cobble-sized material at Site 7, and they recommended that Site 7 be used as the borrow source.

We understand that current plans are for an overland route. Access from this route to the source at Site 7 is longer and more

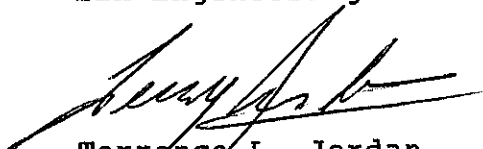
difficult and would require more construction than the corresponding access to Site 6. Also, the shallower depth of material at Site 7 would result in the disturbance of a greater area (up to 10,000 square metres) in order to recover the required quantity.

We understand that Site 7 is a popular berry picking and fishing site for the community of Snowdrift. For these reasons it would be prudent to consider community attitudes and plans prior to making a final decision on choice of sites. Either site contains sufficient material of superior hardness which can be processed to provide surfacing material for the runway and access road.

6.0 CLOSURE

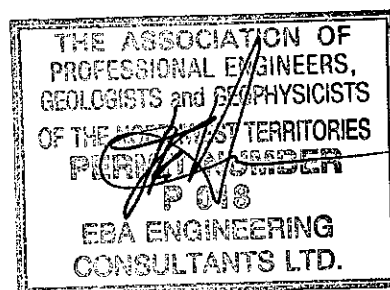
We trust that you will find this report sufficient to your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
EBA Engineering Consultants Ltd.



Terrence L. Jordan
Senior Technologist

Reviewed by

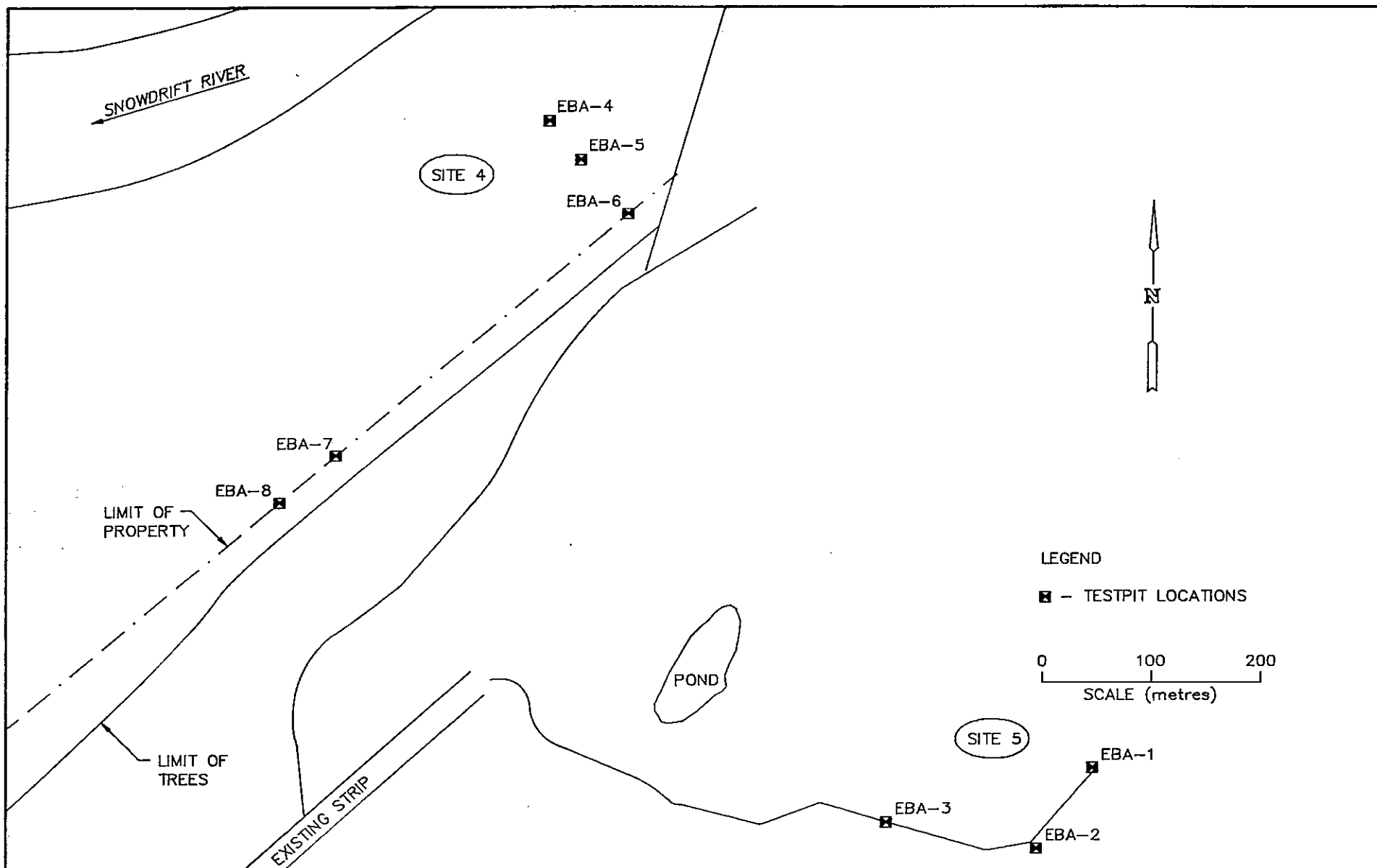


MAY 01, 1992

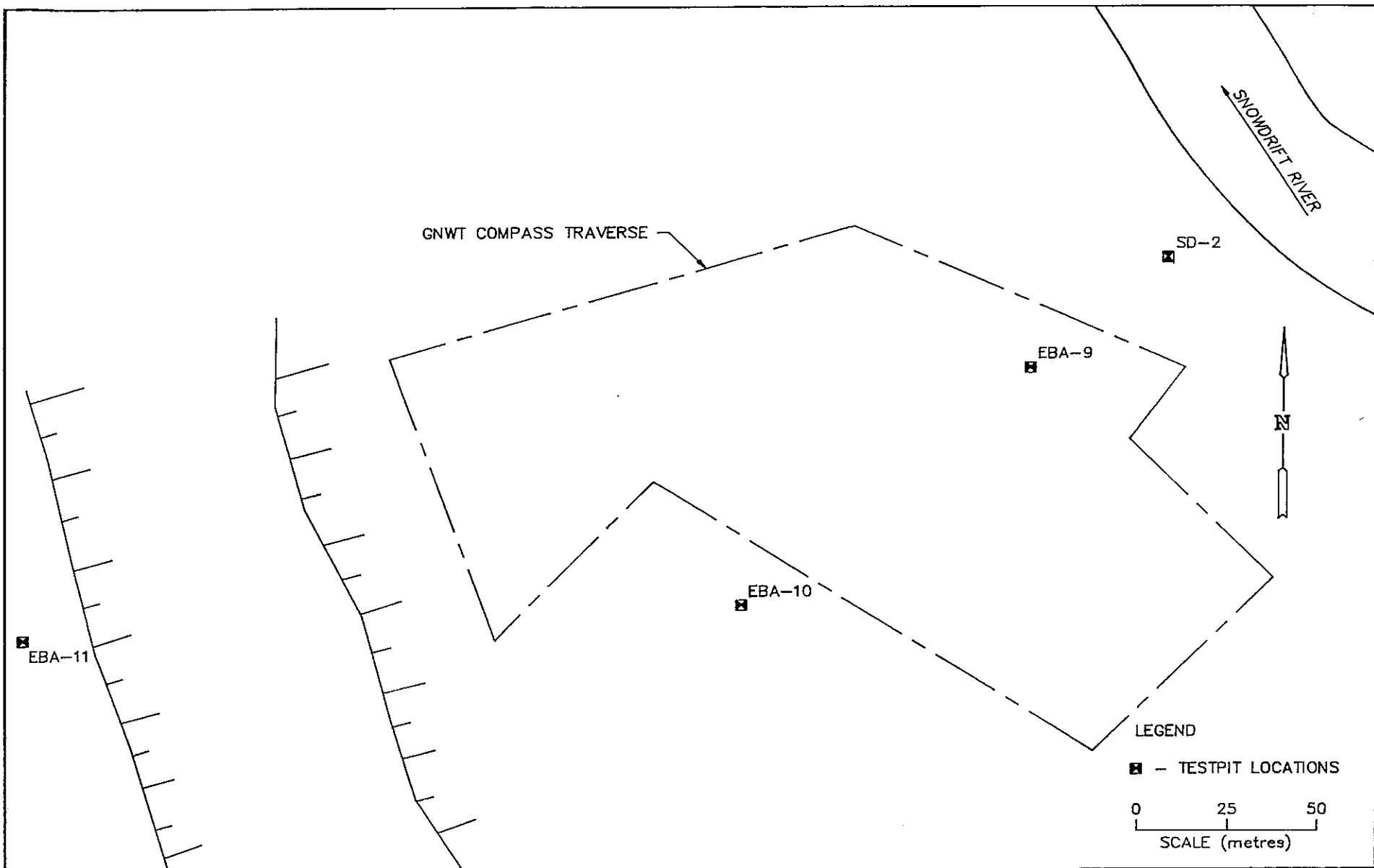
T.E. Hoeve, P. Eng.
Senior Project Engineer

TLJ/tlj/10609.snd

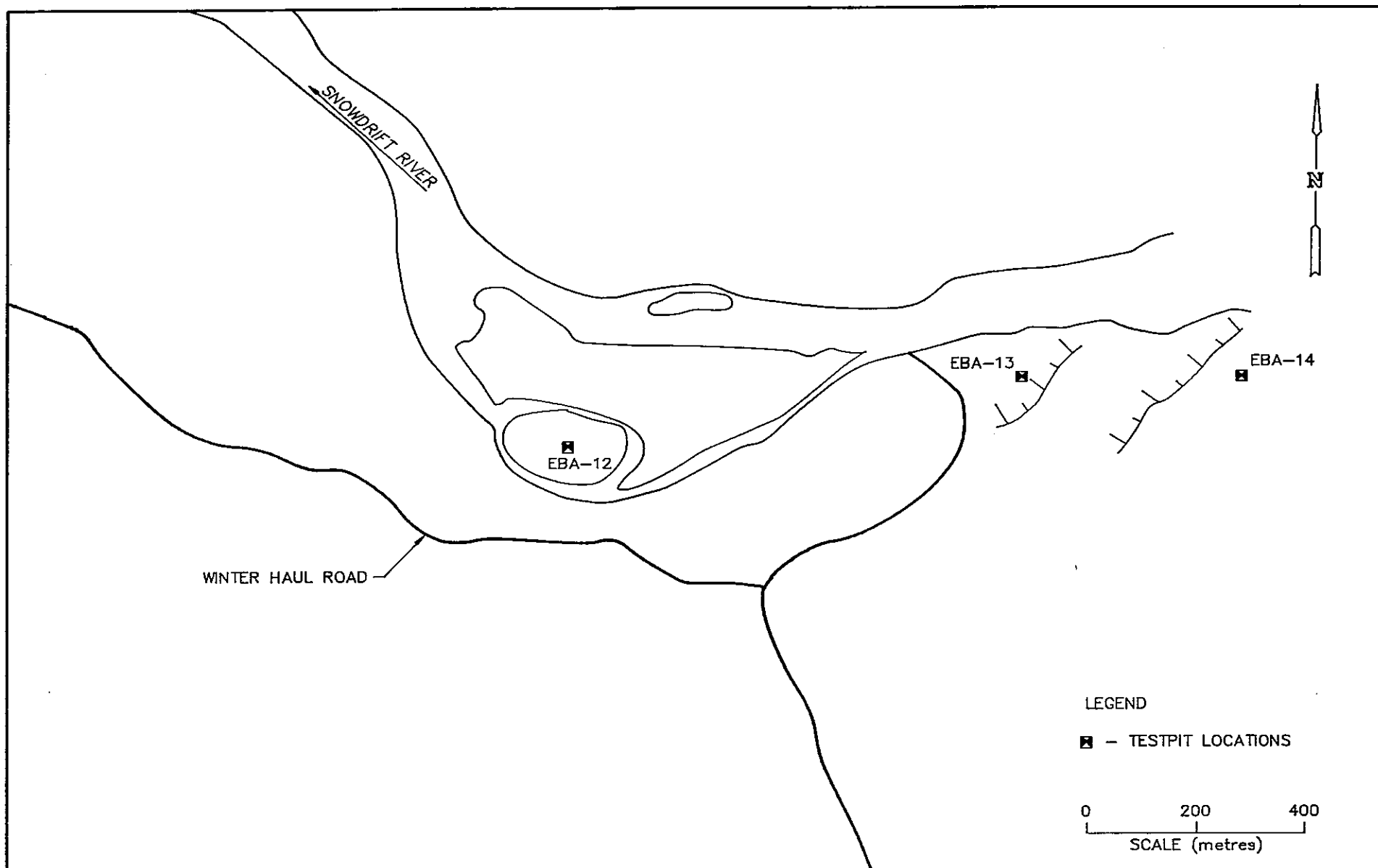
APPENDIX A
FIGURES



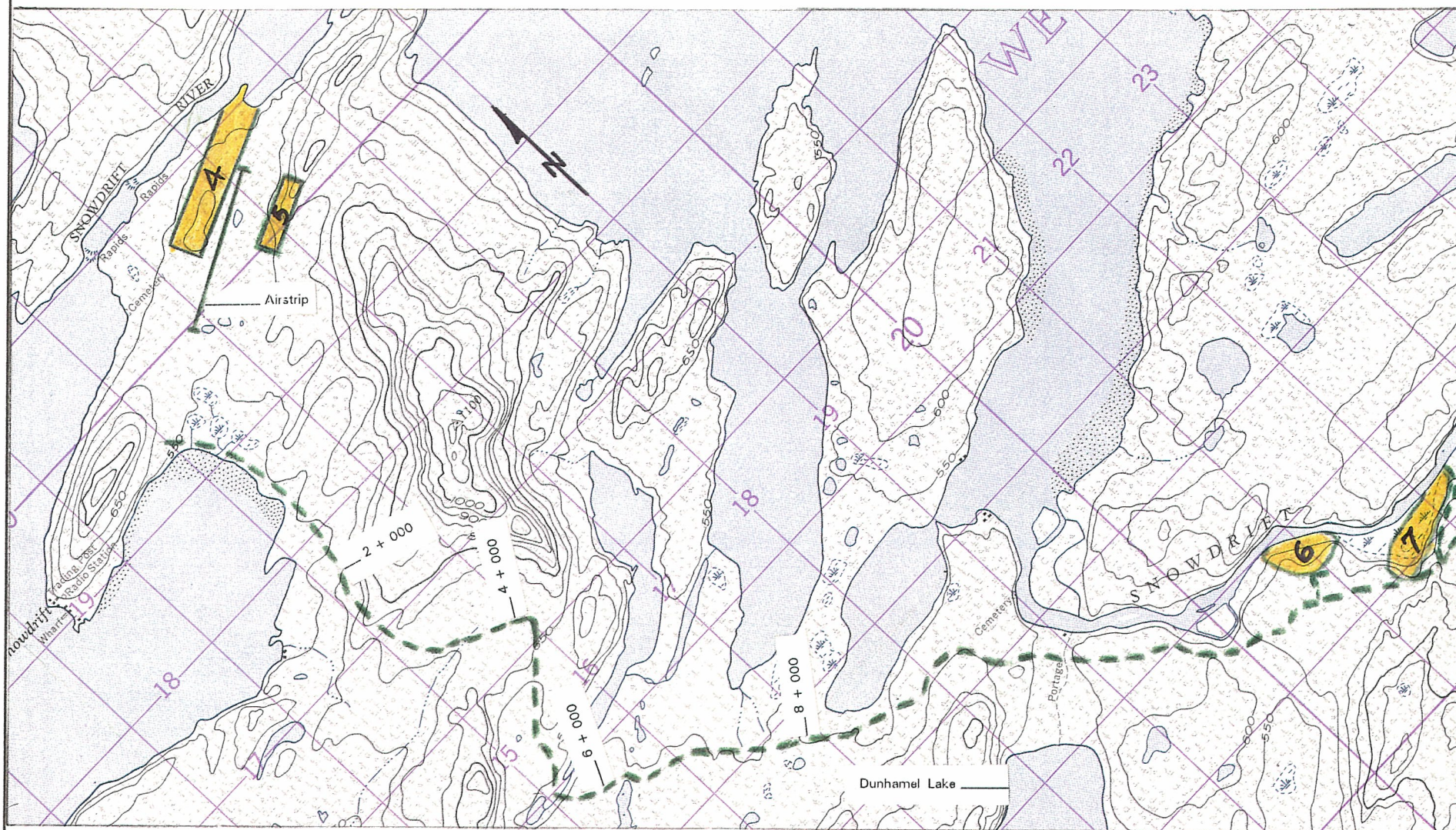
EBA Engineering Consultants Ltd.					PROJECT SNOWDRIFT GRANULAR INVESTIGATION SNOWDRIFT, N.W.T.		
CLIENT GOVERNMENT OF THE NORTHWEST TERRITORIES TRANSPORTATION DEPARTMENT					TITLE SITES 4 & 5 SITE PLAN AND TESTPIT LOCATIONS		
DATE	92-04-13	DWN.	WMG	CHKD.	TLJ	FILE NO.	10609001
						FIGURE 1	



<i>EBA Engineering Consultants Ltd.</i>				PROJECT	SNOWDRIFT GRANULAR INVESTIGATION SNOWDRIFT, N.W.T.	
CLIENT GOVERNMENT OF THE NORTHWEST TERRITORIES TRANSPORTATION DEPARTMENT				TITLE	SITE 6 SITE PLAN AND TESTPIT LOCATIONS	
DATE	92-04-13	DWN.	WMG	CHKD.	TLJ	FILE NO. 10609003
						FIGURE 2



EBA Engineering Consultants Ltd.				PROJECT SNOWDRIFT GRANULAR INVESTIGATION SNOWDRIFT, N.W.T.	
CLIENT GOVERNMENT OF THE NORTHWEST TERRITORIES TRANSPORTATION DEPARTMENT				TITLE SITE 7 SITE PLAN AND TESTPIT LOCATIONS	
DATE	92-04-13	DWN.	WMG	CHKD.	TLJ
FILE NO.		10609002			FIGURE 3



EBA Engineering Consultants Ltd.

PROJECT

SNOWDRIFT GRANULAR INVESTIGATION
SNOWDRIFT, N.W.T.

CLIENT

**GOVERNMENT OF THE
NORTHWEST TERRITORIES
TRANSPORTATION DEPARTMENT**

TITLE

**AREA MAP
SHOWING
BORROW SITES AND ROUTE**

DATE

92-04-13

DWN.

WMG

CHKD.

TLJ

FILE NO.

0701-10609

FIGURE 4

APPENDIX B
TEST PIT LOGS
AND
RESULTS OF LABORATORY TESTING

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 to 20%	0 to 4
Loose	20 to 40%	4 to 10
Compact	40 to 75%	10 to 30
Dense	75 to 90%	30 to 50
Very Dense	90 to 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (kPa)
Very Soft	Less Than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater Than 400

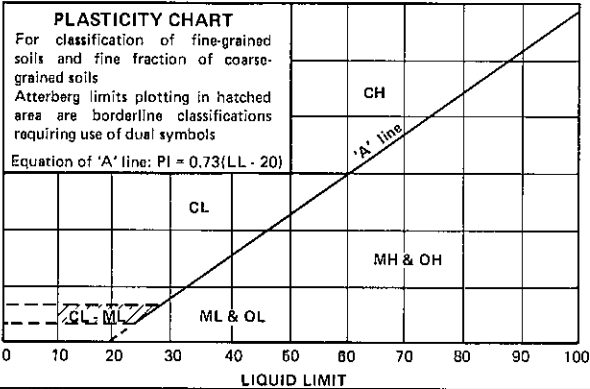
NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated	- composed of thin layers of varying colour and texture.
Interbedded	- composed of alternate layers of different soil types.
Calcareous	- containing appreciable quantities of calcium carbonate.
Well Graded	- having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded	- predominantly of one grain size, or having a range of sizes with some intermediate size missing.



UNIFIED SOIL CLASSIFICATION†

MAJOR DIVISIONS			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	Classification on basis of percentage of fines GW, GP, SW, SP GM, GC, SM, SC Borderline classification requiring use of dual symbols	$C_u = D_{60}/D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3					
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW					
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols				
			GC	Clayey gravels, gravel-sand clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7					
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3					
			SP	Poorly-graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW					
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols				
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7					
FINE-GRAINED SOILS 50% or more passes No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	60 50 40 30 20 10 4 0 PLASTICITY INDEX	<div>PLASTICITY CHART</div> <div>For classification of fine-grained soils and fine fraction of coarse-grained soils</div> <div>Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols</div> <div>Equation of 'A' line: $PI = 0.73(LL - 20)$</div> 						
		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								
	SILTS AND CLAYS Liquid limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts								
		CH	Inorganic clay of high plasticity, fat clays								
		OH	Organic clays of medium to high plasticity								
	HIGHLY ORGANIC SOILS		PT					Peat, muck and other highly organic soils	*Based on the material passing the 3 in. (75 mm) sieve †ASTM Designation D 2487, for identification procedure see D 2488		

GROUND ICE DESCRIPTION

ICE NOT VISIBLE

GROUP SYMBOLS	SYMBOLS	SUBGROUP DESCRIPTION	
N	Nf	Poorly-bonded or friable	
	Nbn	No excess ice, well-bonded	
	Nbe	Excess ice, well-bonded	

NOTE:

- Dual symbols are used to indicate borderline or mixed ice classifications
- Visual estimates of ice contents indicated on borehole logs $\pm 5\%$
- This system of ground ice description has been modified from NRC Technical Memo 79, Guide to the Field Description of Permafrost for Engineering Purposes

LEGEND

Soil Ice

VISIBLE ICE LESS THAN 50% BY VOLUME

GROUP SYMBOLS	SYMBOLS	SUBGROUP DESCRIPTION	
V	Vx	Individual ice crystals or inclusions	
	Vc	Ice coatings on particles	
	Vr	Random or irregularly oriented ice formations	
	Vs	Stratified or distinctly oriented ice formations	

VISIBLE ICE GREATER THAN 50% BY VOLUME

ICE	ICE + Soil Type		
	ICE		
		Ice with soil inclusions	
		Ice without soil inclusions (greater than 25 mm (1 in.) thick)	

SNOWDRIFT GRANULAR INVESTIGATION			TESTPITS DUG WITH D-6 BULLDOZER			TESTPIT No: 10609-EBA09				
GNWT TRANSPORTATION						Project No: 0701-10609				
LUTSEL K'E DEVELOPMENT CORPORATION			UTM ZONE: 12 N6911690.00 E521130.00			ELEVATION: 0.00 (m)				
SAMPLE TYPE			DISTURBED							
DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOIL DESCRIPTION	▲ D-50 (mm) ▲ 20 40 60 80 ■ SILT (%) ■ 20 40 60 80 ◆ SAND (%) ◆ 20 40 60 80 ● GRAVEL (%) ● 20 40 60 80				USC SOIL SYMBOLS	DEPTH (m)
0.0				GRAVEL (GW), sandy, some cobble subangular, clean maximum size 150 mm						0.0
1.0		1								1.0
2.0				End of testpit 1.8 m. Bottom of gravel layer not encountered						2.0
3.0										3.0
4.0										4.0
5.0										5.0

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Yellowknife, N.W.T.

COMPLETION DEPTH: 1.8 m

LOGGED BY: TLJ

COMPLETE:

FIG No: 10609-2

Page 1 of 1

SHOWDRIFT GRANULAR INVESTIGATION		TESTPITS DUG WITH D-6 BULLDOZER		TESTPIT No: 10609-EBA10	
GNWT TRANSPORTATION				Project No: 0701-10609	
LUTSEL K'E DEVELOPMENT CORPORATION		UTM ZONE: 12 N6911630.00 E521050.00		ELEVATION: 0.00 (m)	
SAMPLE TYPE <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> DISTURBED <input type="checkbox"/>					

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOIL DESCRIPTION	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> ▲ D-50 (mm) ▲ ■ SILT (%) ■ ◆ SAND (%) ◆ ● GRAVEL (%) ● </div> <div style="display: flex; justify-content: space-between; font-size: 0.7em;"> 20 40 60 80 20 40 60 80 20 40 60 80 20 40 60 80 </div>				USC	SOIL SYMBOL	DEPTH (m)
0.0				SILT (ML), light brown, frozen					ML		0.0
				GRAVEL (GW), fine to med, and SAND some cobble subangular, clean maximum size 100 mm					GW		
-1.0											-1.0
-2.0											-2.0
-3.0				End of testpit 2.5 m Bottom of gravel layer not encountered							-3.0
-4.0											-4.0
-5.0											-5.0

EBA Engineering Consultants Ltd. Yellowknife, N.W.T.		COMPLETION DEPTH: 2.5 m		COMPLETE:	
		LOGGED BY: TLJ	FIG No: 10609-10	Page 1 of 1	

SNOWDRIFT GRANULAR INVESTIGATION			TESTPITS DUG WITH D-8 BULLDOZER			TESTPIT No: 10609-EBA11				
GNWT TRANSPORTATION						Project No: 0701-10609				
LUTSEL K'E DEVELOPMENT CORPORATION			UTM ZONE: 12 N6911610.00 E520850.00			ELEVATION: 0.00 (m)				
SAMPLE TYPE			<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOIL DESCRIPTION	▲ D-50 (mm) ▲ 20 40 60 80 ■ SILT (%) ■ 20 40 60 80 ◆ SAND (%) ◆ 20 40 60 80 ● GRAVEL (%) ● 20 40 60 80				SOIL SYMBOL	DEPTH (m)
0.0				SILT (ML), light brown, frozen					ML	0.0
				SAND (SW), and GRAVEL, fine subangular, clean maximum size 40 mm					SW	
-1.0										-1.0
-2.0										-2.0
-3.0				CLAY (CL), brown, frozen End of testpit 2.7 m						-3.0
-4.0										-4.0
-5.0										-5.0

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COMPLETION DEPTH: 2.7 m

LOGGED BY: TLJ

COMPLETE:

FIG No: 10609-11

Page 1 of 1

SNOWDRIFT GRANULAR INVESTIGATION		TESTPITS DUG WITH D-9 BULLDOZER		TESTPIT No: 10609-EBA12	
GNWT TRANSPORTATION				Project No: 0701-10609	
LUTSEL K'E DEVELOPMENT CORPORATION		UTM ZONE: 12 N6911180.00 E521680.00		ELEVATION: 0.00 (m)	
SAMPLE TYPE <input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/> DISTURBED <input type="checkbox"/>	

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOIL DESCRIPTION	USC				SOIL SYMBOL	DEPTH (m)
					▲ D-50 (mm) ▲ 20 40 60 80					
					■ SILT (%) ■ 20 40 60 80					
					◆ SAND (%) ◆ 20 40 60 80					
					● GRAVEL (%) ● 20 40 60 80					
0.0				GRAVEL (GW), some cobble some sand trace silt subangular maximum size 200 mm						0.0
		1								
1.0				End of testpit 1.0 m. Frozen gravel Bottom of gravel layer not encountered						1.0
2.0										2.0
3.0										3.0
4.0										4.0
5.0										5.0

EBA Engineering Consultants Ltd. Yellowknife, N.W.T.		COMPLETION DEPTH: 1.0 m		COMPLETE:	
		LOGGED BY: TLJ	FIG No: 10609-12	Page 1 of 1	

SNOWDRIFT GRANULAR INVESTIGATION			TESTPITS DUG WITH D-6 BULLDOZER			TESTPIT No: 10609-EBA13					
GNWT TRANSPORTATION						Project No: 0701-10609					
LUTSEL K'E DEVELOPMENT CORPORATION			UTM ZONE: 12 N6911300.00 E522530.00			ELEVATION: 0.00 (m)					
SAMPLE TYPE			DISTURBED								
DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOIL DESCRIPTION	▲ D-50 (mm) ▲ 20 40 60 80 ■ SILT (%) ■ 20 40 60 80 ◆ SAND (%) ◆ 20 40 60 80 ● GRAVEL (%) ● 20 40 60 80				USC	SOIL SYMBOL	DEPTH (m)
0.0				PEAT (Pt), and SILT light brown frozen					Pt		0.0
				GRAVEL (GW), some cobble some sand trace silt subangular maximum size 200 mm					GW		1.0
				CLAY (CL), frozen End of testpit 1.5 m							2.0
											3.0
											4.0
											5.0

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COMPLETION DEPTH: 1.5 m

COMPLETE:

LOGGED BY: TLJ

FIG No: 10609-13

Page 1 of 1

SNOWDRIFT GRANULAR INVESTIGATION			TESTPIT DUG WITH D-9 BULLDOZER			TESTPIT No: 10609-EBA14			
GNWT TRANSPORTATION						Project No: 0701-10609			
LUTSEL K'E DEVELOPMENT CORPORATION			UTM ZONE: 12 N6911300.00 E522930.00			ELEVATION: 0.00 (m)			
SAMPLE TYPE			<input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			DISTURBED			
DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SPT(N)	SOIL DESCRIPTION		▲ D-50 (mm) ▲ 20 40 60 80 ■ SILT (%) ■ 20 40 60 80 ◆ SAND (%) ◆ 20 40 60 80 ● GRAVEL (%) ● 20 40 60 80	USC	SOIL SYMBOL	DEPTH (m)
0.0				SILT (ML) and SAND, fine light brown frozen					0.0
1.0									1.0
2.0		1		GRAVEL (GW), some cobble some sand trace silt maximum size 40 mm subangular median size 2 mm		▲ ■ ◆ ●	GW		2.0
3.0				SAND (SP), silty saturated free water entering testpit End of testpit 2.30 m.					3.0
4.0									4.0
5.0									5.0

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COMPLETION DEPTH: 2.3 m	COMPLETE:
LOGGED BY: TLJ	FIG No: 10609-14
Page 1 of 1	

Date: 1992 04 08

LABORATORY TEST RESULT SUMMARY

PROJECT TITLE: SNOWDRIFT GRANULAR INVESTIGATION

AREA	TESTPIT	GRAVEL (%)	SAND (%)	FINES (%)	CRUSH COUNT (%)	L.A ABR. (%)
Site #7	14	67.0	33.0	0.4		
Crush Sieve		64.0	35.0	1.1	68.0	16.0
Site #7	13	74.0	25.0	1.4		
Crush Sieve		66.0	32.0	2.0	80.0	17.0
Site #7	12	69.0	30.0	1.3		
Crush Sieve		65.0	33.0	2.0	80.0	16.0
Site #6	11	28.0	72.0	0.3		
Crush Sieve		31.0	69.0	0.5	20.0	***
Site #6	10	47.0	52.0	0.8		
Crush Sieve		54.0	45.0	1.2	58.0	17.0
Site #6	9	65.0	34.0	1.0		
Crush Sieve		56.0	43.0	1.5	67.0	17.0
Site #4	6	21.0	59.0	20.0		
Site #4	5	21.0	61.0	18.0		

*** Insufficient sample size



GRAIN SIZE CURVES

DEPARTMENT OF TRANSPORTATION

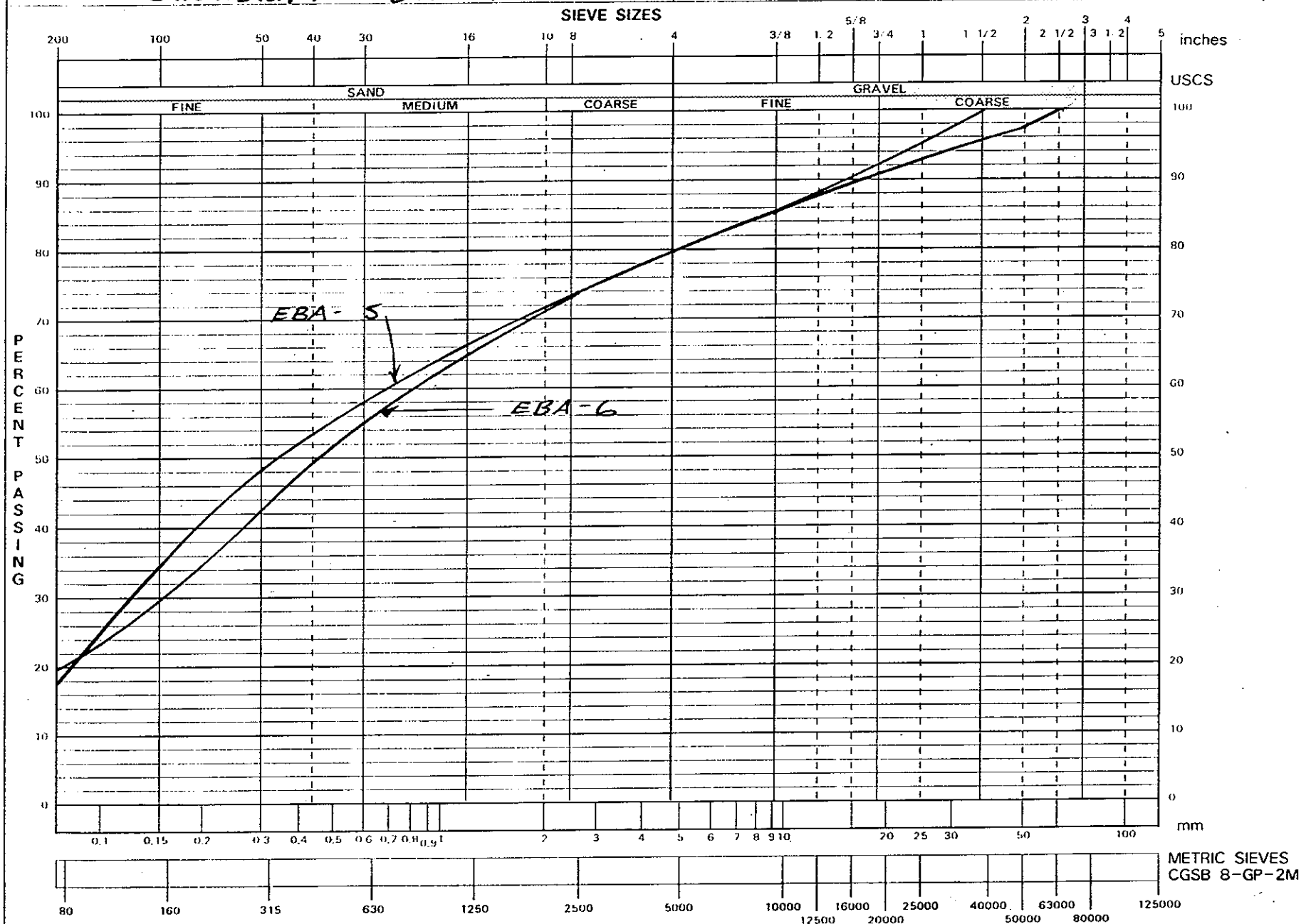
SAMPLE IDENTIFICATION

SNOWDRIFT SITE 4

LAB NUMBER

TESTED BY

BR EBA ENG



D₁₀

D₃₀

D₆₀

C_u

C_c



GRAIN SIZE CURVES

DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION

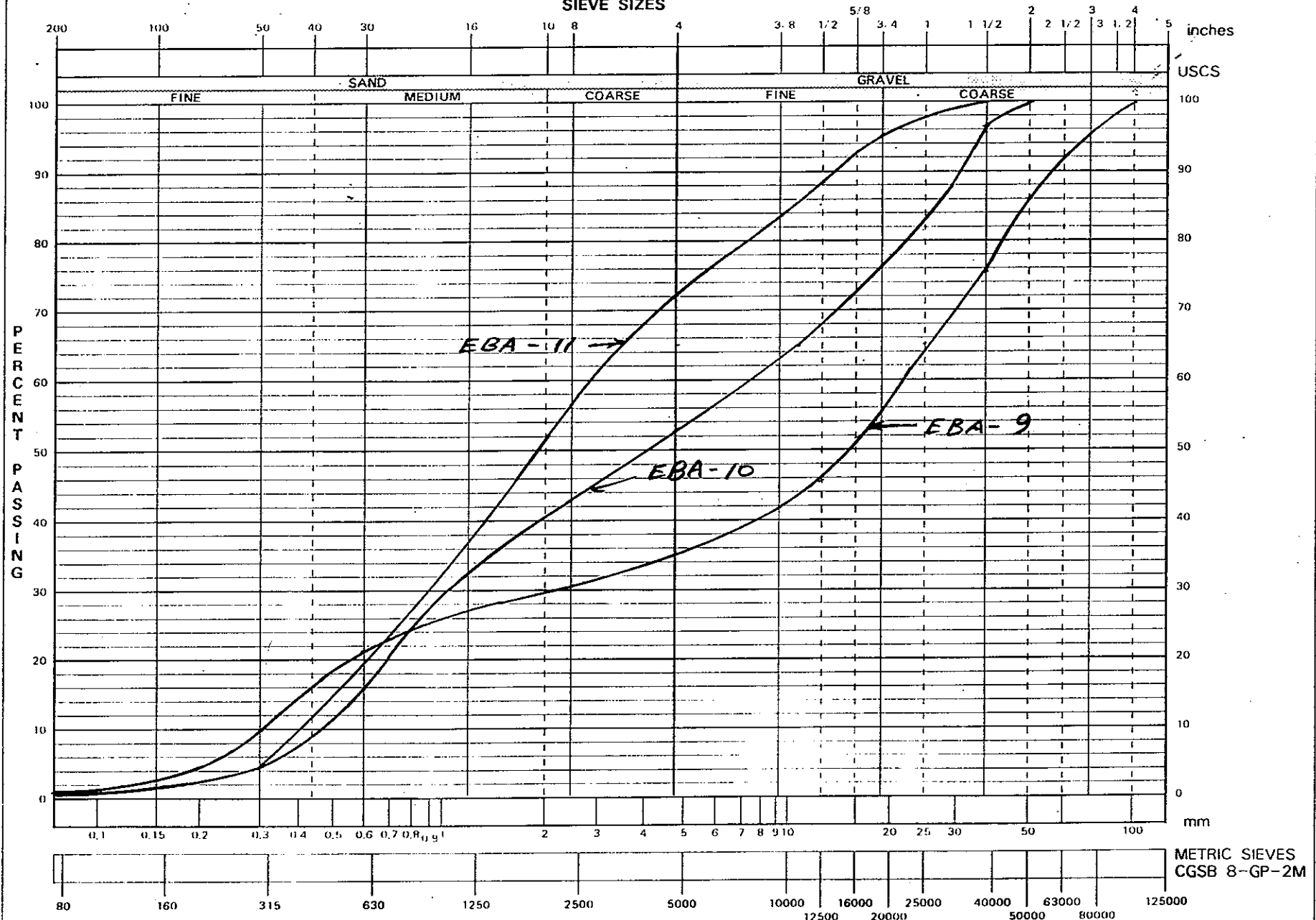
SNOWDRIFT SITE 6

LAB NUMBER

TESTED BY

BR EBA ENG

SIEVE SIZES



METRIC SIEVES
CGSB 8-GP-2M

D₁₀

D₃₀

D₆₀

C_u

C_c



GRAIN SIZE CURVES

DEPARTMENT OF TRANSPORTATION

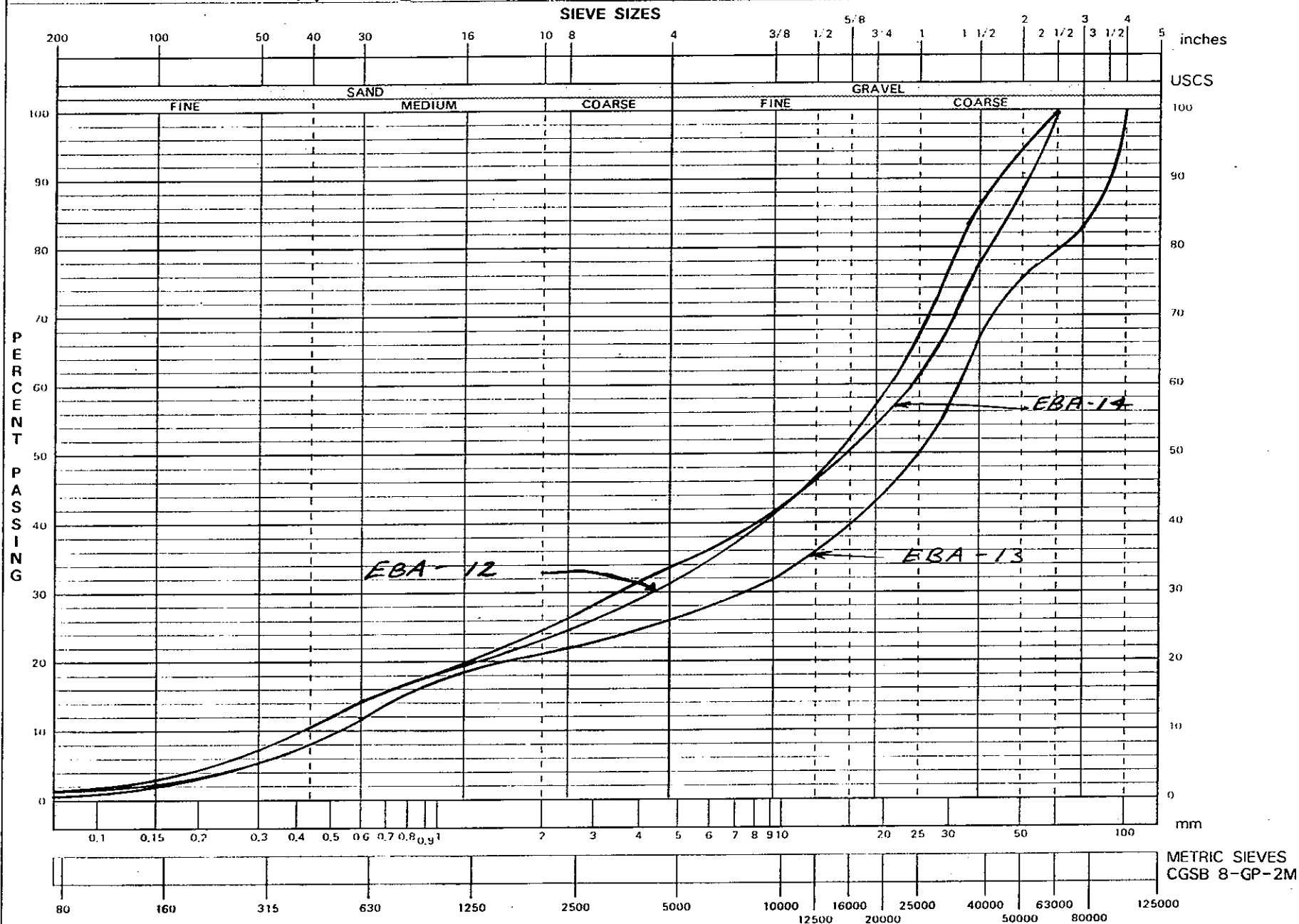
SAMPLE IDENTIFICATION

SNOWDRIFT SITE 7

LAB NUMBER

TESTED BY

BR EBA ENG



D₁₀

D₃₀

D₆₀

C_u

C_c



GRAIN SIZE CURVES

DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION

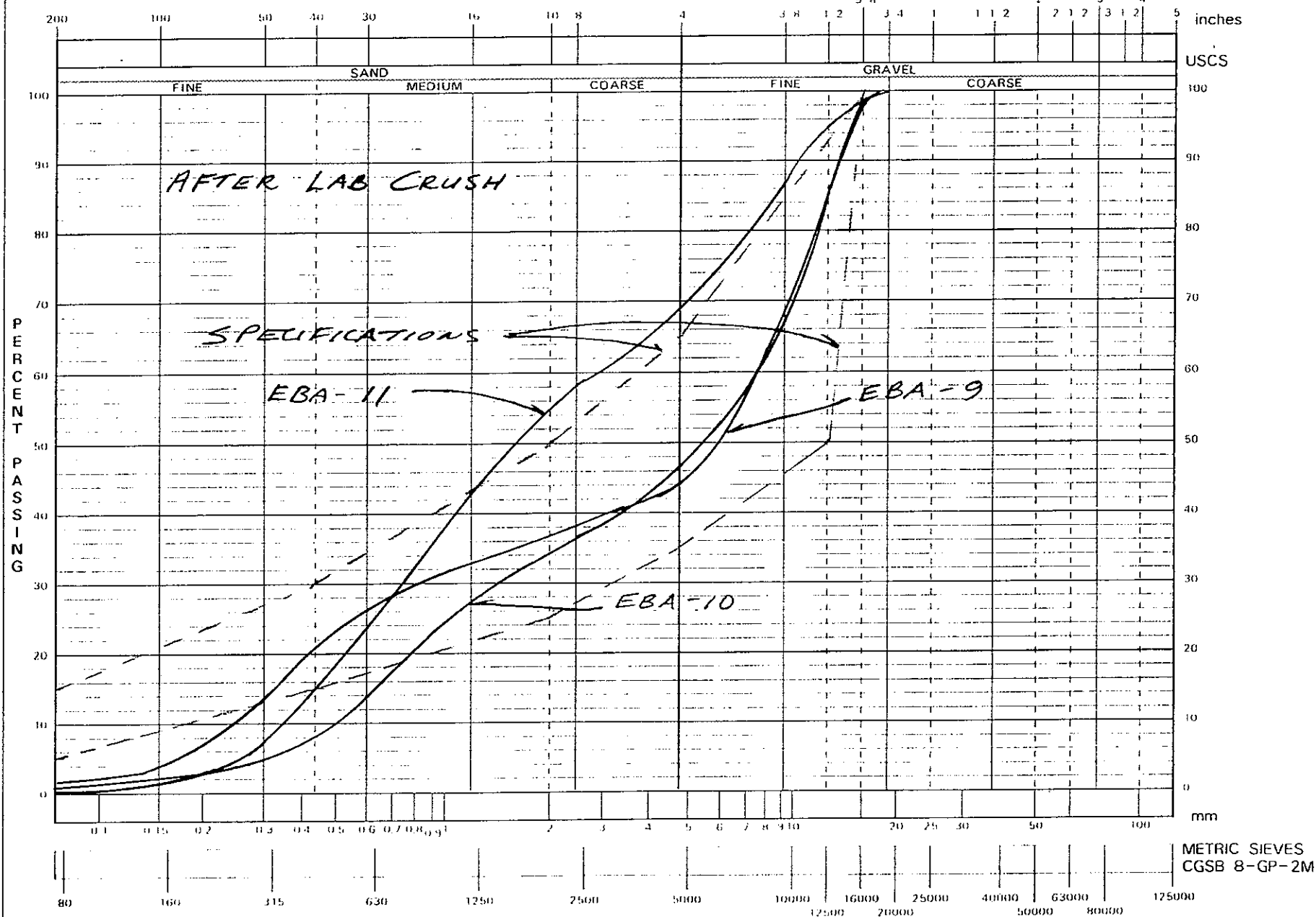
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LAB NUMBER

TESTED BY

BR EBA ENG

SIEVE SIZES



METRIC SIEVES
CGSB 8-GP-2M

D₁₀

D₃₀

D₆₀

C_u

C_c



GRAIN SIZE CURVES

DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION

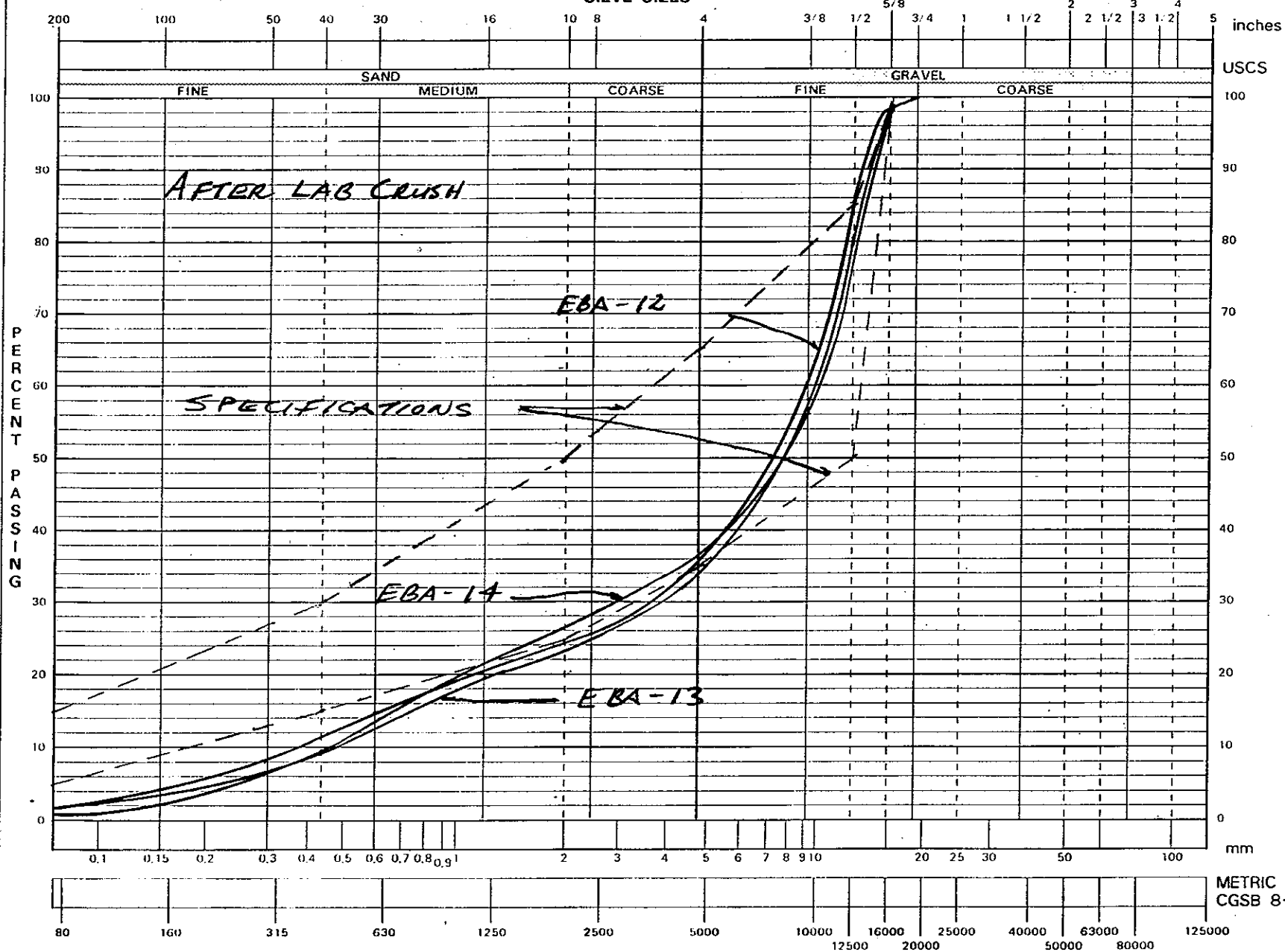
SNOWDRIFT SITE 7

LAB NUMBER

TESTED BY

BR EBA ENG

SIEVE SIZES



D₁₀

D₃₀

D₆₀

C_u

C_c

APPENDIX C
DESCRIPTION OF OVERLAND ROUTE

Snowdrift River Route (From T. Jordan's field notes March 18 - 19, 1992)

LOCATION	ROUTE DESCRIPTION	VEGETATION & SOILS	PHOTO
Turn-off from air- port road 0+000	Route around lake is a flat lacustrine plain. After photo #1, rises gently about 2% to steep hill, about 8%. Then gradually rising at 1% for 200 m to steep hill (10% for about 30 m, then turning right about 4% grade for about 100m. 200 m long grade, average 4%, numerous local steepenings. Then down hill about 3% for 100 m, then flat to left turn. Flat for 400 m. Rising about 1% for 600 m.	Thick spruce to 10 m high.	# 1 , look- ing N # 2 look- ing N # 3 , look- ing S
Traverse point #24 3+111	Sharp bend to right at high point, then descending at 3% for 100 m, then 8% for 100m.	Exposed shale on surface at summit. Trees a bit thinner, some tamarack. Black spruce to 4 m high.	# 4 , look- ing S
4+420	40 m high escarpment to right of road. Descending 1% for 600 m, then flat for 270 m. Descending 2% for 80 m to left turn, then descending 2% for 80 m to steep dip (about 1 m deep). Twisting for 50 m, while climbing to high point, then descending at 2% for 80 m.	Very thin peat cover over lt brown lacustrine silty clay.	# 5 , look- ing N
5+554	Turn right. Undulating, rough,	Beside lake on left.	

Traverse
point #42
5+714

Turn right, then sharp
left, cross creek, then
climbing at 4% for 50 m,
then 8% for 50 m.
Curving to left, climbing
1% or less for 300m. We
looped right (off the
trail) to climb up onto
shale ridge.

Lake on right

Stopped for tea
beside lake on right

Turn right, flat with
occasional rising grade
for 750 m, then turning
to right, flat with
occasional descent for
600 m.

Sparse black spruce
to 3 m.

Rising 5% for 100 m, then
steeply over sandstone
ridge about 1.5 m high,
then descending at 2% for
100 m, then undulating
for 500m.

Old burn area.

6 ,
look-
ing N

Nearly flat for 600 m.
Left turn, due east, flat
for 600 m. Turn right,
climb 1% for 100 m, then
4% for 100 m onto sand-
stone ridge, then right,
descending 4% for 50 m,
then flat, turning right.

Thick spruce to 4 m,
some birch to 5 m.
Bay on left side.

Rising ground to
right of road.

Dead flat, due south for
300 m, then turn left,
descending 4% for 100 m,
then flat for 250 m.

Thick jackpine to 6
m high.

7 ,
look-
ing W

Portage
trail.

Drop through old river
course, about 60 m wide.
Banks about 6%. N bank
1.5 m high, S bank 2.0 m
high.

Coarse angular and
subangular sand in
bank material.
Dozer cleared trail
to cabin on river
for fuel pickup.

Approximately flat for 100 m, then climbing 6% for 70 m, then flat for 80 m. Looping right to climb up on dune ridge, then flat for 80 m, then dip and short steep climb (8%) out of dip. Then generally flat with some undulations for 200 m.

Steep short climb onto sandstone ridge, then flat with occasional climbing grade for 300 m.

Turn right, then dead flat for 200 m.

Curve left for 300 m, dead flat, then descending 2 to 3% and slight meandering for 300 m, then dead flat, meandering for 600 m.

Short steep dip down at 8%, then undulating but generally descending, including one sharp dip through old water course about 1 m deep.

Still meandering about 600 m, then sharp rise onto dune edge, about 1.5 m high, then undulating and meandering 1 km through numerous apparent dune ripples.

Thick jackpine all the way from portage trail.

4 m high ridge adjacent to road on right, sloping down to road.

Thick black spruce to 8 m, some birch to 6 m.

Almost no peat cover over lacustrine silty clay, some fine sand.

Thick jackpine to 6 m.

Very thin peat cover over fine-medium silty sand.

Sand, fine-medium, angular, clean, may be glacial wash followed by some dune action, but well-graded.

Turn off
trail to
gain access
to
area 6.

(About due east,
dead flat about 500
m to river bank.
Trail down to river
is about 300 m at
8%, with some steeper
descents, then
about 300 m dead
flat.)

8 ,
look-
ing
SW

Back on
main trail
at turn-
off to
area 6

Rough undulation, then
climbing 8% for 20 m,
then flat and curving to
right, minor undulations
in curve.

End of jackpine.

Fairly thick black
spruce to 6 m. Peat
cover thicker (about
100 mm).

Flat for 1 km, then curve
left, then 700 m flat,
curve left, 100 m, then
right, slight rise onto
jackpine ridge. Parallel
river bank about 200 m,
then swing left to
descend at 5% for 200 m,
then mainly flat paral-
lelling river bank look-
ing for way down.

Dense black spruce
to 5 m.

Generally descending at
3% for 200 m to point
where trail turns south-
east. We turn north and
continue to descend at 8%
for 300 m. Then turn
left, climb over hump and
continue down at 6% for
200 m to swamp, then
flat, curving left around
bedrock ridge, then
downstream along shore-
bound ice about 1 km to
gravel bar (area 7)

Area 7

APPENDIX D
PHOTOGRAPHS



PHOTO #1 Looking north toward Snowdrift Airport, approx. sta. 1+000.
(Neg # 3A)



PHOTO #2 View looking north from approx. sta. 2+000. Snowdrift community
is on extreme left, across lake. (Neg # 4A)



PHOTO # 3 View looking south from station: 2 + 400 (Neg # 5A)



PHOTO # 4 View looking south from summit near station 4 + 100. (Neg # 6A)



PHOTO #5

View looking north from sta 5 + 300 (Neg # 7A)



PHOTO # 6

View looking north from approximately station 8 + 300 (Neg # 8A)



PHOTO #7

View looking west along E-W section north of Duhamel Lake. (Neg # 9A)



PHOTO #8

View looking South-east along sandy area between Duhamel Lake and Snowdrift River. (Neg # 10A)

Test pit EBA 9
Site 6
(Neg # 14A)



(Neg # 15A)

Test pit EBA 10
Site 6
(Neg #18A)



(Neg #17A)

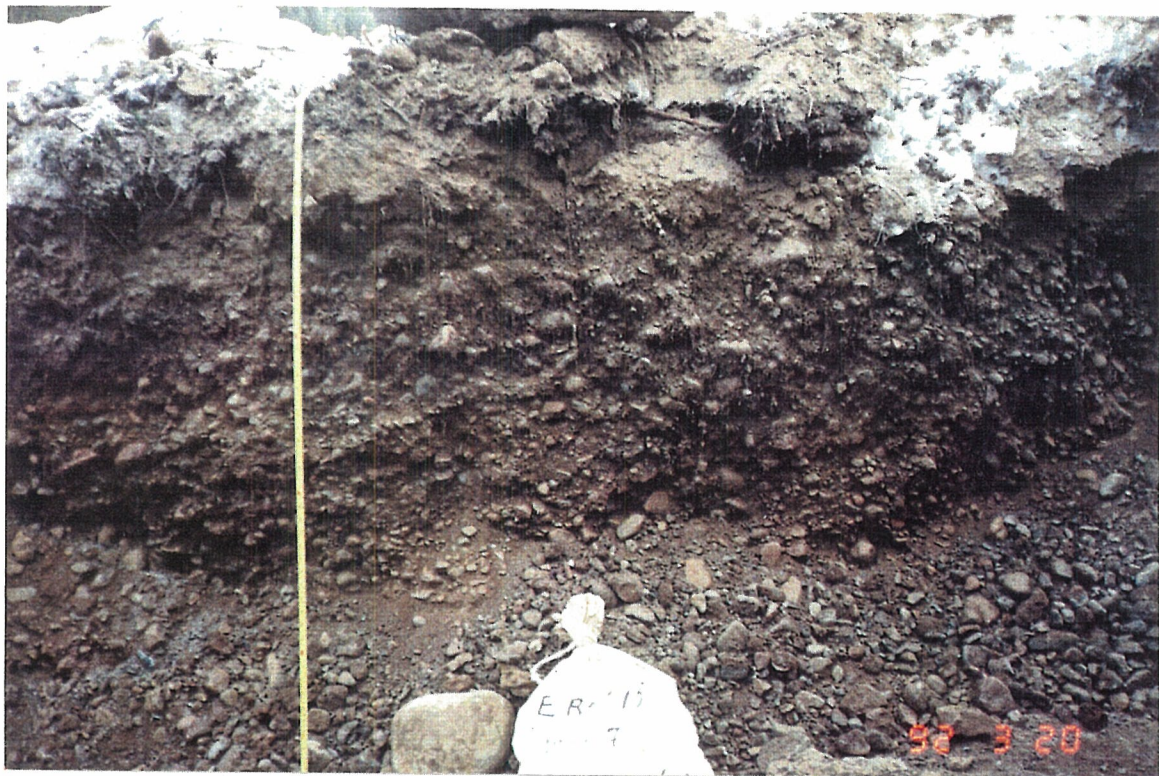




Test Pit EBA 11, Site 6. (Neg #20A)



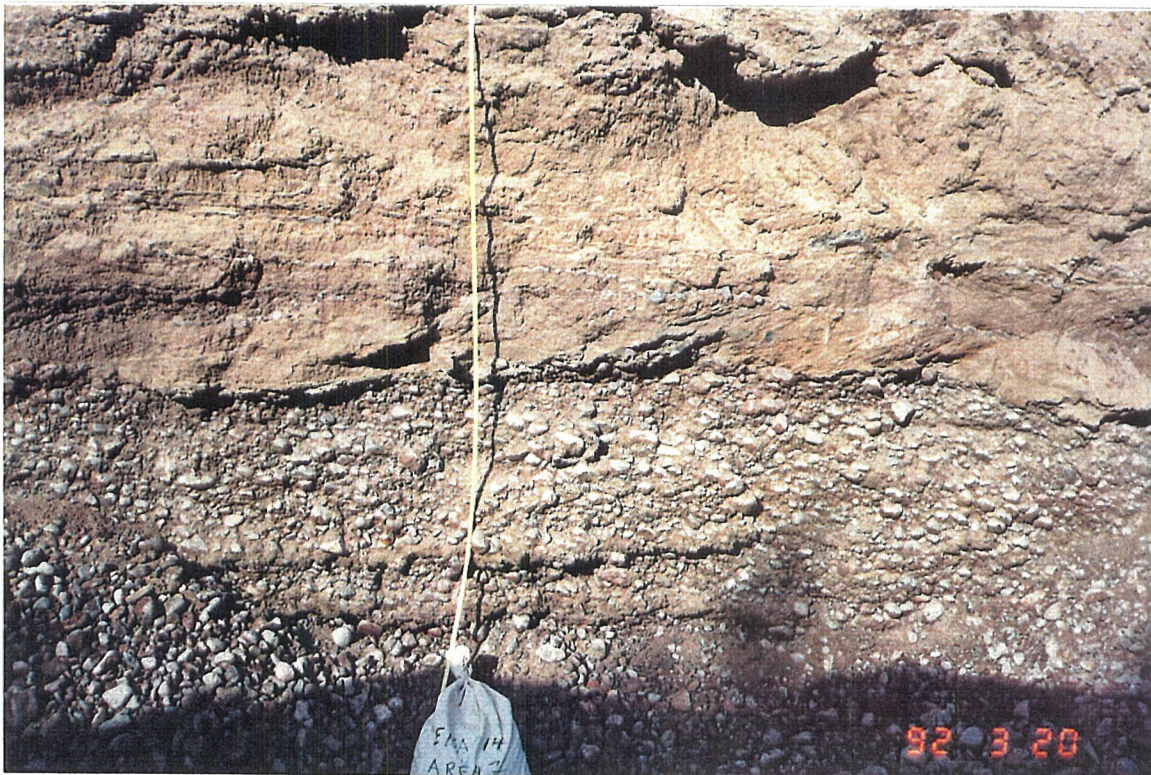
Test Pit EBA 13, Site 7. (Neg #00)



(Neg #24A)



Test Pit EBA 14, Site 7. (Neg #1)



(Neg #0)