



7505 - 40 Street SE
Calgary, Alberta T2C 2H5
Telephone: (403) 236-8880

Grain Size Distribution

Project Nanisivik Drilling Job # 0255-006-07
Client BGC Engineering Inc.
Job # 22-099-11-1 Description
Date Sampled Rec'd Oct. 23/ 02
Date Tested Oct. 25/ 02

Test Hole # BGC02-06
Depth 48ft.

Remarks

Sample # 3

K Values For Use In Computing

Diameter Of Grain Sizes Are

Estimated

Gravel 0.0%
Sand 4.3%
Silt 95.7%
Clay 0.0%

Natural Water Content

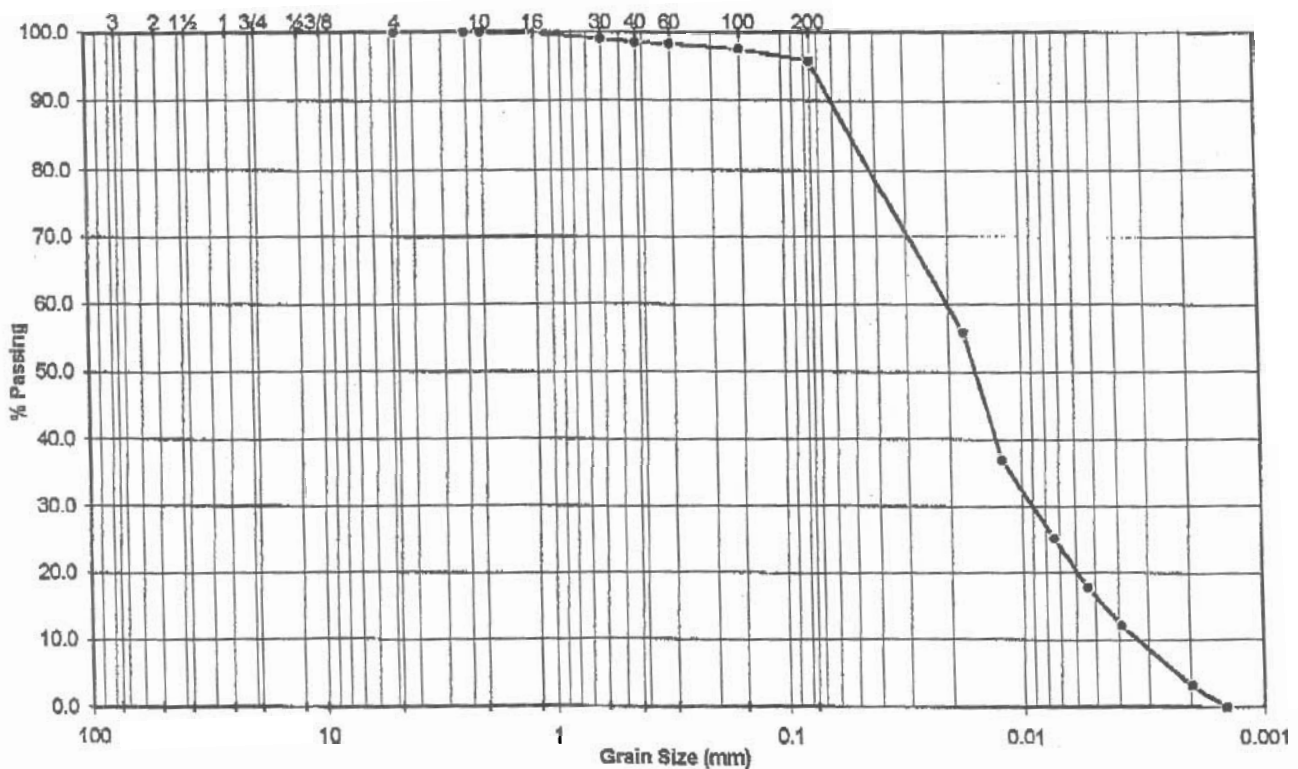
Liquid Limit

Plastic Limit

Plasticity Index

Specific Gravity 4.10

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		





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Grain Size Distribution

Project Nanisivik Drilling Job # 0255-006-07

Client BGC Engineering Inc.

Job # 22-099-11-1

Description

Test Hole # BGC02- 08

Depth 10ft.

Date Sampled Rec'd Oct. 23/ 02

Date Tested Oct. 25/ 02

Remarks

Sample # 4

K Values For Use In Computing

Diameter Of Grain Sizes Are

Estimated

Gravel 0.0%

Sand 5.3%

Silt 92.7%

Clay 2.0%

Natural Water Content

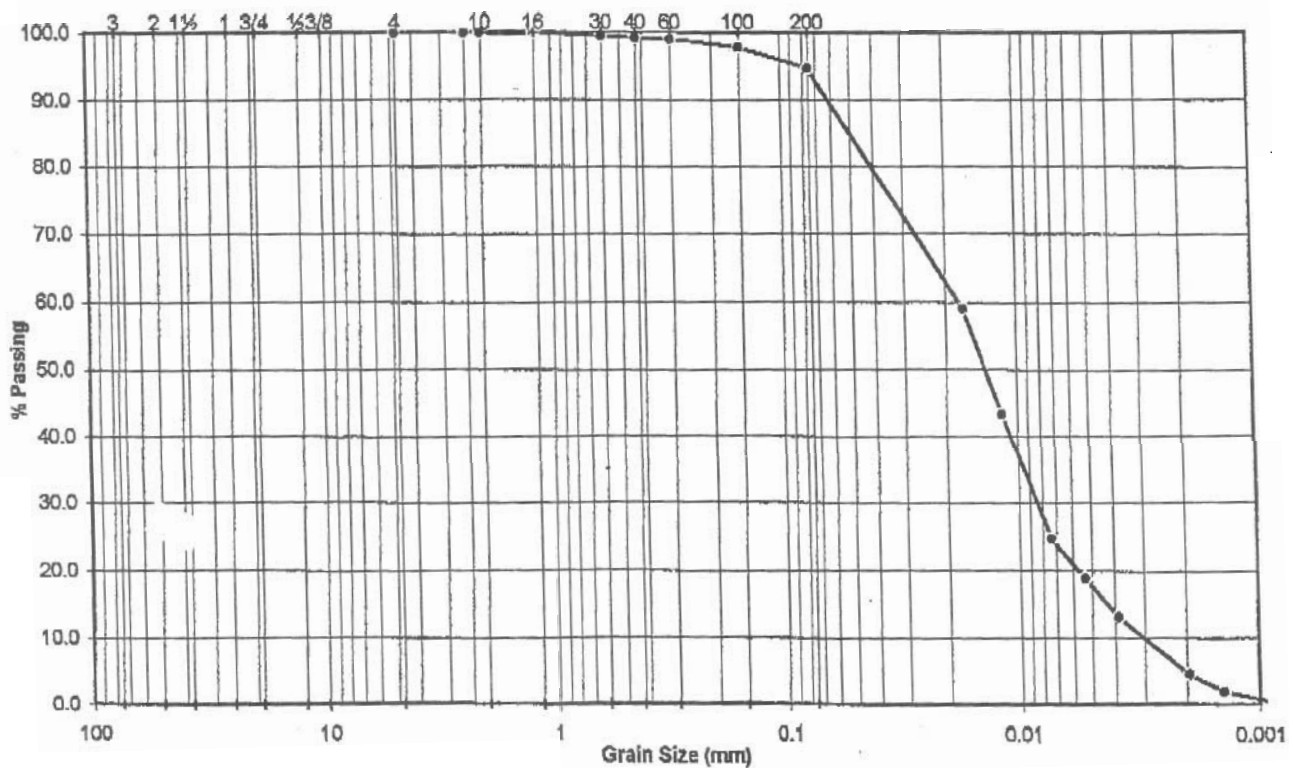
Liquid Limit

Plastic Limit

Plasticity Index

Specific Gravity 4.14

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		





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Grain Size Distribution

Project Nanisivik Drilling Job # 0255-006-07
Client BGC Engineering Inc.
Job # 22-099-11-1
Date Sampled Rec'd Oct. 23/ 02
Date Tested Oct. 28/ 02

Test Hole # BGC02-11
Depth 20ft.

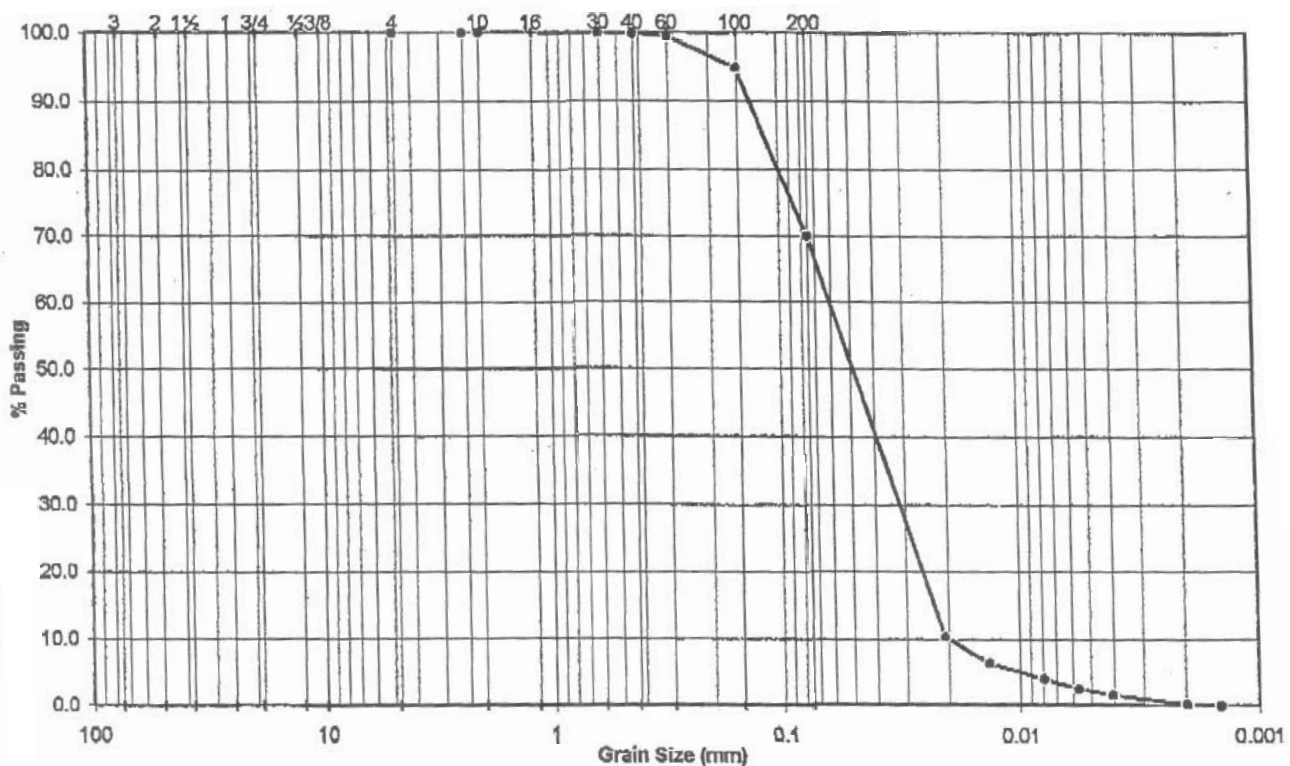
Description

Remarks
Sample # 5
K Values For Use In Computing
Diameter Of Grain Sizes Are
Estimated

Gravel 0.0%
Sand 30.1%
Silt 69.9%
Clay 0.0%

Natural Water Content
Liquid Limit
Plastic Limit
Plasticity Index
Specific Gravity 4.15

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		





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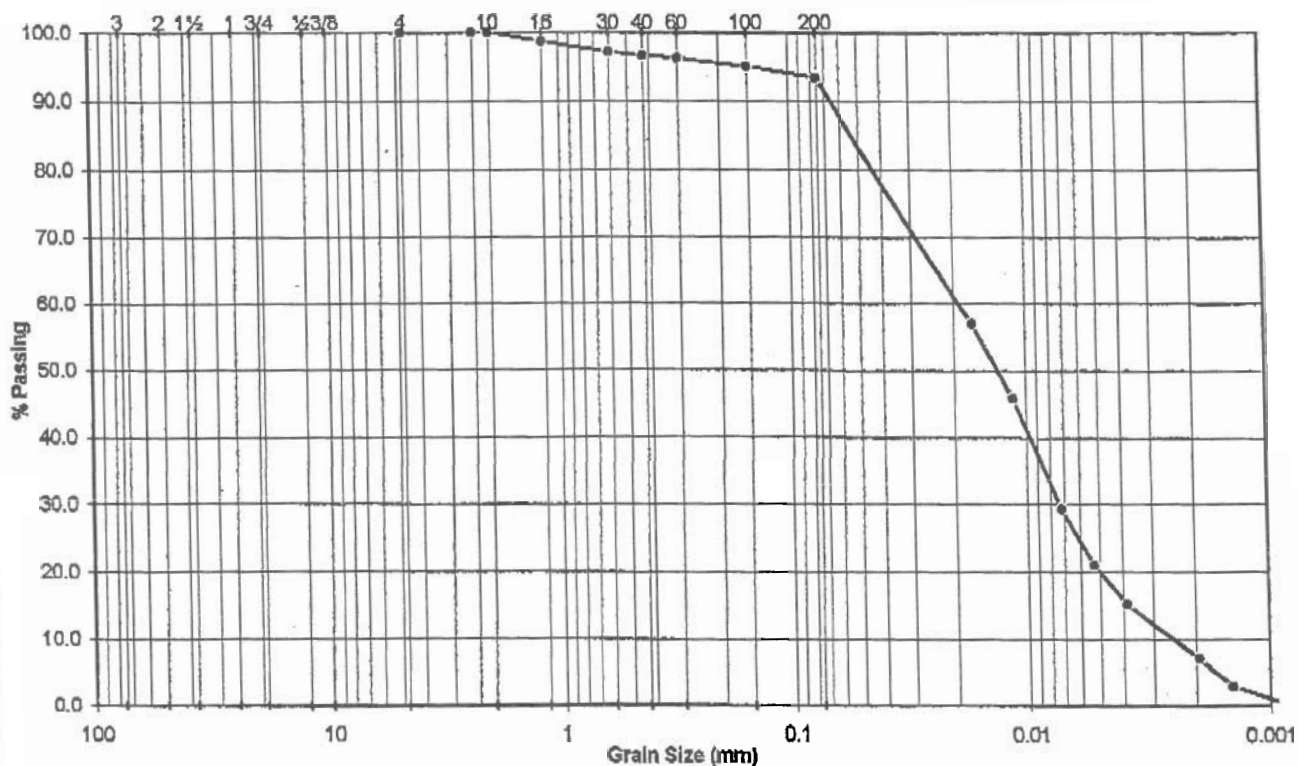
Grain Size Distribution

Project Nanisivik Drilling Job # 0255-006-07
Client BGC Engineering Inc.
Job # 22-099-11-1 Description
Date Sampled Rec'd Oct. 23/ 02
Date Tested Oct. 28/ 02

Test Hole # BGC02-11
Depth 31ft.

Remarks Sample # 6 K Values For Use In Computing Diameter Of Grain Sizes Are Estimated	Gravel	0.0%	Natural Water Content	
	Sand	6.6%	Liquid Limit	
	Silt	90.4%	Plastic Limit	
	Clay	3.0%	Plasticity Index	
			Specific Gravity	3.99

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		





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Grain Size Distribution

Project Nanisivik Drilling Job # 0255-006-07
Client BGC Engineering Inc.
Job # 22-099-011-1
Date Sampled Rec'd Oct. 23/ 02
Date Tested Oct. 28/ 02

Test Hole # BGC02-12
Depth 79ft.

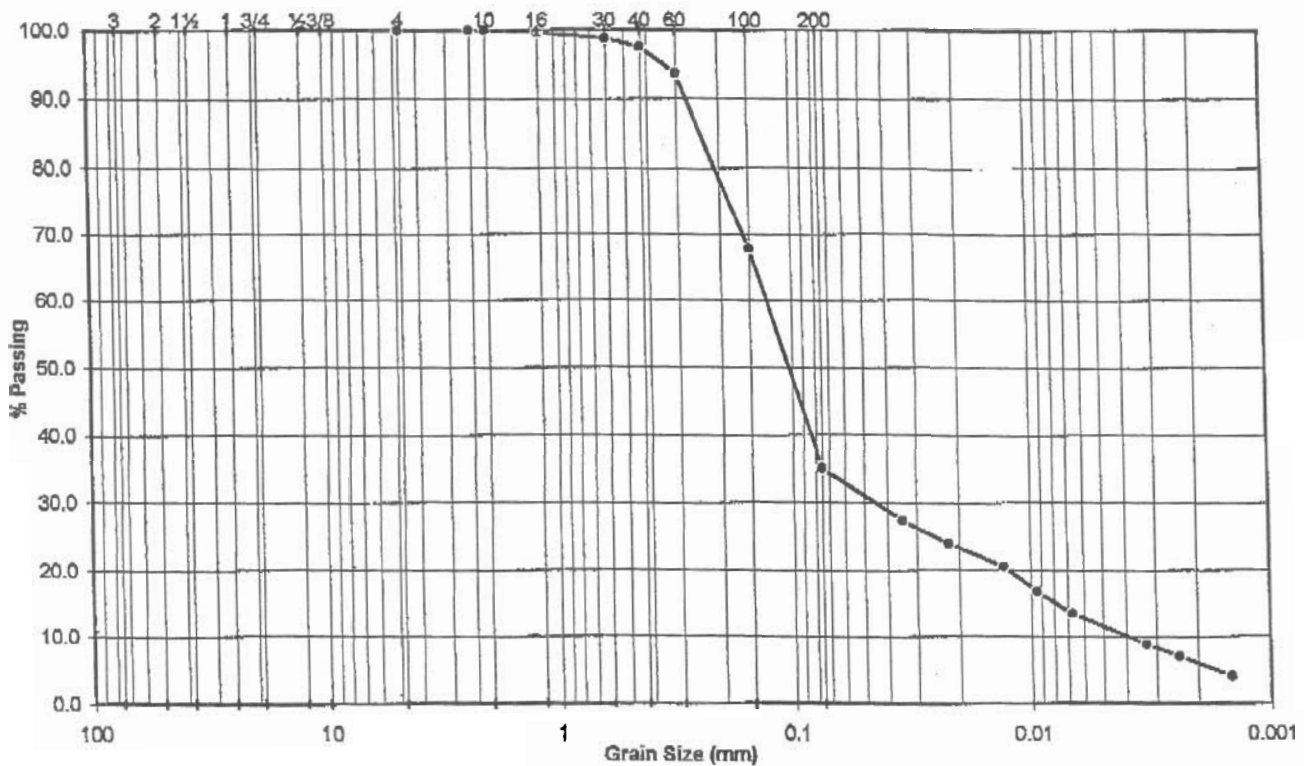
Description

Remarks
Sample # 8

Gravel 0.0%
Sand 64.8%
Silt 28.1%
Clay 7.1%

Natural Water Content
Liquid Limit
Plastic Limit
Plasticity Index
Specific Gravity 2.69

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		



Grain Size Distribution

Project	Nanisivik Drilling	Job # 0255-006-07	
Client	BGC Engineering Inc.		
Job #	22-099-11-1		Description
Date Sampled	Rec'd Oct. 23/ 02		
Date Tested	Oct. 28/ 02		

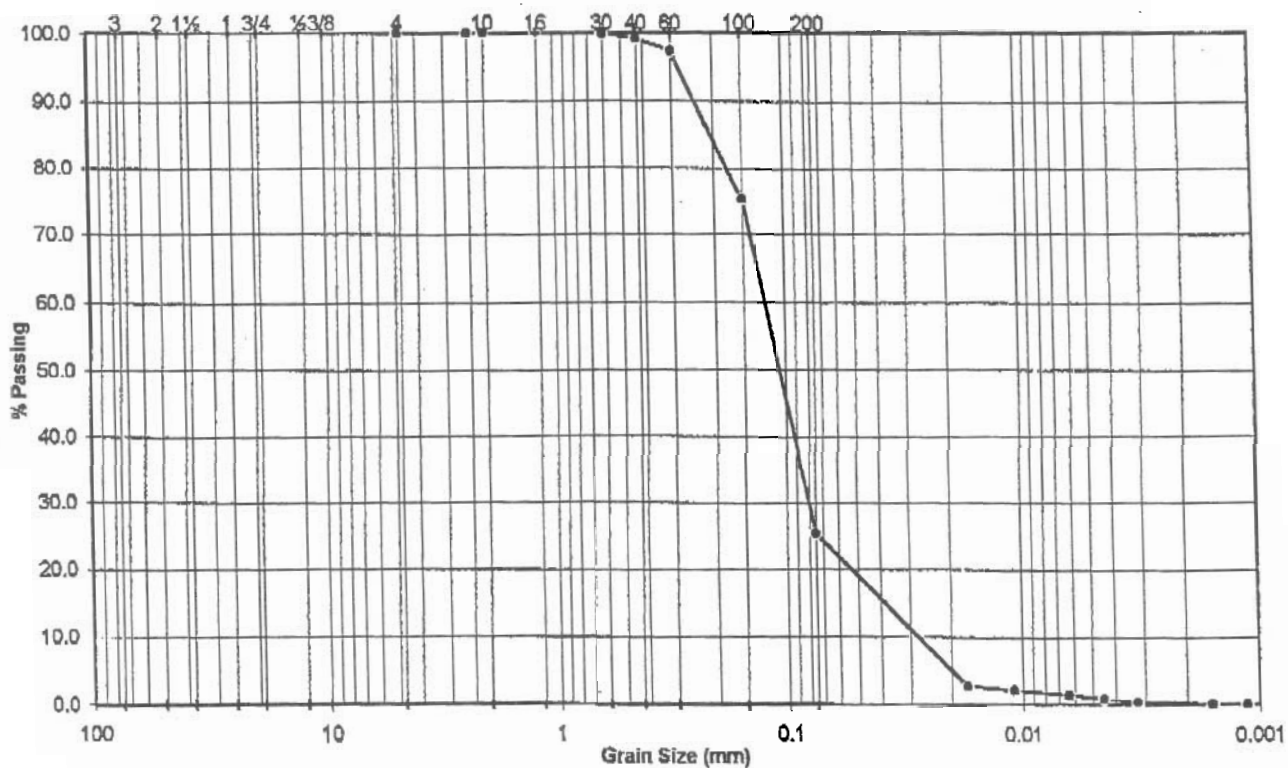
Test Hole # BGC02-13
Depth 13ft.

Remarks
Sample # 7
K Values For Use In Computing
Diameter Of Grain Sizes Are
Estimated

Gravel	0.0%
Sand	74.6%
Silt	25.4%
Clay	0.0%

Natural Water Content	
Liquid Limit	
Plastic Limit	
Plasticity Index	
Specific Gravity	4.46

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		





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Water Content Determination

Project MUNICIPAL Client BGC ENGINEERING INC.
Location #0255-008-03 Tech ATT Date JUNE 17/03

Hole #	GWF-03-03	36	51	52	510	511	513	
Depth	13-14'	17-18	21-22	30.5-31.5	32-33	18-18.4'		
Tare #	909	215	X22	X011	P38	90A		
Wt Wet + Tare	315.0	413.2	251.0	285.8	378.8	229.4		
Wt Dry + Tare	320.8	359.3	213.6	264.9	353.8	190.4		
Wt of Water								
Wt of Tare	3.8	4.0	4.1	4.1	4.3	3.8		
Wt Dry Soil								
Moisture Content (%)	17.1	15.2	17.9	8.0	7.2	20.9		
Hole #	GWF-03-04	520	522 PL	523 PL	GWF-03-05	526	527	530 PL
Depth	?	8-9	10-13			?	?	?
Tare #	9513	6426	63			9129	902	5M41
Wt Wet + Tare	310.0	265.0	260.4			304.0	321.6	199.1
Wt Dry + Tare	294.8	264.1	259.9			284.9	299.0	198.4
Wt of Water								
Wt of Tare	3.8	4.2	4.1			4.2	5.3	4.1
Wt Dry Soil								
Moisture Content (%)	5.2	0.4	0.2			6.8	7.7	0.4
Hole #	GWF-03-06	533		GWF-03-07	545			
Depth					?			
Tare #	5R20				LK5			
Wt Wet + Tare	359.6				364.4			
Wt Dry + Tare	340.9				330.7			
Wt of Water								
Wt of Tare	3.8				3.8			
Wt Dry Soil								
Moisture Content (%)	5.5				10.3			
Hole #	GWF-03-13	582	580					
Depth		?	?					
Tare #		AL25	90M					
Wt Wet + Tare		253.9	130.8					
Wt Dry + Tare		229.3	111.6					
Wt of Water								
Wt of Tare		3.8	3.8					
Wt Dry Soil								
Moisture Content (%)		10.9	17.8					
Hole #	GWF-03-17	501	5104	5104	ATT			
Depth	7.8.5	?	12.5	24.5				
Tare #	LK6	DE17	95					
Wt Wet + Tare	141.9	32.0	166.3					
Wt Dry + Tare	134.7	27.5	141.5					
Wt of Water								
Wt of Tare	3.8	3.8	4.1					
Wt Dry Soil								
Moisture Content (%)	5.5	18.9	18.0					



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Water Content Determination

Project NUNISIVIK Client BSC ENGINEERING LTD
Location # 0255-008 -03 Tech dbd Date JUNE 17/03

Hole #	<u>GWF-03-19</u>	<u>5119</u>						
Depth	<u>?</u>							
Tare #	<u>509</u>							
Wt Wet + Tare	<u>276.2</u>							
Wt Dry + Tare	<u>203.1</u>							
Wt of Water								
Wt of Tare	<u>3.8</u>							
Wt Dry Soil								
Moisture Content (%)	<u>36.7</u>							
Hole #	<u>GWF-03-20</u>	<u>5127</u>	<u>← 14D</u>					
Depth	<u>218.5</u>	<u>351</u>						
Tare #	<u>508</u>	<u>507</u>						
Wt Wet + Tare	<u>444.1</u>	<u>414.7</u>						
Wt Dry + Tare	<u>330.1</u>	<u>358.9</u>						
Wt of Water								
Wt of Tare	<u>3.8</u>	<u>3.8</u>						
Wt Dry Soil								
Moisture Content (%)	<u>14.0</u>	<u>15.7</u>						
Hole #	<u>GWF-03-21</u>	<u>5137</u>	<u>← GRADATION</u>					
Depth	<u>2.34</u>	<u>1.475</u>						
Tare #	<u>556</u>	<u>552</u>						
Wt Wet + Tare	<u>397.7</u>	<u>620.0</u>						
Wt Dry + Tare	<u>336.2</u>	<u>568.2</u>						
Wt of Water		<u>58.6</u>						
Wt of Tare	<u>3.8</u>	<u>72.6</u>						
Wt Dry Soil		<u>187.8</u>						
Moisture Content (%)	<u>18.5</u>	<u>12.0</u>						
Hole #								
Depth								
Tare #								
Wt Wet + Tare								
Wt Dry + Tare								
Wt of Water								
Wt of Tare								
Wt Dry Soil								
Moisture Content (%)								
Hole #								
Depth								
Tare #								
Wt Wet + Tare								
Wt Dry + Tare								
Wt of Water								
Wt of Tare								
Wt Dry Soil								
Moisture Content (%)								



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Atteberg Limits Determination

ASTM D4318

Client BGC ENG

Date _____

Project NUN ISIVIK

Job # _____

0255-008 -03 ✓

Test Hole GWT 03-03 Depth 30.5-31.5, 32-33

Tech. _____

Sample ID SAMPLE# S10 ; S11 COMBINED

Date Sampled

Rec'd JUNE 17/03

Soil Description _____

	Liquid Limit				Wn	Plastic Limit	
Tare No.							
Wet + Tare							
Dry + Tare							
Tare Wt.							
Dry - Tare							
Wet - Dry							
M.C. %							
# of Blows						Average	

NO PLASTE

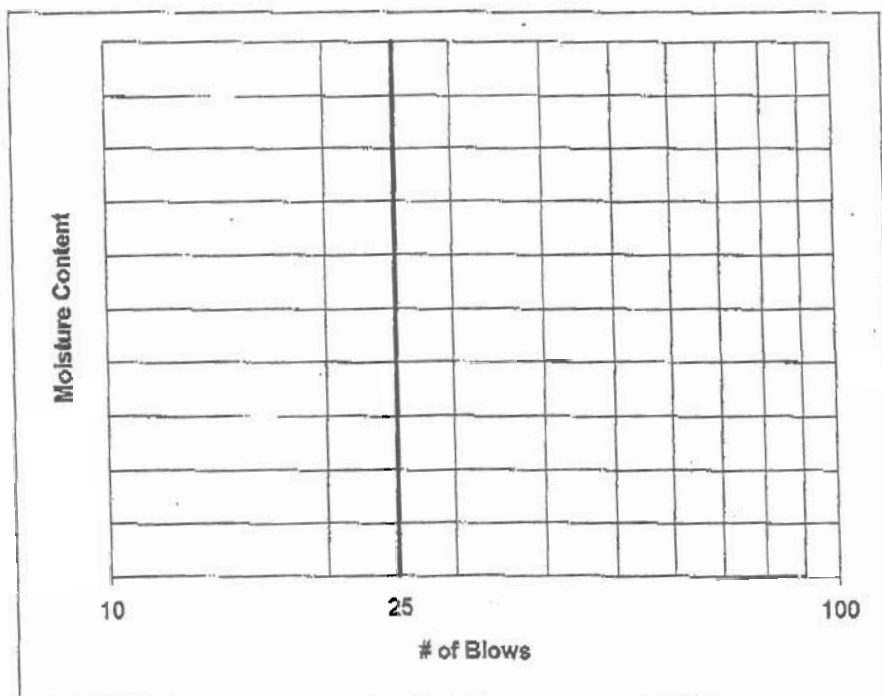
Natural Moisture Content (%)

LL = _____

PL = _____

PI = _____

USC = _____



CP



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Atteberg Limits Determination

ASTM D4318

Client BSC ENG Date _____

Project NUNISIVIK Job # _____

H: 0255-008 -03

Test Hole SWE-03-17 Depth 5101, 5102, 5104 Tech. _____

Sample ID _____ Date Sampled Real Time / 03

Soil Description _____

	Liquid Limit				Wn	Plastic Limit	
Tare No.							
Wet + Tare							
Dry + Tare							
Tare Wt.							
Dry - Tare							
Wet - Dry							
M.C. %							
# of Blows						Average	

Non Plastic

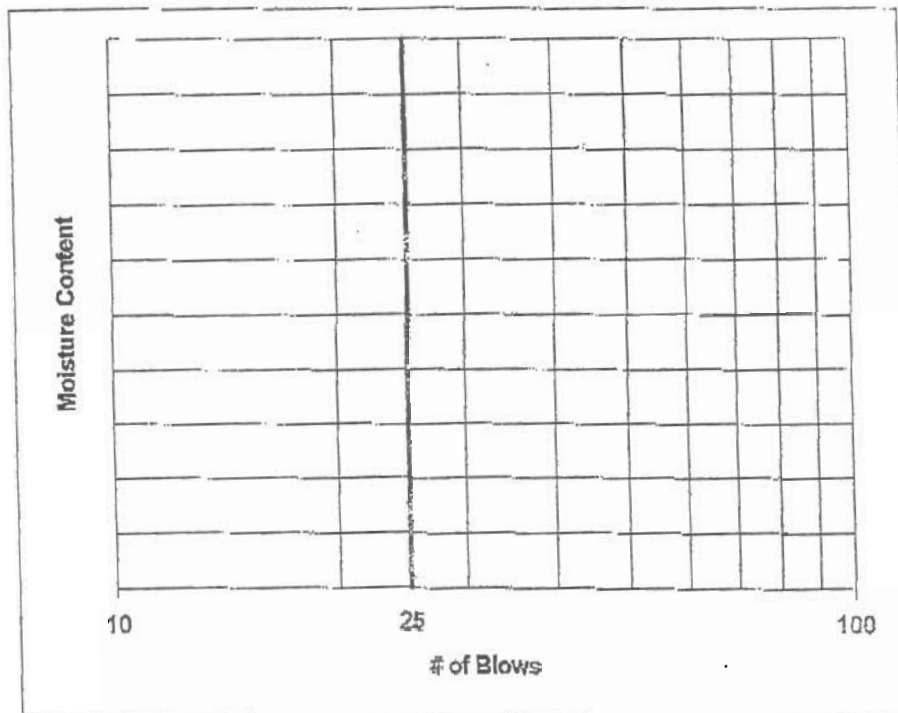
Natural Moisture Content (%)

LL = _____

PL = _____

PI = _____

USC = _____





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Aggregate Analysis Report

Sieve Size (mm)	% Passing
200	
150	
100	
80	
50	
40	
25	
20	
12.5	
10	
5	
2.5	100.0
1.25	99.7
0.63	96.4
0.315	89.0
0.16	50.5
0.08	18.4

Client BGC Engineering Inc.

Address 1605 840-7 Ave S.W.

Attention Mr. Gerry Ferris

Project Nanisivik
BGC # 0255-008-03

Job # 33-099-10-1

Date Sampled Rec'd June 17/ 03

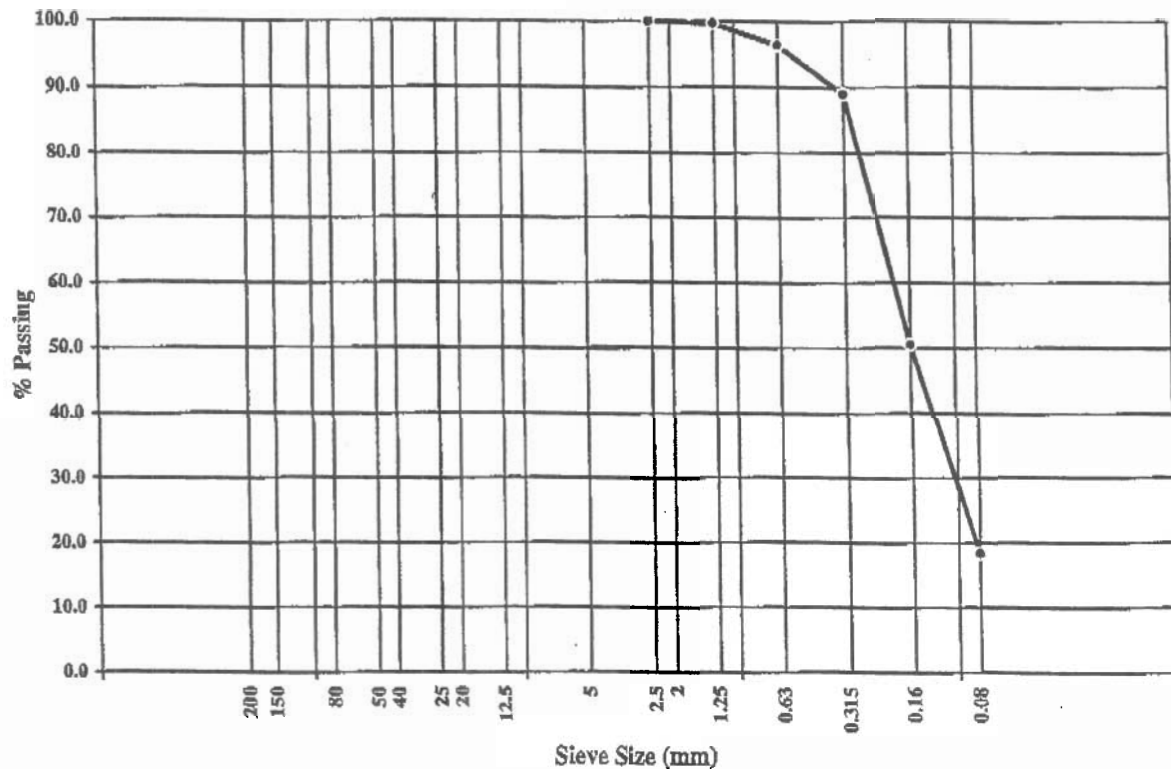
By Client

Date Tested June 18/ 03

By TH

Aggregate Type SAND, trace of silt & clay

Comments GWF 03-21
Sample # 137
M.C. = 12.0%



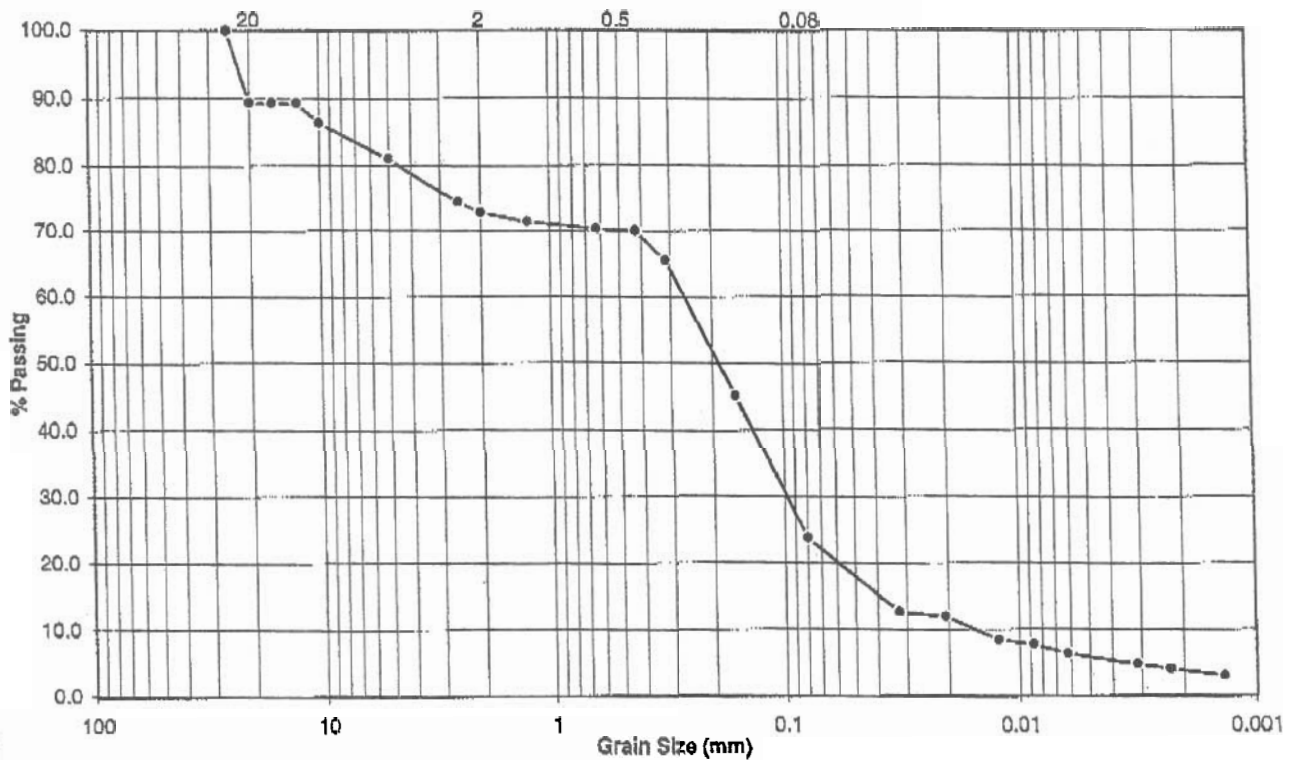


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Grain Size Distribution

Project	Nanisivik	BGC #	0255-008-03	Test Hole #	GWF03-07
Client	BGC Engineering Inc.	Depth	S 45		
Job #	33-099-10-1	Description	SAND, some silt, some gravel, trace of clay		
Date Sampled	Rec'd June 18/ 03				
Date Tested	June 21/ 03				
Remarks	Gravel	18.9%	Natural Water Content	10.3%	
	Sand	57.2%	Liquid Limit		
	Silt	19.8%	Plastic Limit		
Sample # 45	Clay	4.1%	Plasticity Index		
			Specific Gravity	2.83	

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		





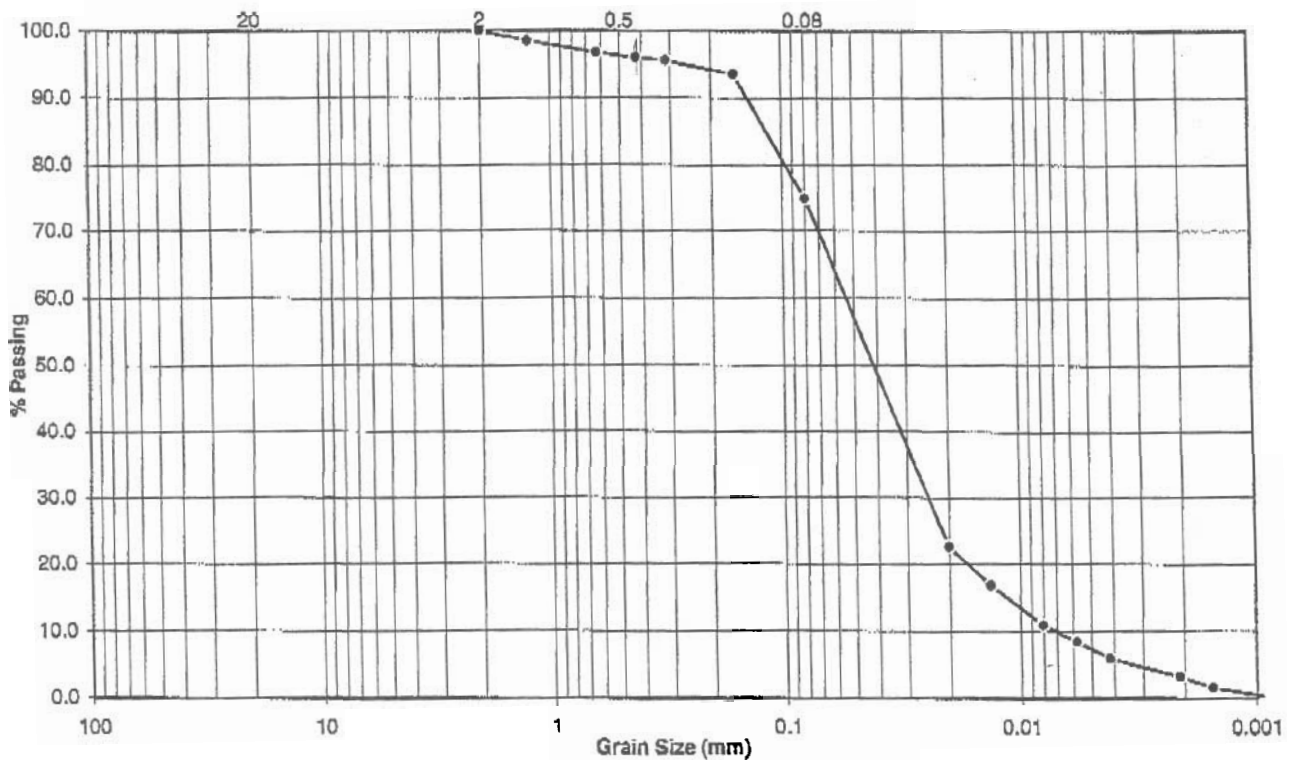
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Calgary, Alberta T2C 2H5
Telephone: (403) 236-8880

Grain Size Distribution

Project Nanisivik **BGC #** 0255-008-03 **Test Hole #** GWF03-20
Client BGC Engineering Inc. **Depth** S127
Job # 33-099-10-1 **Description** Sandy SILT, trace of clay
Date Sampled Rec'd June 17/ 03
Date Tested June 21/ 03

Remarks Sample # 127 K Values To Determine Particle Diameter Have Been Extrapolated From Table 3 Of ASTM D422 For Specific Gravities Not Listed In Table 3.	Gravel	0.0%	Natural Water Content	15.7%
	Sand	25.0%	Liquid Limit	
	Silt	73.4%	Plastic Limit	
	Clay	1.6%	Plasticity Index	
			Specific Gravity	3.89

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		





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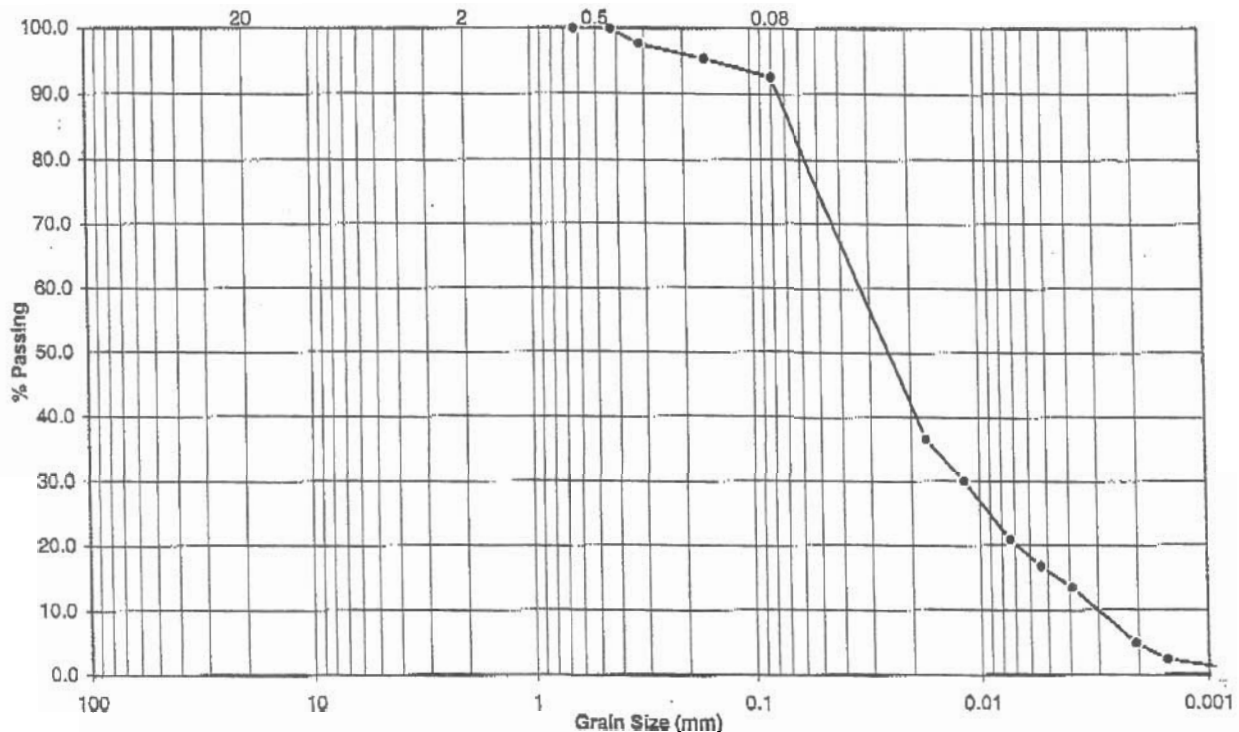
Grain Size Distribution

Project Nanisivik **BGC #** 0255-008-03 **Test Hole #** GWF03-21
Client BGC Engineering Inc. **Depth** S136
Job # 33-099-10-1 **Description** SILT, trace of sand, trace of clay
Date Sampled Rec'd June 17/ 03
Date Tested June 21/ 03

Remarks	Gravel	0.0%	Natural Water Content	18.5%
	Sand	7.5%	Liquid Limit	
	Silt	90.1%	Plastic Limit	
	Clay	2.4%	Plasticity Index	
			Specific Gravity	3.92

Sample # 136
 K Values To Determine Particle Diameter Have
 Been Extrapolated From Table 3 OF ASTM D422
 For Specific Gravities Not Listed In Table 3.

Gravel		Sand			Silt	Clay
Coarse	Fine	Coarse	Medium	Fine		



EBA Engineering Consultants Ltd.

Creating and Delivering Better Solutions

FACSIMILE COVER SHEET

Date: November 14, 2002 Total Number of Pages: (including this page) 2
Attention: Mr. Jeff Claypool
Company: GBC Engineering
Fax No.: 250-5330 Telephone: 250-5185
From: Garth Erickson File Number: 4300181
Subject: Point Load Testing
Please circle as appropriate: Original to follow YES / NO By Mail/Other YES / NO

Message:

Please find attached the results of the axial and diametral point load testing performed on the five rock core samples delivered to our office.

We trust this information meets with your present requirements, however if you have any questions please contact our office.

Respectfully submitted,

EBA Engineering Consultants Ltd.



Garth Erickson
Laboratory Supervisor

GE:BC:dlc
Attachment



Bozena Czarnecki, P. Eng.
Senior Project Engineer

\\12504\FRONT\4300181\Communication\4300181p01.Rc



EBA Engineering Consultants Ltd.

Standard Test Method for Determination of the Point Load Strength Index of Rock ASTM D5731-95

DIAMETRAL LOADING

SAMPLE NUMBER	CORE NUMBER	L (mm)	D (mm)	MAX. LOAD (lbs)	Is (Mpa)	Is ₍₅₀₎ (Mpa)
6121	BG-C02-02, 52'	38.25	36.10	1775	6.1	5.2
6122	BG-C02-03, 54'	39.14	36.09	1680	5.7	4.9
6123	BG-C02-06, 57'	38.78	36.09	1550	5.3	4.6
6124	BG-C02-11, 81'	40.13	36.11	1920	6.6	5.7
6125	BG-C02-12, 80'	39.54	36.10	1850	6.3	5.4

AXIAL LOADING

SAMPLE NUMBER	CORE NUMBER	D (mm)	W (mm)	MAX. LOAD (lbs)	Is (Mpa)	Is ₍₅₀₎ (Mpa)
6121	BG-C02-02, 52'	18.71	36.09	1210	15.4	9.9
6122	BG-C02-03, 54'	21.22	36.09	1375	13.6	9.2
6123	BG-C02-06, 57'	19.14	36.11	1200	14.6	9.5
6124	BG-C02-11, 81'	21.39	36.10	1300	12.6	8.6
6125	BG-C02-12, 80'	19.69	36.11	1375	15.8	10.4

REMARKS:

APPENDIX V - THERMAL CONDUCTIVITY TEST REPORT

EBA Engineering Consultants Ltd.

Creating and Delivering Better Solutions

September 12, 2003

EBA File: 1100035

VIA FAX: (403) 250-5330 (6 pages)

BGC Engineering Inc.
1605, 840-7 Avenue S. W.
Calgary, Alberta, T2P 3G2

Attention: Mr. Jim Cassie, P.Eng.

**Subject: Laboratory Tests on Mine Tailings
Test Results for Nanisivik Mine Sample
(BGC Project No. 0080-019-01)**

1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) was retained by BGC Engineering Inc. (BGC) to measure specific thermal and index properties for samples of tailings from Nanisivik Mine and Lupin Mine. This letter presents the test results for a sample from the Nanisivik Mine. Test results for a sample from the Lupin Mine will be reported in a separate letter.

As specified in your letter to EBA dated August 28, 2003, EBA conducted the following tests on the provided sample:

1. Thermal conductivity in both frozen and unfrozen states;
2. Unfrozen water content versus freezing temperature; and
3. Index tests to measure the frozen bulk density, water content, particle size distribution, and specific gravity.

The letter also presented specific instructions on preparing the sample.

2.0 SAMPLE PREPARATION AND TEST METHODS

EBA received two 20 L pails of tailings, one containing coarse-sized particles in a damp state, and the other containing fine-sized particles in a wet state. The tailings from the two pails were blended at approximately a 1:1 ratio (by volume). The blended sample used in the tests had a gravimetric moisture content of 15.5% (volumetric water content

of 37.8%) and a frozen bulk density of 2730 kg/m³. These values were within the ranges specified by BGC.

Thermal conductivity was measured using the thermal needle probe method in accordance with the ASTM test procedure D5334-92.

The unfrozen water content curve was determined using the Time Domain Reflectometry (TDR) technique (Topp et al., 1980; Patterson and Smith, 1981; Smith and Tice, 1988). The sample was immersed in a temperature-controlled bath. The TDR test was conducted when the sample was in thermal equilibrium with the bath fluid.

3.0 TEST RESULTS

Figure 1 presents the grain size curve of the blended sample.

The measured specific gravity of the bulk sample is 3.92.

The measured thermal conductivity values are 1.9 W/(m°C) at room temperature and 3.2 W/(m°C) at -15°C.

The volumetric unfrozen water contents at different sample temperatures were estimated using the empirical relationship developed by Smith and Tice (1988). This relationship was calibrated with the nuclear magnetic resonance (NMR) technique and is considered the most accurate available for frozen soils.

The test results are summarised in Table 1 and shown in Figure 2.

Table 1	
ESTIMATED UNFROZEN WATER CONTENT SUMMARY	
Temperature (°C)	Volumetric Unfrozen Water Content (%)
-11.9	4.9
-5.8	6.4
-3.0	7.6
-2.0	8.5
-1.3	9.6
-1.0	10.8
-0.6	12.9
-0.4	14.8
0	37.2

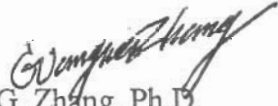
4.0 CLOSURE

We trust that this letter meets your current requirements. Please contact us if you have any questions.

Yours truly,
EBA Engineering Consultants Ltd.

Prepared by:

Reviewed by:


G. Zhang, Ph.D.
Geotechnical Specialist
Circumpolar Regions
(Direct Line: (780)451-2130, ext. 501)
(e-mail: gzhang@eba.ca)


J.T.C. Seto, P.Eng.
Senior Project Engineer
Circumpolar Regions
(Direct Line: (780)451-2130, ext. 273)
(e-mail: jseto@eba.ca)

Attachments