APPENDICES

Directors : D.A.X. Williams (Managing Director) J.C. Francke (Director) T.A. Williams (Company Secretary)
www.geoedgejamaica.com ■ info@geoedgejamaica.com ■ +1-876-366-9021

Client YACHIYO ENGINEERING CO.LDT./ ODPEM	Location Reference **Mount Airy, Westmoreland**	TYPE/SIZE
Project Upgrade of Emergency Communication System, Jamaica.		NQ Coring & 95.25mm HAS
Address:	NORTHINGS: 18°15'20.3"N DATUM: Sea Level	EASTINGS 78°19'44.7"W ELEVATION:

SAMPLE TYPE — WASH — GRAB — SPLIT SPOON — T.W. TUBE — R.CORE

SAMPLE TYPE	DEPTH DRIVEN / RECOVERY	CASING DEPTH DRIVEN	SAMPLE NO. / SAMPLE DEPTH	BLOWS PER 6" DRIVEN	DEPTH OF SAMPLE (ft)	LAYER INTERFACE	
					0		
							Coring with NQ Series from 0-5'
R/C					1		
							Cream calcareous course to fine sand and gravel
					2		
					3		Medium cream porous limestone
					4		RQD 25%
R/C					5		Coring with NQ Series from 5'-10ft
					6		Medium cream porous limestone
					7		Medium cream porous limestone
R/C							
					8		
							Medium cream porous limestone
					9		
					10		RQD 40%
					11		
					12		
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

WATER LEVEL					START	FINISH
TIME					TIME	TIME
DATE					DATE	DATE
CASING DEPTH						

GEO-EDGE LIMITED
14 CALEDONIA ROAD, MANDEVILLE, JAMAICA
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STARTED	April 24th 2016	JOB NO.	
COMPLETION	April 24th 2016		SHEET OF
FINAL W.L.			FIG NO.

OFFICE BOREHOLE RECORDS

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

REPORT ON ROCK STRENGTH TESTS:

Client: Geo-Edge Limited	Ref: L16032
Project: Repeater Station Soil Investigation	Report No. G/805/01494
Reported To: Mr. Damian Williams	Location: Mount Airy, Westmoreland
Report Date: 5/25/2016	Date Cored: 4/24/2016
Specified Works Strength: psi (cylinder)	Date Tested: 5/3/2016
Actual Works Strength (Average): N/A p.s.i (cube)	Date Placed: N/A
Specified Slump: N/A inches	Test Specification: ASTM D7012 - 14
Actual Slump: N/A inches	Weather during Pour: N/A
Placed By: Chute/Bucket/other (Specify):	Compiled By: Mr. Roger Haisley

TEST RESULTS

Curing Conditions: N/A

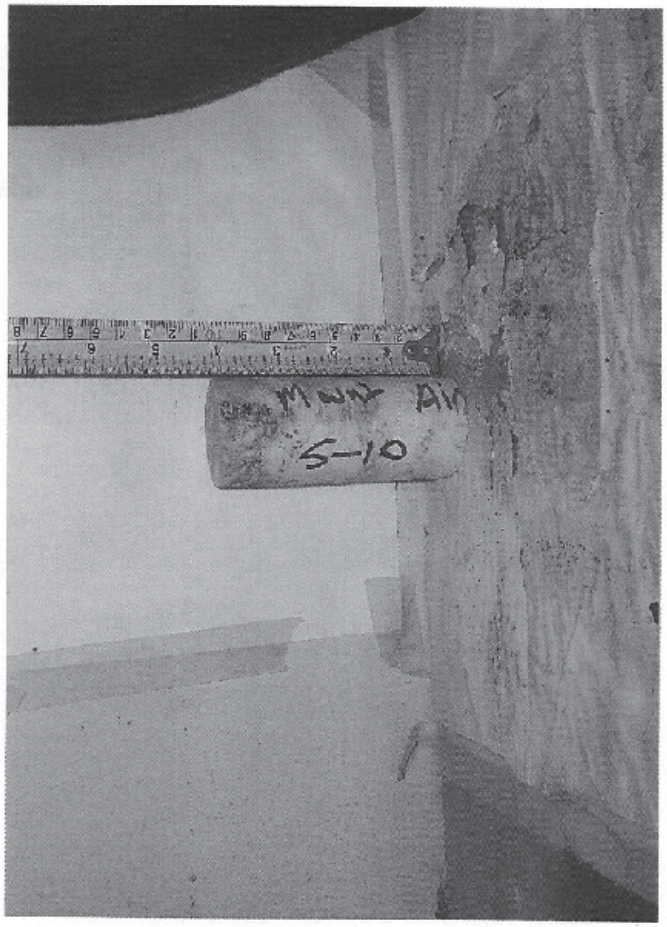
Specimen Number (Comp. Strength Specimen No.)	1	2	3			
Specimen Depth	5'-10'	5'-10'	0'-5'			
Element Cored	Rock	Rock	Rock			
Location	Mount Airy, Westmoreland					
Diameter - inches	1.75	1.75	1.63			
Length uncapped - inches	4.00	4.00	4.00			
Length capped - inches	N/A	N/A	N/A			
Length/Diameter	2.29	2.29	2.45			
Correction Factor	-	-	-			
Density p.c.f	161.2	159.5	163.7			
Compressive Strength - Mpa (cylinder)	40.40	41.16	34.96			
Equivalent Compressive Strength Mpa (cube)	-	-	-			
Compressive Strength - PSI (cylinder)	5860	5970	5070			
Equivalent Compressive Strength PSI (cube)	-	-	-			

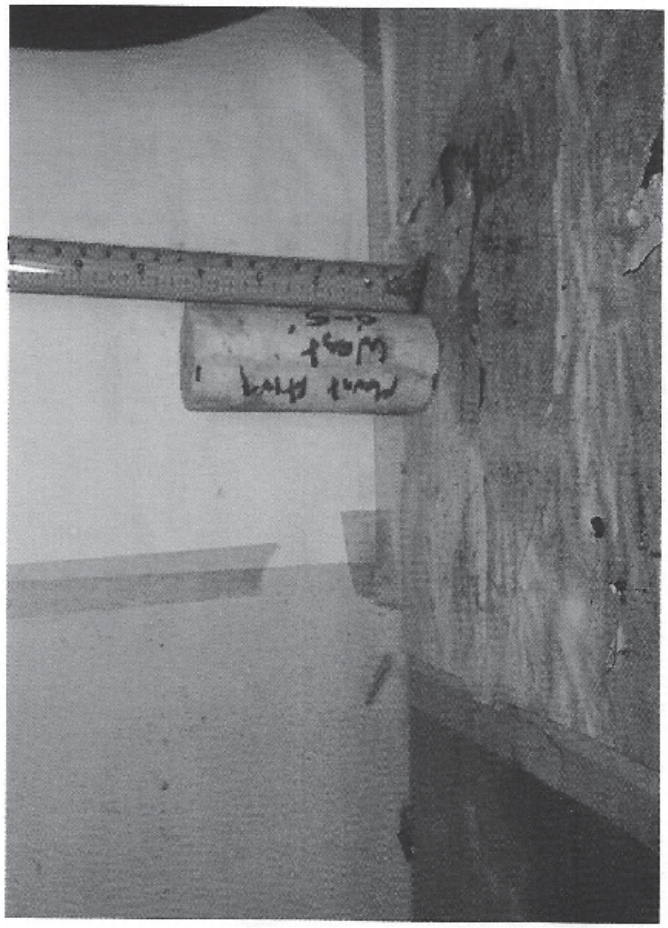
Checked by: Agarwood

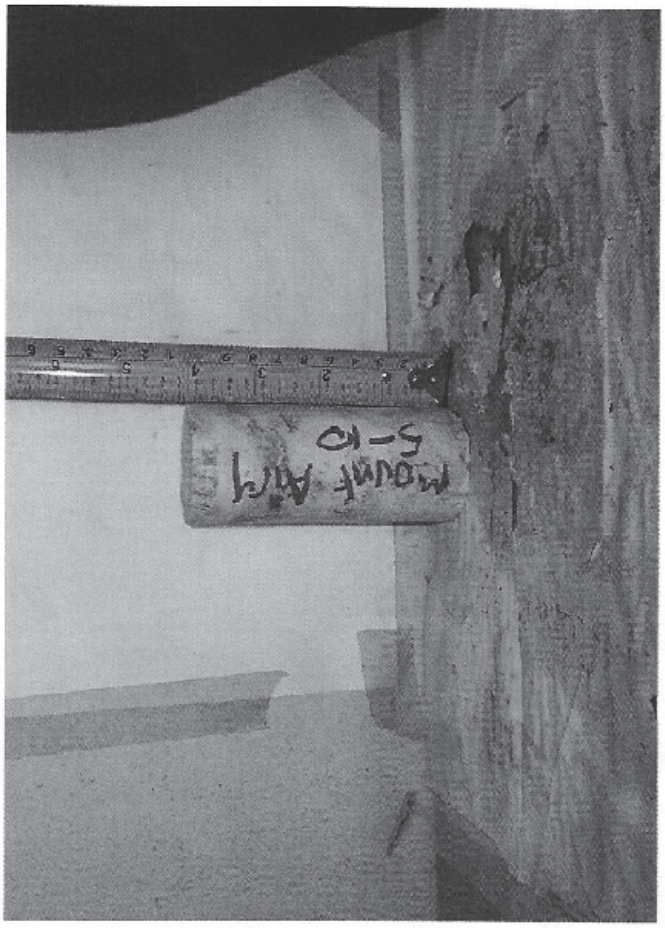
Signed by:

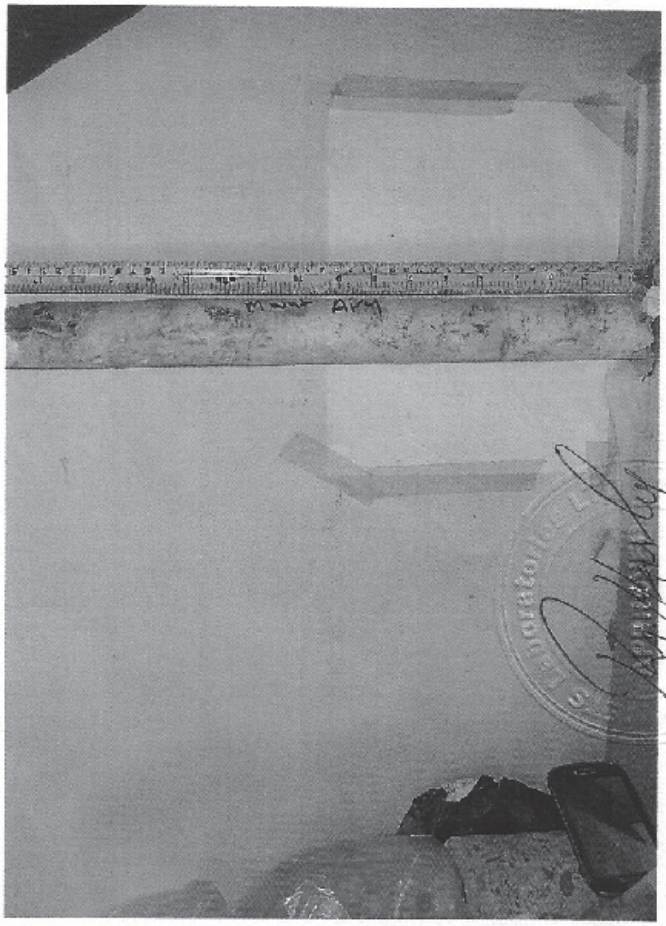
Notes:

Mount Airy

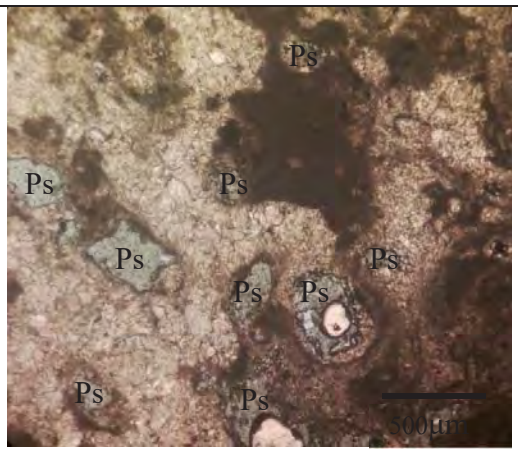








Sample ID: Mt. Airy (5ft)

Description		Photo-documentation
Macroscopic		
Colour	Creamish white	
External Features	Cavities (small vugs)	
Mineralogy	Calcite	
Allochems	fossils (corals)	
Spar cement or Mud	Spar	
Microscopic		
Folk Classification	biosparite	
Dunham Classification	grainstone	
Porosity	high	
Fossils	Benthic Foram, corals	
Other		Photo micrographs showing sample with coral with inter fossil pore space in Plane Polarized light. Ps - pore space

Comments: The sample is an algae forminiferal biosparite. The presence of algae and benthic forminifera makes the limestone a shallow water limestone. . The sample is consolidated as the allochems are cemented to each other by calcite cement. There are pore spaces between allochems (fossils) and within the corals.

Additional Micrograph

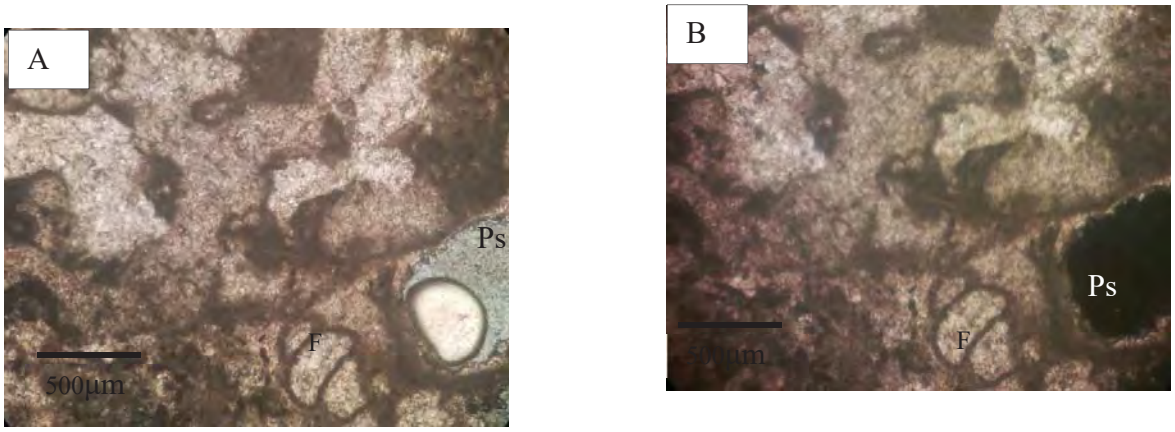


Photo micrographs showing sample in (A) Plane Polarized light and (B) cross Polarized light. F- Foraminifera, Ps- Pore space

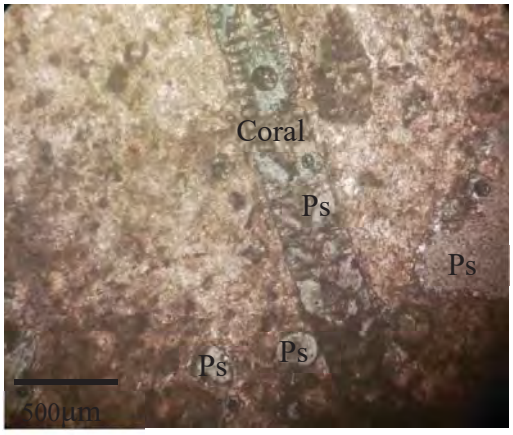
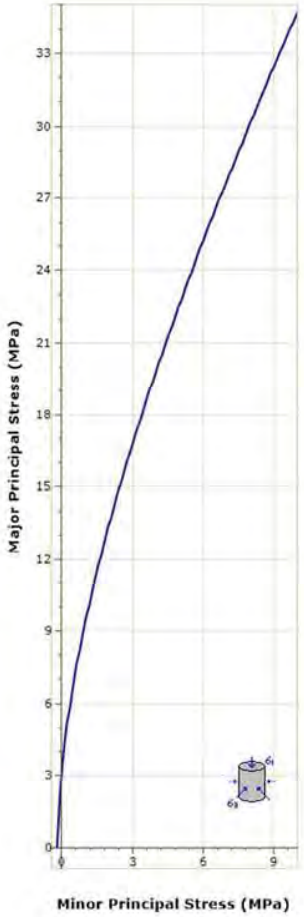
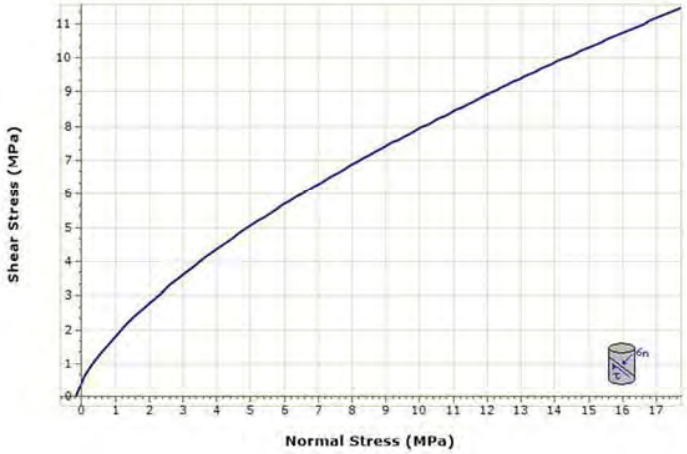


Photo micrographs showing sample coral with inter fossil pore space in Plane Polarized light. Ps - pore space





Mt. Airy Sample	
Hoek Brown Classification	
intact uniaxial compressive strength	39 MPa
GSI	66
mi	10
disturbance factor	0.7
intact modulus	35100 MPa
modulus ratio	900
Hoek Brown Criterion	
mb	1.544
s	0.007
a	0.502
Failure Envelope Range	
application	general
sig3max	9.75 MPa
Mohr Coulomb Fit	
cohesion	1.983 MPa
friction angle	29.749 deg
Rock Mass Parameters	
tensile strength	-0.183 MPa
uniaxial compressive strength	3.29 MPa
global strength	6.835 MPa
modulus of deformation	9003.154 MPa

— Mt. Airy Sample - Principal Stress Envelope
— Mt. Airy Sample - Shear vs. Normal Stress Envelope

Client YACHIYO ENGINEERING CO.LDT./ ODPEM Project Upgrade of Emergency Communication System, Jamaica. Address:	Location Reference **Shafston Westmoreland** NORTHINGS: EASTINGS 18°10'21.8"N 77 59' 31.7W DATUM: Sea Level ELEVATION: 885m	TYPE/SIZE NQ Coring & 95.25mm HAS

SAMPLE TYPE ■ WASH ▨ GRAB ▩ SPLIT SPOON ▭ T.W. TUBE ■ R.CORE

SAMPLE TYPE	DEPTH DRIVEN / RECOVERY	CASING DEPTH DRIVEN	SAMPLE NO. / SAMPLE DEPTH	BLOWS PER 6" DRIVEN	DEPTH OF SAMPLE (ft)	LAYER INTERFACE	
					0		Augered to one foot (1ft)
					1		0-1ft brown clay with gravel
					2		Moderately hard cream limestone rock with clay filled cavities
					3		RQD 26.7%
					4		Recovery of coarse Calcareous material
					5		Moderately hard cream limestone rock with fractured cobbles
					6		Moderately hard cream limestone rock with fractured cobbles
					7		, RQD=12%
					8		
					9		
					10		Recovery of coarse Calcareous material
					11		Moderately hard cream limestone rocks with cobbles and sand filled cavity
					12		
					13		RQD 16%
					14		Recovery of coarse Calcareous material
					15		
					16		
					17		
					18		
					19		
					20		

WATER LEVEL | START TIME | FINISH TIME

TIME

DATE | DATE | DATE

CASING DEPTH

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GEOEDGE LTD ONSITE. INSIGHTS.

OFFICE BOREHOLE RECORDS

STARTED	May 08 2016	JOB NO.	
COMPLETION	May 08 2016	SHEET OF	
FINAL W.L.		FIG NO.	

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

REPORT ON ROCK STRENGTH TESTS:

Client:	Geo-Edge Limited	**Report No.**	2016/805/A		
Project:	Shafston Repeater Site	**Location:**	Shafston, Westmoreland		
Test Specification:	ASTM D7012 - 14				
Curing Conditions: N/A					
Specimen Identification		BH1	BH1	BH1	BH1
Specimen Depth		1'-6'	6'-11'	6'-11'	11'-15.5'
Element Cored		Rock	Rock	Rock	Rock
Location		Shafston, Westmoreland			
Diameter - inches		1.75	1.63	1.75	1.75
Length - inches		3.5	3.375	3.375	3.5
Length/Diameter		2	2.1	1.9	2..0
Density p.c.f		142.5	155.3	156.9	157.2
Specific Gravity		2.284	2.489	2.516	2.519
Compressive Strength - Mpa		32.68	45.09	57.77	41.43

Table 5.1

Sample ID : No ID _(9ft)

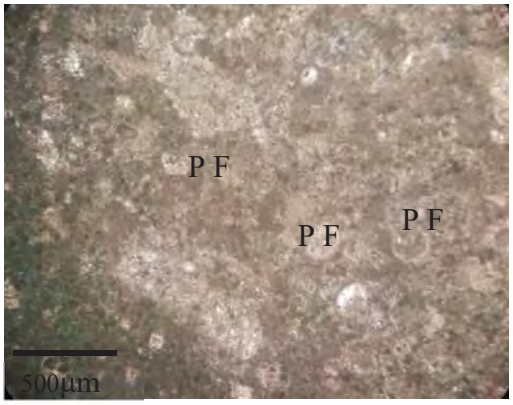
<table>
<tr><th colspan="2">Description</th><th>Photo-documentation</th></tr>
<tr><td colspan="3">Macroscopic</td></tr>
<tr><td>Colour</td><td>Cream</td><td rowspan="5"> 
1cm</td></tr>
<tr><td>External Features</td><td></td></tr>
<tr><td>Mineralogy</td><td>Calcite</td></tr>
<tr><td>Allochems</td><td>No visible fossils or other allochems</td></tr>
<tr><td>Spar cement or Mud</td><td>Mud</td></tr>
<tr><td colspan="3">Microscopic</td></tr>
<tr><td>Folk Classification</td><td>Biomicrite</td><td rowspan="5"> 

Photo micrograph of sample showing Planktonic Forams (PF) within micrite matrix</td></tr>
<tr><td>Dunham Classification</td><td>Wackestone</td></tr>
<tr><td>Porosity</td><td>Low</td></tr>
<tr><td>Fossils</td><td>Planktonic Foram (high percentage)
Benthic Foram (low percentage)</td></tr>
<tr><td>Other</td><td></td></tr>
</table>

Comments: The sample is a deep water limestone which is term chalk. Deep water limestone due to high percentage of planktonic Foraminifera while low benthic Forams content. The sample is poorly consolidated, which makes water absorption high

Additional Micrograph

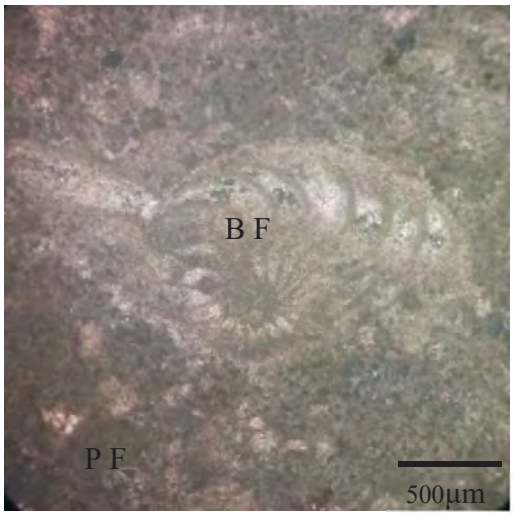
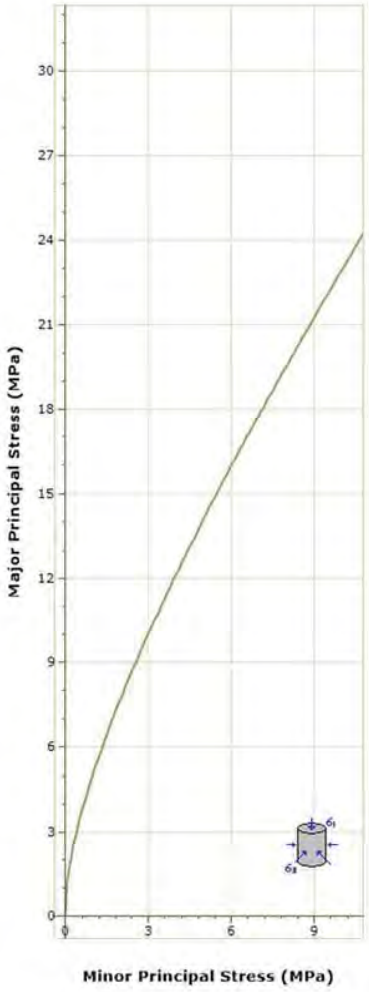
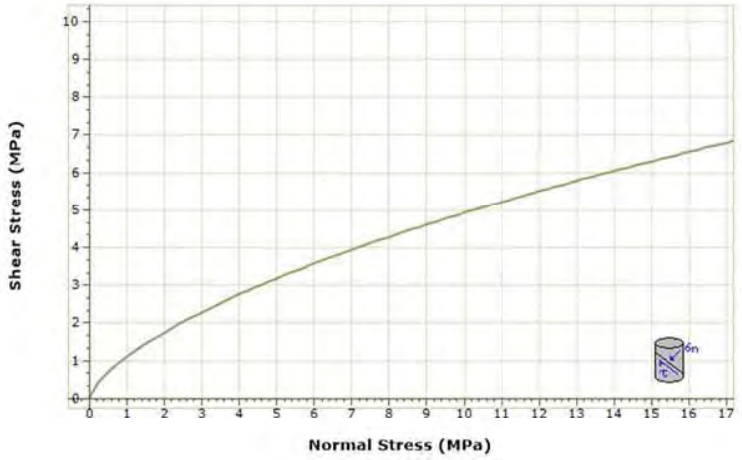


Photo micrograph of sample showing Planktonic Forams (PF) and Benthic Forams (BF) within micrite matrix





Shafston Sample	
Hoek Brown Classification	
intact uniaxial compressive strength	42 MPa
GSI	44
mi	9
disturbance factor	0.7
intact modulus	37800 MPa
modulus ratio	900
Hoek Brown Criterion	
mb	0.415
s	2.987e-004
a	0.509
Failure Envelope Range	
application	general
sig3max	10.5 MPa
Mohr Coulomb Fit	
cohesion	1.225 MPa
friction angle	19.703 deg
Rock Mass Parameters	
tensile strength	-0.03 MPa
uniaxial compressive strength	0.677 MPa
global strength	3.48 MPa
modulus of deformation	2702.585 MPa

Shafston Sample - Principal Stress Envelope
Shafston Sample - Shear vs. Normal Stress Envelope

Client YACHIYO ENGINEERING CO.LDT./ ODPEM	Location Reference	TYPE/SIZE
Project Upgrade of Emergency Communication System, Jamaica.	**Portland Cottage, Clarendon**	NQ Coring & 95.25mm HAS
Address:	NORTHINGS: 17°44'31.50"N / EASTINGS 77°09'26.92"W	
	DATUM: Sea Level / ELEVATION:	

SAMPLE TYPE — WASH — GRAB — SPLIT SPOON — T.W. TUBE — R.CORE

SAMPLE TYPE	DEPTH DRIVEN / RECOVERY	CASING DEPTH DRIVEN	SAMPLE NO / SAMPLE DEPTH	BLOWS PER 6" DRIVEN	DEPTH OF SAMPLE (ft)	LAYER INTERFACE	WATER LEVEL	START	FINISH
							TIME	TIME	TIME
							DATE	DATE	DATE
							CASING DEPTH		
					0				
R/C					1		Coring with NQ core barells from 0-5'		
					2		Medium hard limstone		
					3		Hard Brown Silty Clay with some Sand & Gravel		
					4		RQD 10%		
R/C					5		Coring with NQ barrels from 5-10'		
					6		Medium hard cream micritic limestone		
					7		Medium hard cream micritic limestone		
R/C					8		RQD 20%		
					9		Medium cream porous limestone		
					10		Coring with NQ core barells from 0-5'		
					11		Medium- Hard cream Limestone		
					12		RQD is 25%		
					13				
					14				
					15				
					16				
					17				
					18				
					19				
					20				

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E RECORDS

		JOB NO.	
STARTED	April 17th 2016		SHEET OF
COMPLETION	April 17th 2016		FIG NO.
FINAL W.L.			

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

REPORT ON ROCK STRENGTH TESTS:

Client: Geo-Edge Limited	Ref: L16032
Project: Repeater Station Soil Investigation	Report No. G/805/01494
Reported To: Mr. Damian Williams	Location: Portland Cottage (Lighthouse)
Report Date: 5/25/2016	Date Cored: 4/20/2016
Specified Works Strength: psi (cylinder)	Date Tested: 5/3/2016
Actual Works Strength (Average): N/A p.s.i (cube)	Date Placed: N/A
Specified Slump: N/A inches	Test Specification: ASTM D7012 - 14
Actual Slump: N/A inches	Weather during Pour: N/A
Placed By: Chute/Bucket/other (Specify):	Compiled By: Mr. Roger Haisley

TEST RESULTS

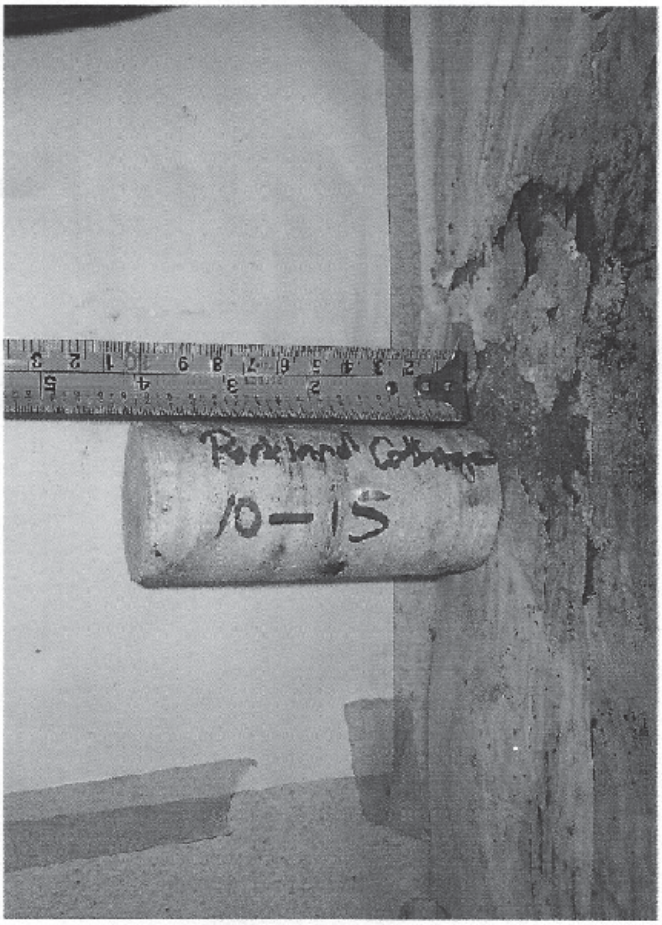
Curing Conditions: N/A

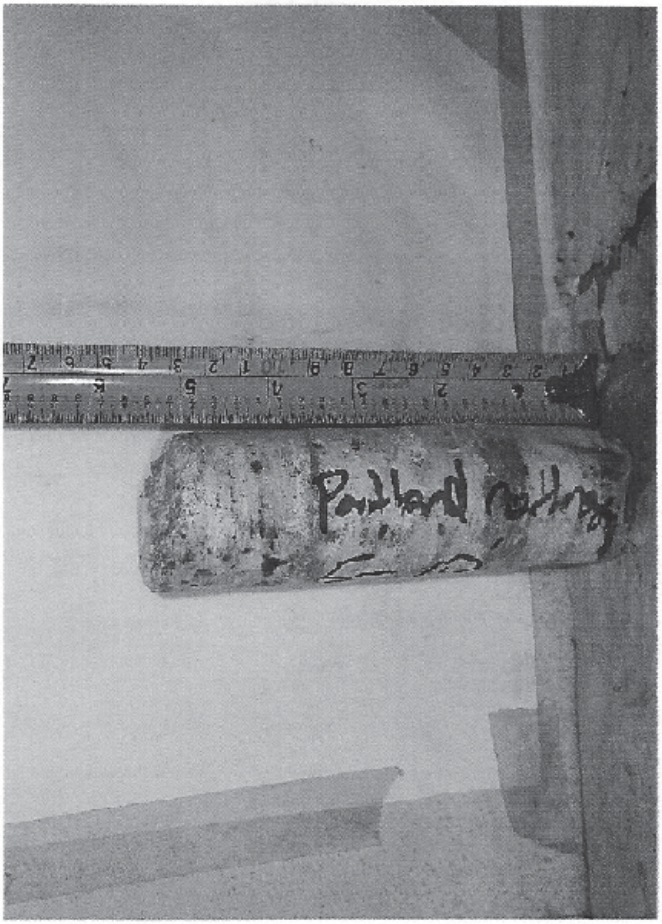
Specimen Number (Comp. Strength Specimen No.)	1	2	3			
Specimen Depth	10'-15'	10'-15'	5'-10'			
Element Cored	Rock	Rock	Rock			
Location	Portland Cottage (Lighthouse)					
Diameter - inches	1.63	1.63	1.63			
Length uncapped - inches	4.125	4	4.125			
Length capped - inches	N/A	N/A	N/A			
Length/Diameter	2.54	2.46	2.54			
Correction Factor	-	-	-			
Density p.c.f	158.5	156.8	160.2			
Compressive Strength - Mpa (cylinder)	30.54	28.20	62.74			
Equivalent Compressive Strength Mpa (cube)	-	-	-			
Compressive Strength - PSI (cylinder)	4430	4090	9100			
Equivalent Compressive Strength PSI (cube)	-	-	-			

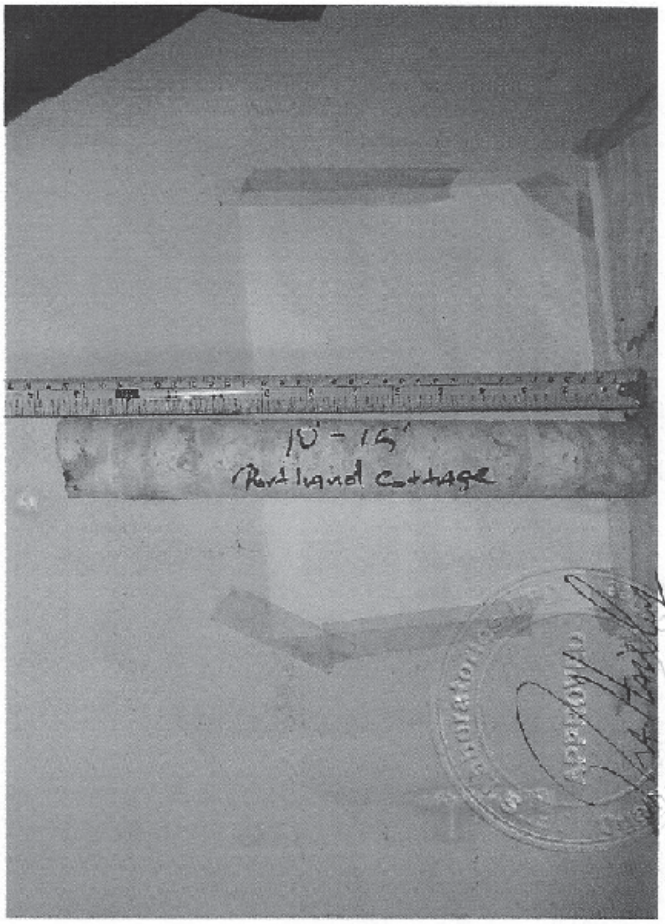
Checked by: Garwood

Signed by:

Notes:

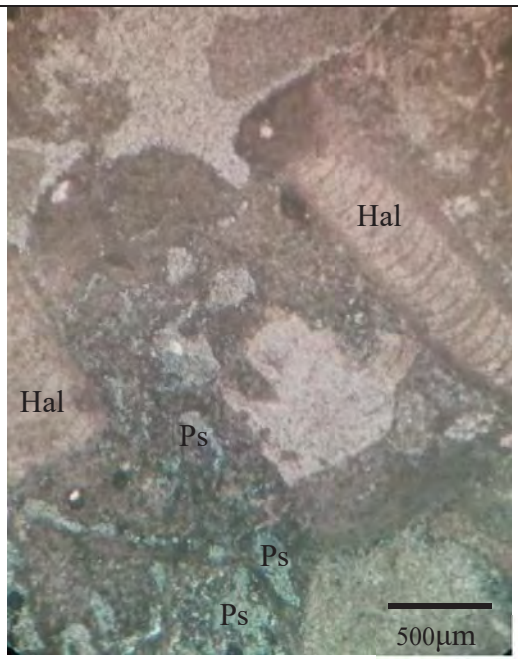






Portland Cottage

Sample ID : Portland Cottage – 5ft

Description		Photo-documentation
Macroscopic		
Colour	Creamish white	
External Features	Cavities (small vugs)	
Mineralogy	Calcite	
Allochems	fossils (foraminifera	
Spar cement or Mud	Spar	
Microscopic		
Folk Classification	biosparite	
Dunham Classification	grainstone	
Porosity	high	
Fossils	Benthic Foram, algae	
Other		

Comments: The sample is an algae forminiferal biosparite. The presence of algae and benthic forminifera makes the limestone a shallow water limestone. . The sample is consolidated as the allochems are cemented to each other by calcite cement. There is pore space between allochems (fossils).

Additional Micrograph

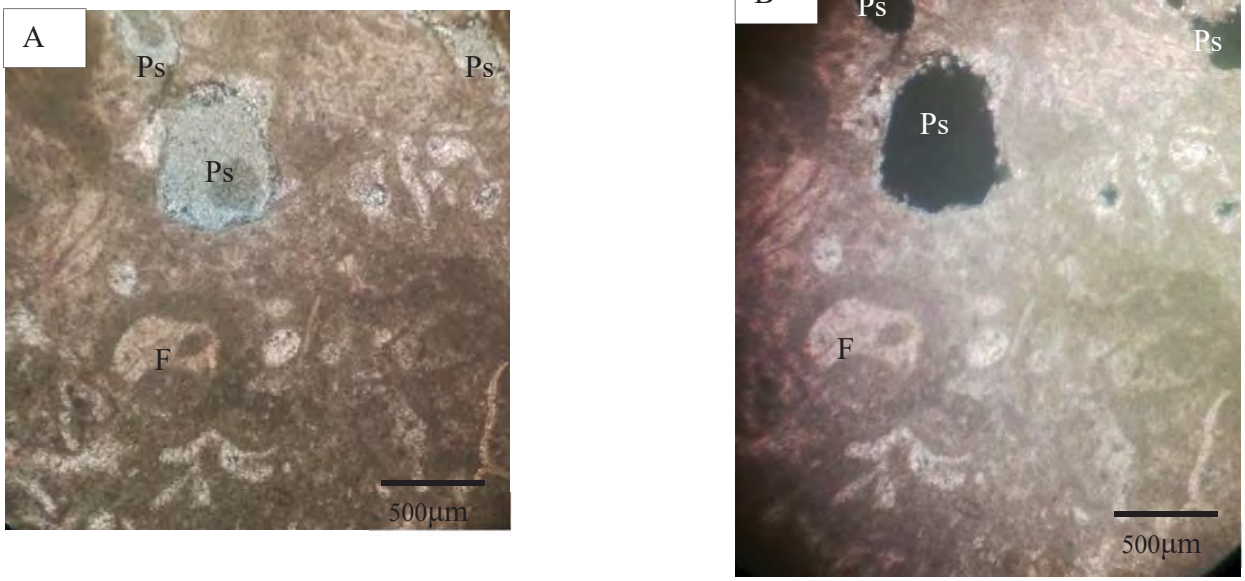


Photo micrographs showing sample in (A) Plane Polarized light and (B) cross Polarized light. F- Foraminifera, Ps- Pore space

Photo micrograph of sample showing Benthic Forams (BF) within micrite matrix. Pore spaces (Ps) are observed indicated by the blue dye

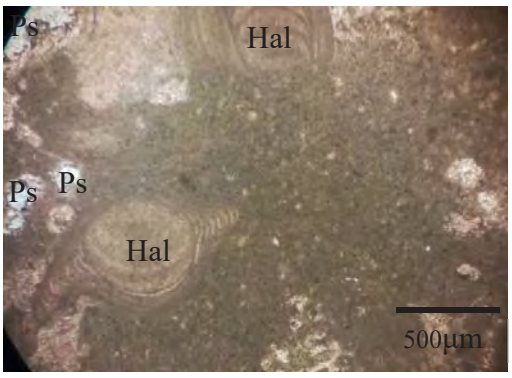
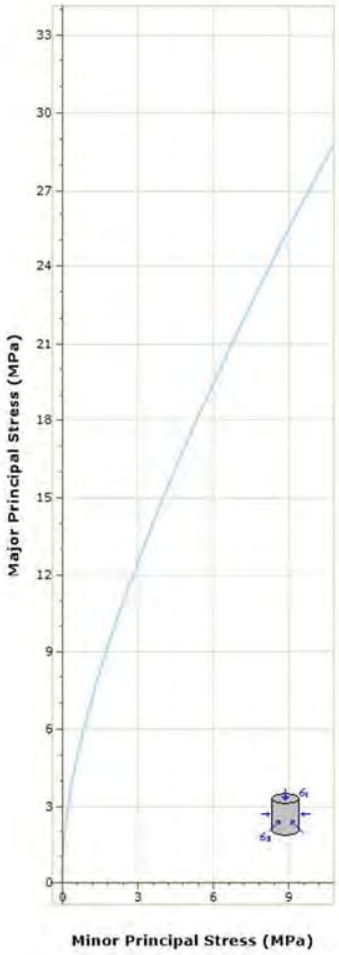
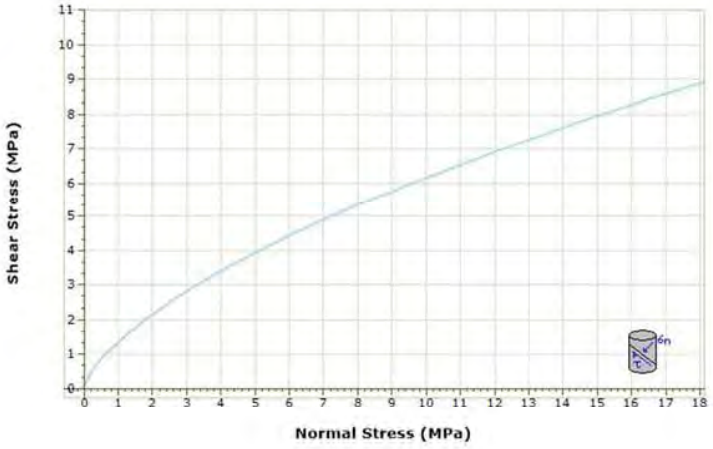


Photo micrograph of sample showing Halimedia (Hal) within micrite matrix. Pore spaces (Ps) are observed indicated by the blue dye





Portland Cottage	
Hoek Brown Classification	
intact uniaxial compressive strength	40.49 MPa
GSI	53
mi	10
disturbance factor	0.7
intact modulus	12000 MPa
Hoek Brown Criterion	
mb	0.756
s	0.001
a	0.505
Failure Envelope Range	
application	general
sig3max	10.123 MPa
Mohr Coulomb Fit	
cohesion	1.518 MPa
friction angle	24.123 deg
Rock Mass Parameters	
tensile strength	-0.059 MPa
uniaxial compressive strength	1.302 MPa
global strength	4.686 MPa
modulus of deformation	1560.197 MPa

Portland Cottage - Principal Stress Envelope
Portland Cottage - Shear vs. Normal Stress Envelope

Client YACHIYO ENGINEERING CO.LDT./ ODPEM	Location Reference	TYPE/SIZE
	Sligoville, St Catherine	
Project Upgrade of Emergency Communication System, Jamaica.		NQ Coring & 95.25mm HAS
Address:	NORTHINGS: 18°05'44.00"N / EASTINGS 76°56'51.00"W	
	DATUM: Sea Level / ELEVATION:	

SAMPLE TYPE — WASH — GRAB — SPLIT SPOON — T.W. TUBE — R.CORE

SAMPLE TYPE	DEPTH DRIVEN / RECOVERY	CASING DEPTH DRIVEN	SAMPLE NO. / SAMPLE DEPTH	BLOWS PER 6" DRIVEN	DEPTH OF SAMPLE (ft)	LAYER INTERFACE	
					0		WATER LEVEL: TIME / DATE / CASING DEPTH — START TIME / START DATE — FINISH TIME / FINISH DATE
R/C					1		Gravel Fill
					2		
					3		Hard Brown Silty Clay with some Sand & Gravel
					4		
R/C					5		Hard brown silty clay and sand, Gravel, Cobble, Boulders
					6		
R/C					7		Very Dense Gravel, boulder with traces of sand
					8		Refusal of auger at 8', Coring with NQ core barells from 8' to 13' Medium cream porous limestone
					9		
					10		Hard cream Limestone
					11		Hard cream Limestone
					12		RQD is 50%
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

GEO-EDGE LIMITED
14 CALEDONIA ROAD, MANDEVILLE, JAMAICA
info@geoedgejamaica.com
+1 (876)366-9021

GEOEDGE ONSITE. INSIGHTS. E RECORDS

STARTED	April 20th 2016	JOB NO.	SHEET OF
COMPLETION	April 20th 2016		FIG NO.
FINAL W.L.			

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2518

LABORATORY TEST REPORT

OUR REF:	CLIENT AUTHORISATION:	REPORT NUMBER	REPORT DATE:
L16032	Verbal	G/805/01494	May 25, 2016

CLIENT: Geo-Edge Limited	REPORTED TO: Mr. Damian Williams
ADDRESS: 14 Caledonia Road, Mandeville	SAMPLING DATA: 3 Bags Soil
PROJECT: Repeater Station Soil Investigation	SOURCE: Sligoville, St. Catherine

CLIENT REP:	SAMPLES TAKEN BY:			DATE SAMPLE RECEIVED:	TEST SPECIFICATION:
	CLIENT	JETS	GEOTECH		
Mr. Damian Williams	X			April 27, 2016	ASTM D 2216

MOISTURE CONTENT DETERMINATION

SAMPLE IDENTIFICATION	MOISTURE CONTENT (%)
0089 @ 2ft-6"	8.0
0089 @ 5ft	7.0
0089 @ 7ft-6"	13.1

DATE TESTED:	TECHNICIAN:	CERTIFIED BY:
May 15, 2015	C. Campbell	

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7746; Fax No. (876) 928-2516

LABORATORY TEST REPORT

OUR REF:	CLIENT AUTHORISATION:	REPORT NUMBER	REPORT DATE:
L16032	Verbal	G/805/01494	May 25, 2016

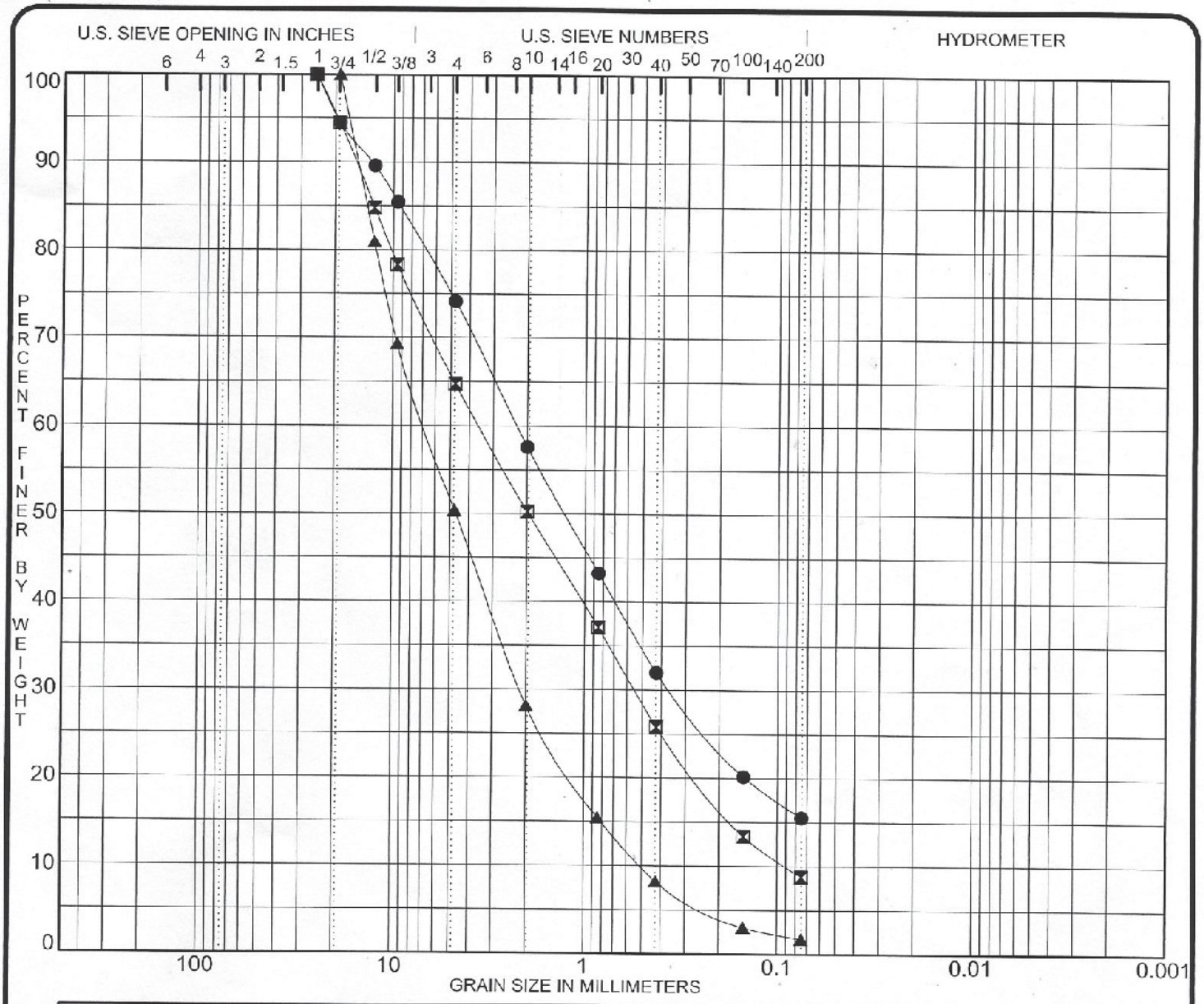
CLIENT:	Geo-Edge Limited	REPORTED TO:	Mr. Damian Williams
ADDRESS:	14 Caledonia Road, Mandeville	SAMPLING DATA:	3 Bags Soil
PROJECT:	Repeater Station Soil Investigation	SOURCE:	Sligoville, St. Catherine

CLIENT REP:	SAMPLES TAKEN BY:			DATE SAMPLE RECEIVED:	TEST SPECIFICATION:
	CLIENT	JETS	GEOTECH		ASTM C 117
Mr. Damian Williams	X			April 27, 2016	ASTM C 136

GRAIN SIZE ANALYSIS		WET SIEVE		
U.S SIEVE SIZES		PERCENTAGE PASSING		
SAMPLE IDENTIFICATION		0089 @ 2ft-6"	0089 @ 5ft	0089 @ 7ft-6"
Imperial	Metric (mm)			
1"	25.000	100.00	100.00	
3/4"	19.000	94.50	94.50	100.00
1/2"	12.500	89.60	84.80	81.00
3/8"	9.500	85.50	78.30	69.30
#4	4.750	74.20	64.70	50.30
#10	2.000	57.60	50.20	28.10
#20	0.850	43.30	37.10	15.40
#40	0.425	32.00	25.80	8.20
#100	0.150	20.20	13.40	3.00
#200	0.075	15.50	8.80	1.70

DATE TESTED:	TECHNICIAN:	CERTIFIED BY:
May 15, 2016	C. Campbell	

3203:(CRSZLSZ:16-5-25



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	0089	0.8		8					
⊠	0089	1.5		13				0.94	39.8
▲	0089	2.3	WELL-GRADED GRAVEL with SAND GW	7				1.36	13.4

	Specimen Identification		D50	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	0089	0.8	1.27	2.27	0.357		25.8	58.7	15.5	
⊠	0089	1.5	1.97	3.58	0.550	0.0898	35.2	56.0	8.8	
▲	0089	2.3	4.68	6.76	2.150	0.5040	49.6	48.6	1.7	

PROJECT **Repeater Stations Soil Investigation -**

JOB NO. **L16032**
DATE **16-5-25**

GRADATION CURVES

JETS Laboratories Ltd.
Kingston

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

REPORT ON ROCK STRENGTH TESTS:

Client: Geo-Edge Limited	Ref: L16032
Project: Repeater Station Soil Investigation	Report No. G/805/01494
Reported To: Mr. Damian Williams	Location: Sligoville, St. Catherine
Report Date: 5/25/2016	Date Cored: 4/19/2016
Specified Works Strength: psi (cylinder)	Date Tested: 5/3/2016
Actual Works Strength (Average): N/A p.s.i (cube)	Date Placed: N/A
Specified Slump: N/A inches	Test Specification: ASTM D7012 - 14
Actual Slump: N/A inches	Weather during Pour: N/A
Placed By: Chute/Bucket/other (Specify):	Compiled By: Mr. Roger Haisley

TEST RESULTS

Curing Conditions: N/A						
Specimen Number (Comp. Strength Specimen No.)	1	2				
Specimen Depth	8'-13'	8'-13'				
Element Cored	Rock	Rock				
Location	Sligoville, St. Catherine					
Diameter - inches	1.75	1.75				
Length uncapped - inches	4.00	4.00				
Length capped - inches	N/A	N/A				
Length/Diameter	2.29	2.29				
Correction Factor	-	-				
Density p.c.f	160.8	159.9				
Compressive Strength - Mpa (cylinder)	22.55	23.51				
Equivalent Compressive Strength Mpa (cube)	-	-				
Compressive Strength - PSI (cylinder)	3270	3410				
Equivalent Compressive Strength PSI (cube)	-	-				

Checked by: Signed by:

Notes:

Sligoville

A-10-1-81

Sample ID: Sligoville 8-13′ A

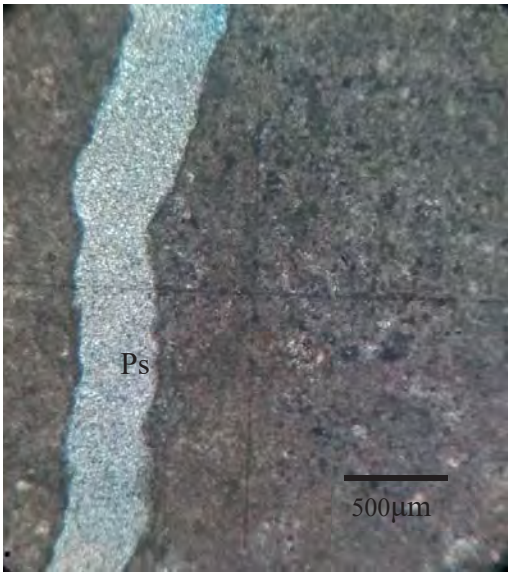
<table>
<tr><td colspan="2">Description</td><td>Photo-documentation</td></tr>
<tr><td colspan="3">Macroscopic</td></tr>
<tr><td>Colour</td><td>Cream</td><td rowspan="5"> 
</td></tr>
<tr><td>External Features</td><td>Cavities (small vugs) about a ≤ 5mm</td></tr>
<tr><td>Mineralogy</td><td>Calcite</td></tr>
<tr><td>Allochems</td><td>No visible fossils or other allochems</td></tr>
<tr><td>Spar cement or Mud</td><td>Mud</td></tr>
<tr><td colspan="3">Microscopic</td></tr>
<tr><td>Folk Classification</td><td>Micrite</td><td rowspan="4"> 

Photo micrograph showing sample in plane polarized light with large cavity</td></tr>
<tr><td>Dunham Classification</td><td>Mudstone</td></tr>
<tr><td>Porosity</td><td>High (large cavities/vugs), approx... 12%</td></tr>
<tr><td colspan="2"></td></tr>
</table>

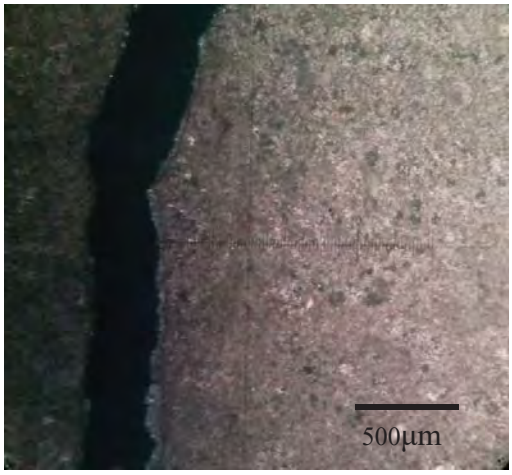


Photo micrograph showing sample in cross polarized light with large cavity

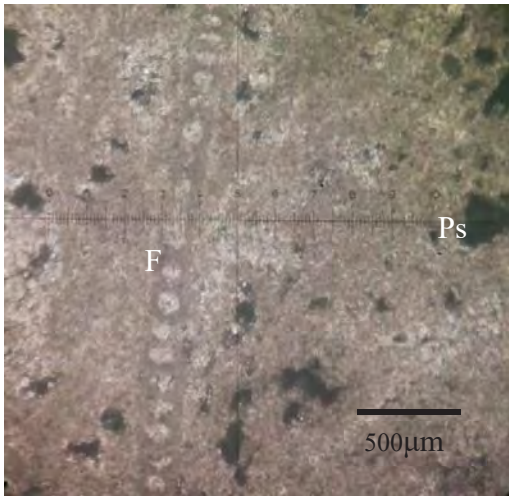
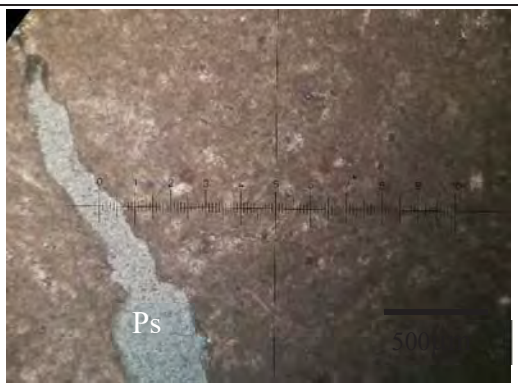


Photo micrographs showing sample in cross polarized light (F-foraminifera, Ps – Pore space)

	 Photo micrograph showing sample in plane polarized light with large cavity

Sample ID: Sligoville 8-13′ B

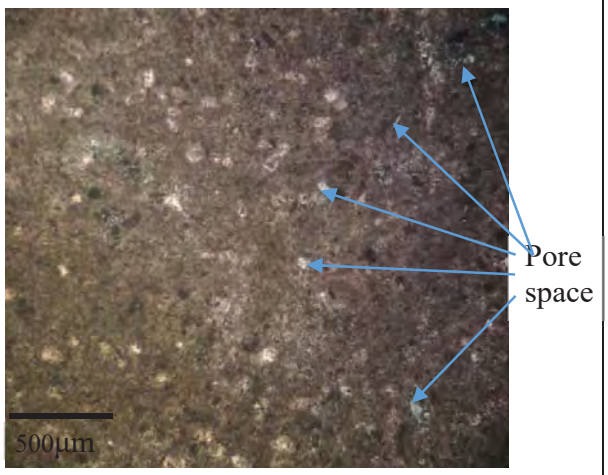
<table>
<tr><td colspan="2">Description</td><td>Photo-documentation</td></tr>
<tr><td colspan="3">Macroscopic</td></tr>
<tr><td>Colour</td><td>Cream</td><td rowspan="5"> 
</td></tr>
<tr><td>External Features</td><td>Cavities (small vugs) about a ≤ 1mm</td></tr>
<tr><td>Mineralogy</td><td>Calcite</td></tr>
<tr><td>Allochems</td><td>No visible fossils or other allochems</td></tr>
<tr><td>Spar cement or Mud</td><td>Mud</td></tr>
<tr><td colspan="3">Microscopic</td></tr>
<tr><td>Folk Classification</td><td>Dismicrite</td><td rowspan="4"> 

Photo micrograph of sample showing micrite with pore spaces</td></tr>
<tr><td>Dunham Classification</td><td>Mudstone</td></tr>
<tr><td>Porosity</td><td>moderate</td></tr>
<tr><td colspan="2"></td></tr>
</table>

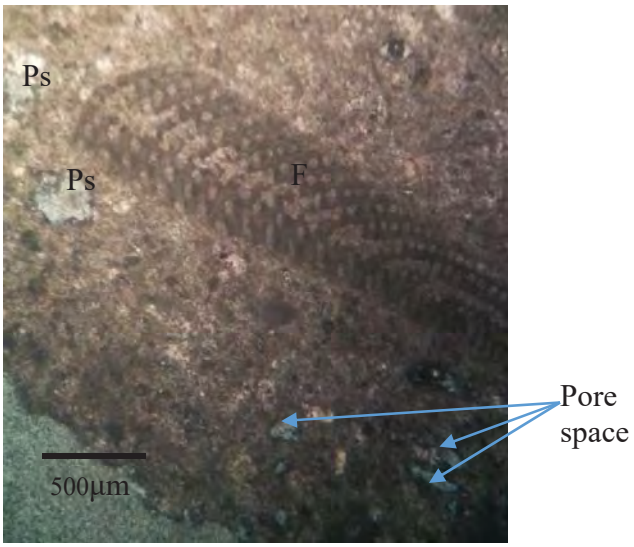


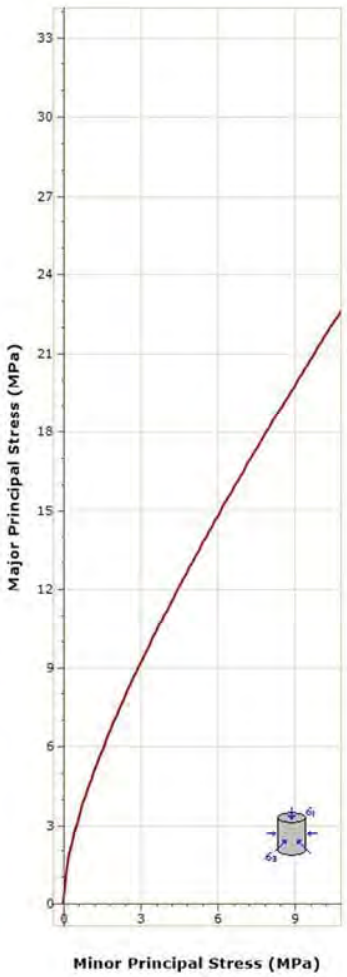
Photo micrograph of sample showing Foraminifera (F) within micrite matrix with pore spaces indicated by blue dye

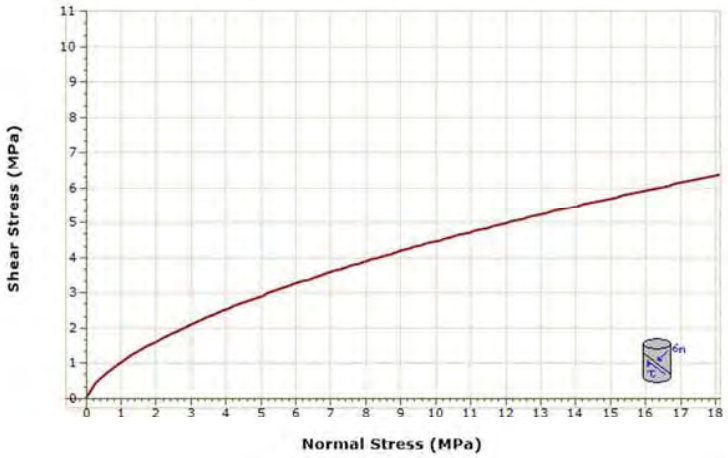
Relationship to regional Geology:

This sample belongs to the the Newport Formation. The Newport Formation has been photographed and described from the Sligoville are by Mitchell (2013, p. 117) as “Newport Formation (Sample WL1632), carbonate mudstones, sparsley fossiliferous, Sligoville, parish of St. Catherine.”

References

Mitchell, S. F. 2013. Stratigraphy of the White Limestone of Jamaica. *Bulletin de la Societe Geologique de France*, 184 (1-2), 111-118.





Sligoville	
Hoek Brown Classification	
intact uniaxial compressive strength	23.03 MPa
GSI	50
mi	9
disturbance factor	0.7
intact modulus	20727 MPa
modulus ratio	900
Hoek Brown Criterion	
mb	0.577
s	7.128e-004
a	0.506
Failure Envelope Range	
application	general
sig3max	5.758 MPa
Mohr Coulomb Fit	
cohesion	0.776 MPa
friction angle	22.088 deg
Rock Mass Parameters	
tensile strength	-0.028 MPa
uniaxial compressive strength	0.59 MPa
global strength	2.306 MPa
modulus of deformation	2223.631 MPa

— Sligoville - Principal Stress Envelope
— Sligoville - Shear vs. Normal Stress Envelope

Client YACHIYO ENGINEERING CO.LDT./ ODPEM	Location Reference	TYPE/SIZE
Project Upgrade of Emergency Communication System, Jamaica. Address:	**Cabbage Hill, St Thomas** NORTHINGS: 17 57'46.5N EASTINGS 76 34' 57.4W DATUM: Sea Level ELEVATION: 885m	Portable Concrete Coring Machine with a 15'' Core Barrel and 24'' extensions

SAMPLE TYPE — WASH — GRAB — SPLIT SPOON — T.W. TUBE — R.CORE

WATER LEVEL					START	FINISH
TIME					TIME	TIME
DATE					DATE	DATE
CASING DEPTH						

SAMPLE TYPE	DEPTH DRIVEN / RECOVERY	CASING DEPTH DRIVEN	SAMPLE NO. / SAMPLE DEPTH	BLOWS PER 6" DRIVEN	DEPTH OF SAMPLE (ft)	LAYER INTERFACE	
					0		
					1		Very hard Creamish white, limestone wuth chert nodules
							9'' limestone core recovered
					2		RQD=60%
							Weathered limestone fragments
					3		Weathered limestone fragments
							Reddish brown gravelly silty clay
					4		Reddish brown gravelly silty clay
							Reddish brown gravelly silty clay
					5		Highly fractured, creamish white micritic limestone
							Highly fractured micritic white limestone
					6		Slightly weathered & fractured white limestone
							Very hard micritic white limestone
					7		Limestone cores <10cm , Hence RQD=0%
					8		
					9		
					10		
					11		
					12		
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

GEO-EDGE LIMITED
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		JOB NO.	
STARTED	May 06 2016		SHEET OF
COMPLETION	May 06 2016		FIG NO.
FINAL W.L.			

OFFICE BOREHOLE RECORDS

JETS LABORATORIES LIMITED
14a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

PRELIMINARY

June 17, 2016

JOB NO.:L16036

Geo-Edge Limited
14 Caledonia Avenue
Mandeville
Manchester

Attention: Mr. Damian Williams

Dear Sirs:

Subject: Material Evaluation

Please find attached our Laboratory Report **G/805/01512** results obtained from Rock Core Tests carried out on samples tested on June 17, 2016.

We trust that the attached is satisfactory to you; however, should there be any queries please address them to the undersigned.

Yours very truly,
JETS LABORATORIES LIMITED

PRELIMINARY

Stacy-Ann Garwood (Miss)
Laboratory/Q.A. Administrator

Gordon E. Hutchinson
Director

/knd

Attachments

PRELIMINARY

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

REPORT ON ROCK STRENGTH TESTS:

Client: Geo-Edge Limited	Ref: L16036
Project: Material Evaluation	Report No.: G/805/01512
Reported To: Mr. Damian Williams	Location: Cabbage Hill | Winchester
Report Date: 17-06-16	Date Cored: Unknown
Test Specification: ASTM D7012 - 14	Date Tested: 17-06-16

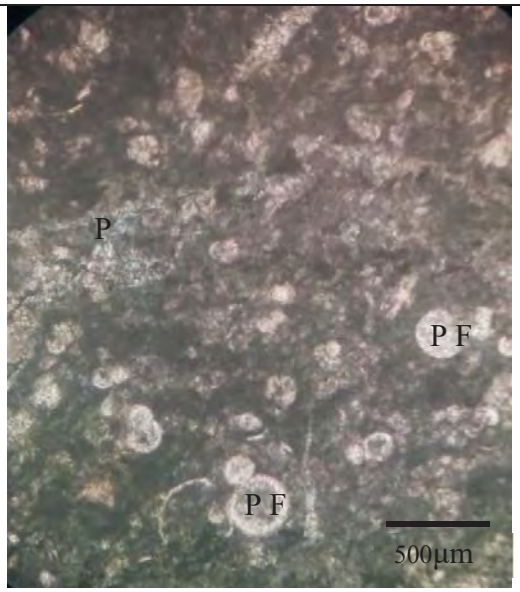
TEST RESULTS

Curing Conditions: N/A		
Specimen Number (Comp. Strength Specimen No.)	BH1	BH2
Sample Identification	0109	0110
Specimen Depth	-	-
Element Cored	Rock	Rock
Location	Winchester	Cabbage Hill
Diameter - inches	1.75	1.75
Length uncapped - inches	4.125	4
Length capped - inches	N/A	N/A
Length/Diameter	2.36	2.29
Correction Factor	1	1
Density p.c.f	144.1	148.7
Compressive Strength - Mpa (cylinder)	-	-
Equivalent Compressive Strength Mpa (cube)	-	-
Compressive Strength - PSI (cylinder)	6585	8430
Equivalent Compressive Strength PSI (cube)	-	-

Checked by: _____ Signed by: _____

Notes: _____

Sample ID -6 No ID _(0-5ft)

Description		Photo-documentation
Macroscopic		
Colour	Creamish white	 2cm
External Features	Chert nodules, calcite veins	
Mineralogy	Calcite, Chert	
Allochems	No visible fossils or other allochems	
Spar cement or Mud	Mud	
Microscopic		
Folk Classification	Biomicrite	 Photo micrograph of sample showing recrystallized Planktonic Forams (PF) within micrite matrix
Dunham Classification	Wackestone	
Porosity	moderate	
Fossils	Planthic Foram	
Other	Veins with recrystallized calcite, chert	

Comments: The sample is a deep water limestone which is term chalk. Deep water limestone due to high percentage of planthic Foraminifera as well as chert. The sample is consolidated, which may be due ro presence of microcrystalline silica (chert) making the sampling harder. Pore space is observed between the cert and the chalk interface.

Additional Micrograph

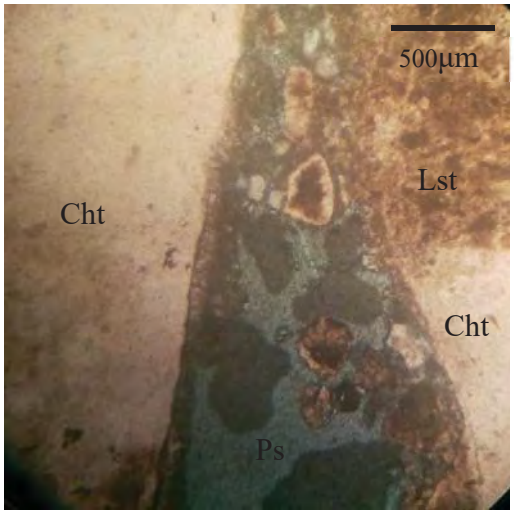


Photo micrograph of sample showing Limestone (lst) with Chert (Cht) and large pore space (indicated by the blue dye) in plane polarized light

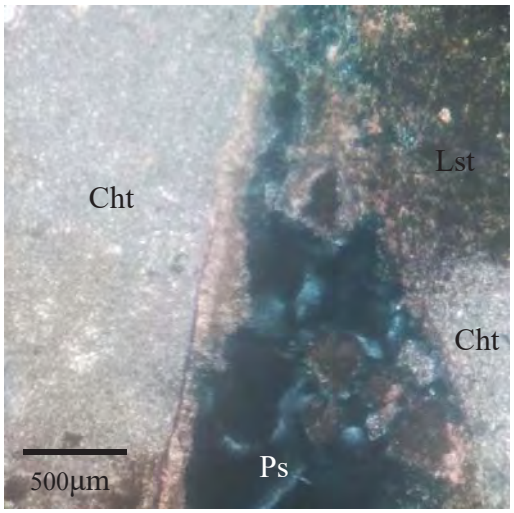


Photo micrograph of sample showing Limestone (lst) with Chert (Cht) and large pore space (indicated by the blue dye) in cross-polarized light

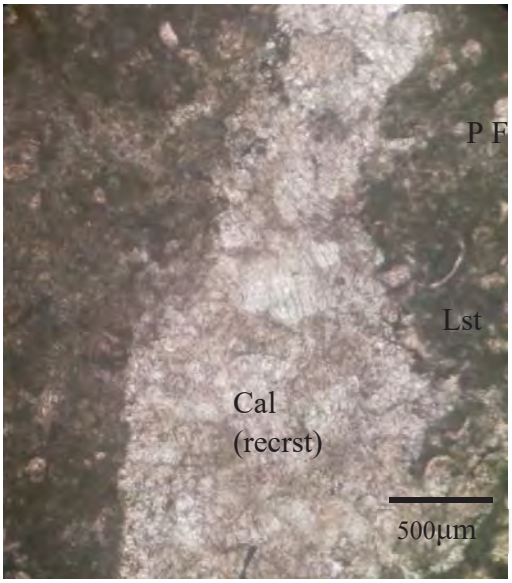


Photo micrograph of sample showing Limestone (lst) with planktonic Forams (PF) and recrystallized calcite vein (Cal recrst) in plane polarized light

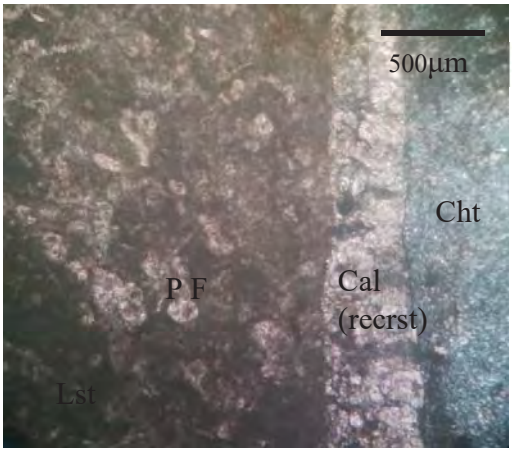
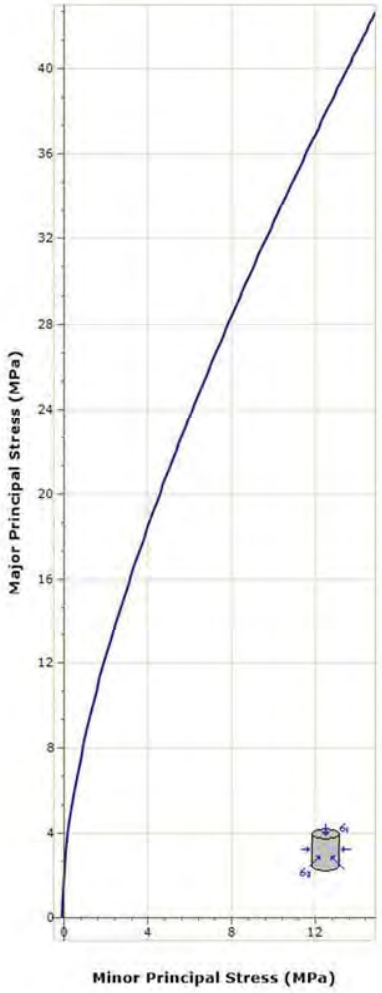
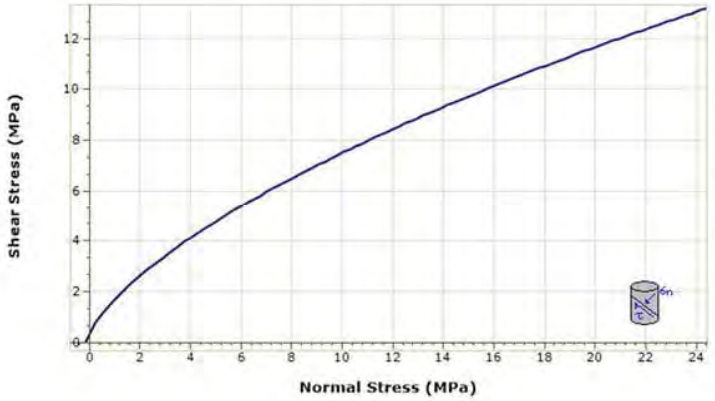


Photo micrograph of sample showing Limestone (lst) with planktonic Forams (PF), recrystallized calcite vein (Cal recrst) and Chert (Cht) in cross-polarized light





Cabbage Hill Sample	
Hoek Brown Classification	
intact uniaxial compressive strength	58 MPa
GSI	58
mi	9
disturbance factor	0.7
intact modulus	12000 MPa
Hoek Brown Criterion	
mb	0.895
s	0.002
a	0.503
Failure Envelope Range	
application	general
sig3max	14.5 MPa
Mohr Coulomb Fit	
cohesion	2.36 MPa
friction angle	25.415 deg
Rock Mass Parameters	
tensile strength	-0.147 MPa
uniaxial compressive strength	2.71 MPa
global strength	7.467 MPa
modulus of deformation	2135.311 MPa

— Cabbage Hill Sample - Principal Stress Envelope
— Cabbage Hill Sample - Shear vs. Normal Stress Envelope

Client YACHIYO ENGINEERING CO.LDT./ ODPEM	Location Reference	TYPE/SIZE
Project Upgrade of Emergency Communication System, Jamaica.	**Winchester, St Thomas**	Portable Concrete Coring Machine with a 15'' Core Barrel and 24'' extensions
Address:	NORTHINGS: 17 58'10.0N / EASTINGS 76 17' 47.6W	
	DATUM: Mean Sea Lev ELEVATIOI 460m	

SAMPLE TYPE — WASH — GRAB — SPLIT SPOON — T.W. TUBE — R.CORE

WATER LEVEL					START	FINISH
TIME					TIME	TIME
DATE					DATE	DATE
CASING DEPTH						

SAMPLE TYPE	DEPTH DRIVEN / RECOVERY	CASING DEPTH DRIVEN	SAMPLE NO. / SAMPLE DEPTH	BLOWS PER 6" DRIVEN	DEPTH OF SAMPLE (ft)	LAYER INTERFACE	
					0		
							Creamish white, medium strong, fossiliferous limestone
					1		6'' limestone core recovered from what was interpreted as a limestone boulder RQD=40%
							Compact limestone fill material, consist of gravelly limestone fragments
					2		Compact limestone fill material (Marl)
							Compact limestone fill material (Marl)
					3		2'' thick concrete screen recovered
							An additional 10'' thick concrete core recovered
					4		Medium hard creamish white micritic limestone fragments recovered
							Medium hard creamish white micritic limestone fragments recovered
					5		Creamish white micritic limestone granules, gravel and cobbles
							Medium hard, creamish white micritic limestone core
					6		Limestone core recovered 4" in length,
							RQD=26%
					7		
					8		
					9		
					10		
					11		
					12		
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

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STARTED	May 03 2016	JOB NO.	
COMPLETION	May 03 2016	SHEET OF	
FINAL W.L.		FIG NO.	

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June 17, 2016

JOB NO.:L16036

Geo-Edge Limited
14 Caledonia Avenue
Mandeville
Manchester

PRELIMINARY

Attention: Mr. Damian Williams

Dear Sirs:

Subject: Material Evaluation

Please find attached our Laboratory Report **G/805/01512** results obtained from Rock Core Tests carried out on samples tested on June 17, 2016.

We trust that the attached is satisfactory to you; however, should there be any queries please address them to the undersigned.

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Yours very truly,
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Laboratory/Q.A. Administrator

Gordon E. Hutchinson
Director

/knd

Attachments

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Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

REPORT ON ROCK STRENGTH TESTS:

Client: Geo-Edge Limited	Ref: L16036
Project: Material Evaluation	Report No.: G/805/01512
Reported To: Mr. Damian Williams	Location: Cabbage Hill | Winchester
Report Date: 17-06-16	Date Cored: Unknown
Test Specification: ASTM D7012 - 14	Date Tested: 17-06-16

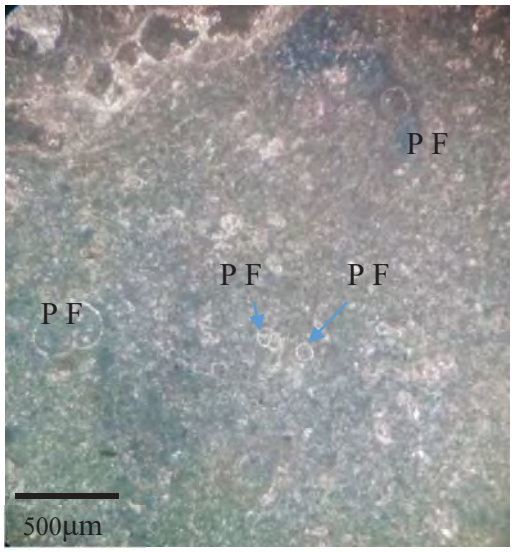
TEST RESULTS

Curing Conditions: N/A		
Specimen Number (Comp. Strength Specimen No.)	BH1	BH2
Sample Identification	0109	0110
Specimen Depth	-	-
Element Cored	Rock	Rock
Location	Winchester	Cabbage Hill
Diameter - inches	1.75	1.75
Length uncapped - inches	4.125	4
Length capped - inches	N/A	N/A
Length/Diameter	2.36	2.29
Correction Factor	1	1
Density p.c.f	144.1	148.7
Compressive Strength - Mpa (cylinder)	-	-
Equivalent Compressive Strength Mpa (cube)	-	-
Compressive Strength - PSI (cylinder)	6585	8430
Equivalent Compressive Strength PSI (cube)	-	-

Checked by: _____ Signed by: _____

Notes: _____

Sample ID: No ID_ (7ft)

Description		Photo-documentation
Macroscopic		
Colour	Creamish white	 1cm
External Features		
Mineralogy	Calcite	
Allochems	No visible fossils or other allochems	
Spar cement or Mud	Mud	
Microscopic		
Folk Classification	Biomicrite	 Photo micrograph of sample showing Planktonic Forams (PF) within micrite matrix
Dunham Classification	Wakestone	
Porosity	Low	
Fossils	Planthic Foram	
Other		

Comments: The sample is a deep water limestone which is term chalk. Deep water limestone due to high percentage of planthic Foraminifera content. The sample is poorly consolidated, which makes water absorption high.

Additional Micrograph

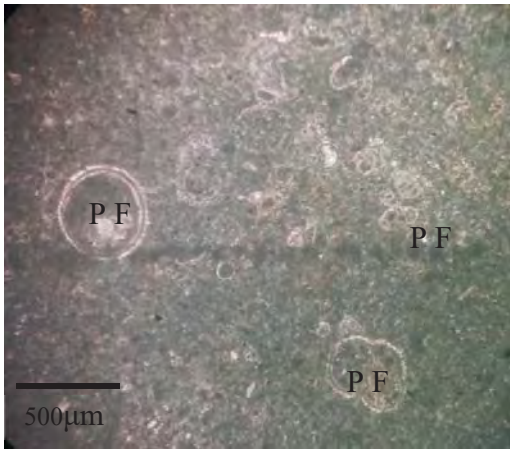
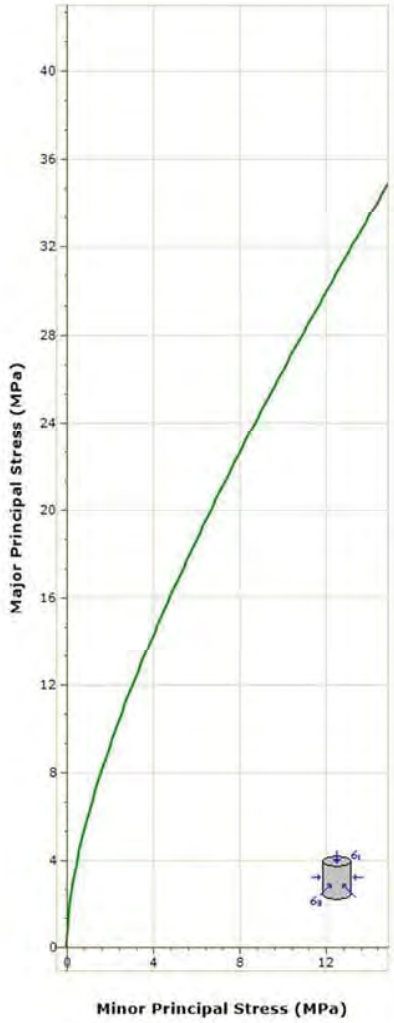
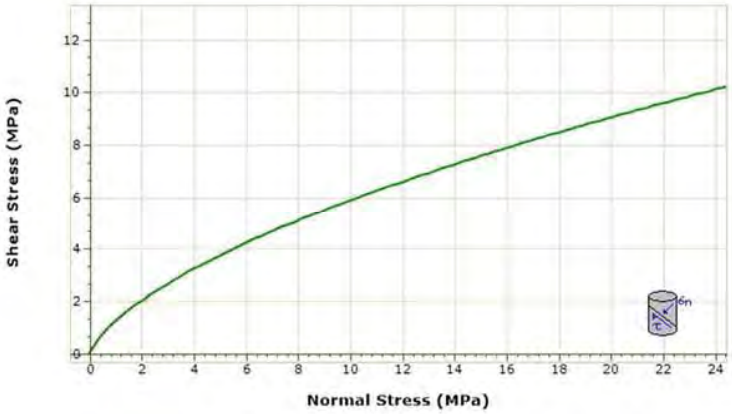


Photo micrograph of sample showing abundant Planktonic Forams (PF) within micrite matrix





Winchester Sample	
Hoek Brown Classification	
intact uniaxial compressive strength	45 MPa
GSI	51
mi	9
disturbance factor	0.7
intact modulus	12000 MPa
Hoek Brown Criterion	
mb	0.61
s	8.239e-004
a	0.505
Failure Envelope Range	
application	general
sig3max	11.25 MPa
Mohr Coulomb Fit	
cohesion	1.553 MPa
friction angle	22.496 deg
Rock Mass Parameters	
tensile strength	-0.061 MPa
uniaxial compressive strength	1.244 MPa
global strength	4.65 MPa
modulus of deformation	1372.587 MPa

— Winchester Sample - Principal Stress Envelope
— Winchester Sample - Shear vs. Normal Stress Envelope

A REPORT ON SOIL INVESTIGATIONS AT SELECTED REPEATER STATIONS (PROJECT FOR IMPROVEMENT OF EMERGENCY COMMUNICATION SYSTEM IN JAMAICA

Table of Contents

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LIST OF FIGURES

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1.0 INTRODUCTION

1.1 OBJECTIVES

The aim of this geotechnical report is to:

- Review and conduct geological assessment of selected repeater stations by employing physical subsurface exploration methods
- Present findings on geological and geotechnical study
- Present recommendations on anticipated earthworks and its potential impact on construction foundation design

1.2 BACKGROUND

In recent years the Japan International Cooperation Agency; JICA, and the Jamaican Government have strengthened bilateral arrangements with the aim of promoting the islands social and economic development.

A crucial component of JICA's operation is aimed at strengthening the goals and strategic objectives of the islands Comprehensive Disaster Management Framework, which partly involves the improvement of Jamaica's emergency communication infrastructure.

Hence, the objective of the project is to improve the existing emergency communication infrastructure in Jamaica. This will be accomplished by upgrading the existing communication infrastructure which will inevitably result in more efficient and effective communication island wide, and by extension a stronger emergency response mechanism in the event of natural disasters

1.3 PROJECT SCOPE

The work conducted at this site was governed under the scope of work provided and commissioned by Yachiyo Engineering Company Limited (YEC) and guided by contract dated April 14th 2016 included all activities necessary to produce findings of geotechnical investigations at target sites and recommendations for construction and design. The site for geotechnical investigation was chosen by YEC and shared with Geo-Edge Ltd via maps and geographical coordinates. This was further confirmed by a reconnaissance visit to each site by representatives of both companies. Field activities of the subsurface exploration included acquisition of soil samples and rock cores from underlying strata at each site employing use of HQ coring. A field geological assessment was also requested by scope. The scope also included production of field reports and logs and transportation of won samples to laboratory for testing. Record of Groundwater levels if encountered was also included. Geotechnical Laboratory testing of soil and rock samples should not exceed three (3) samples per site. Results from these test should then form the basis of geotechnical report to be supplied along with supporting field reports which constitute final deliverables

This report was prepared for the exclusive use of our client and their consultants for design of this project. In the event that any changes are made in the character, design or layout of the improvements,

we must be contacted to review the conclusions and recommendations contained in this report to determine whether modifications are necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

1.4 PROJECT DESCRIPTION

The purpose of this project is to improve the existing emergency telecommunication infrastructure in Jamaica. This involves installing the requisite wireless communication systems and relevant infrastructure.

The preparation of a geological/geotechnical report serves as a major component of study, as it assesses the engineering characteristics of the site and its suitability for the various communication related infrastructure. The availability of such data allows engineers and architects to either proceed by implementing structural designs in accordance with the findings or to find engineering solutions where onsite conditions are challenging.

The report hereby presents the findings of the site investigation carried out at the Shotover Repeater Station located in Shotover Portland

No.	Name	Parish	Longitude	Latitude
??	Shotover	Portland	18°10'18.39"N	76°28'51.02"W

Figure 1 Table showing geographic coordinate location of Shotover (Portland) Repeater Station site

1.5 PROJECT LOCATION

This addendum involves the geotechnical and geological assessment of the telecommunication tower located in the parish of Portland. The tower is located in northcentral section of the parish, just southeast of the parish capital Port Antonio. (See fig.2).

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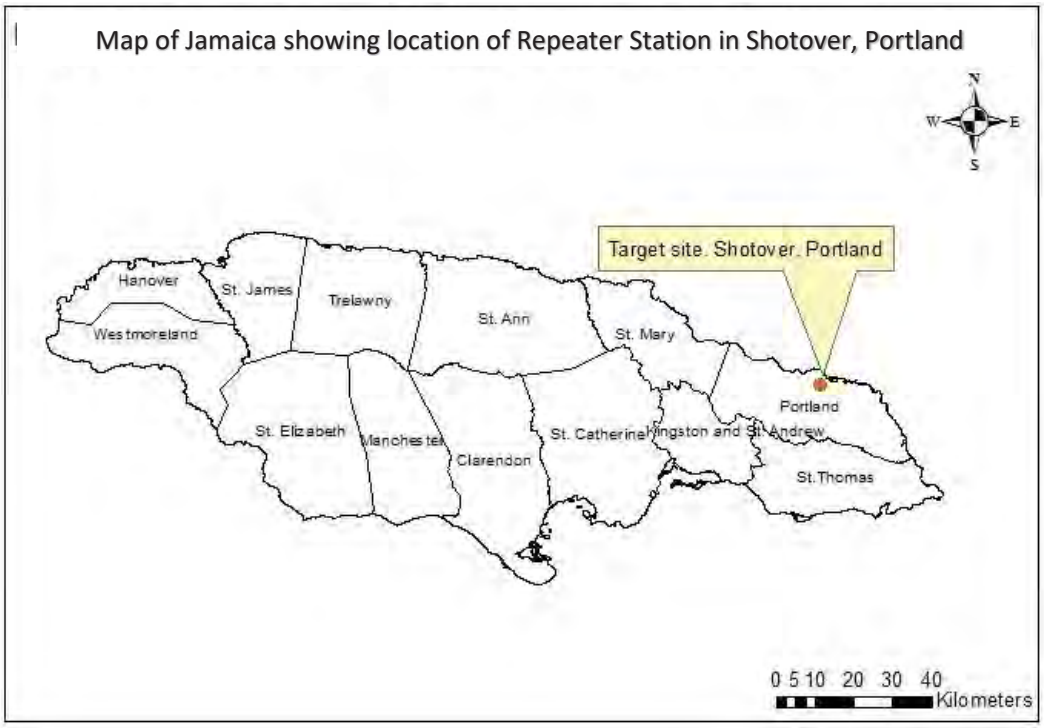

Figure 2. Map showing location of the Shotover Repeater station. where soil investigations were conducted

1.5.1 SHOTOVER, PORTLAND

The parish of Portland covers 814.5 km2, or approximately 7% of the area of Jamaica, and includes the northern flank of the Blue Mountains. The parish is dominantly mountainous with low hills on the northern edge and the steeper, higher slopes of the Blue Mountains on the southern extent. The Blue Mountain Peak, the highest peak in the range, culminates at 2256 metres above sea level. There are also the John Crow Mountains, a low cuesta in the east. Surficial drainage is dominant in Portland; the parish hosts five watersheds having large rivers, such as, the Rio Grande, Buff Bay, Swift, and Spanish Rivers. These are rarely dry, because their headwaters are constantly fed by rainfall in the mountains.

The target repeater station is located some five kilometers south east of Port Antonio in the hilly interior of north-central Portland, within the foothills of the Blue Mountains. It is situated within the rural community of Shotover, one of a number of scattered settlements found in this area of Portland.

The site is accessed via a parochial road leading from the district of Boundbrook and serves the adjacent rural communities of north-central Portland.

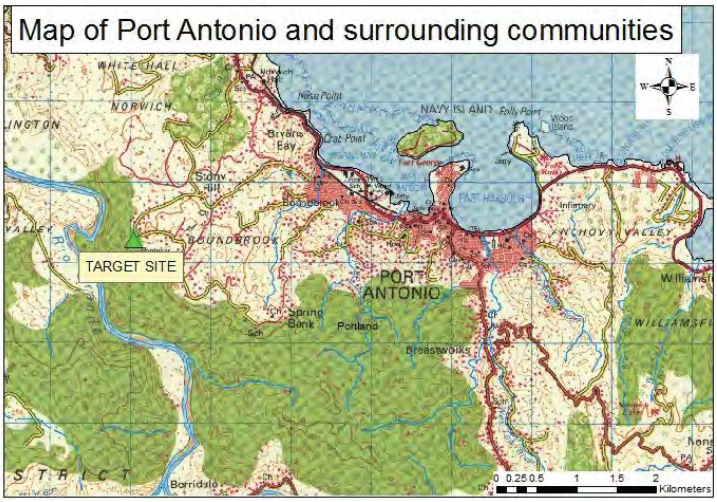

Figure 3 Map showing location of tower site in Shotover, Portland

2.0 GEOLOGY

2.1 INTRODUCTION

This section of the report documents the findings of the geological assessment conducted for and at the Shotover Repeater Station site.

2.2 METHODOLOGY

The geology at the target location is presented from a regional to a local, site specific perspective. A regional geological report was done from a desktop study which highlighted the surrounding geological formations and regional structure (See fig.4). Site specific geological assessment included outcrop sampling, identification and measurement of the orientation and thickness of bedding, identification of minor faults or evidence of major faulting, identification of any major formation contacts and assessment of potential geohazards that may impact the site.

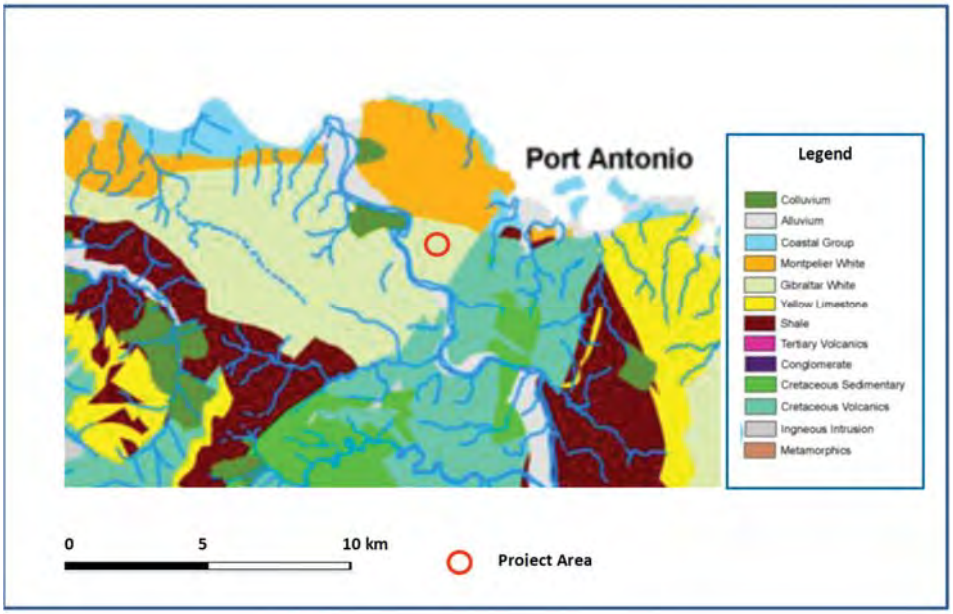

Figure 4Map showing Lithology Units of Northern Portland area

2.3 SHOTOVER, WESTMORELAND

2.3.1 REGIONAL GEOLOGY SETTING

Sedimentary and igneous rock types dominate though metamorphic lithotypes are present within the geological occurrences in the Port Antonio environs. These are of Cretaceous to Neogene age The Cretaceous rocks occur in the Blue Mountains inlier and include quartzo-feldspathic and basic schists, tuffs, lava flows and granodiorite intrusions. Cretaceous lithologies comprise the upper sections of the Blue Mountains extending from Silver Hill Peak in the west to the left bank of the Rio Grande in the east. These extend northwards as far as Port Antonio.

Paleocene to Miocene sedimentary rocks encircle the Blue Mountain inlier. Paleocene-Eocene rocks dominate, and range from conglomerates, sandstones and shales, to impure to pure limestones (such as those at Shotover).

The John Crow Mountains comprise shale capped by deep-water micrites. There are also minor Miocene volcanic rocks (tuffs and lava flows) in the north central section of the parish. Elevated rocks of the Coastal Group fringe the coastline. Fluvial deposits extend from the coastal areas inland along some of the river valleys. Large masses of colluvium consisting of rock and debris drape the landscape in many areas such as Shrewsbury, Tranquility, Milbank and Cornwall Barracks.

2.3.2 LOCAL GEOLOGY

2.3.2.1 LITHOLOGY

At the target site the bedrock is seen outcropping intermittently beyond the fenced perimeter of the Repeater Station. Field investigation indicated a massive micritic limestone with thin to absent topsoil.

The geology of the Shotover district is defined by the dominance of Gibraltar Bonnygate Limestone formation that is the primary lithological unit in the area. It is an Eocene Age White Limestone formation and is composed of evenly bedded white micrites typically chalky and porous. These white chalky limestones contain planktonic foraminifera such as Porticulasphaera mexicana and Hantkenina alubamensi in the lower sequences and Globigerina ampliapertarec in the upper sequences. Bioclastic layers include Lepidocyclina pustulosa and L. chaperi at the lower levels and L. yurnagunesis, L. undosa and Pararotolia sp. towards the top

Figure 5. Picture showing bedrock at the Shotover Tower site

2.3.2.2 GEOLOGICAL STRUCTURE

The dominant structural feature of Portland is the northern extension of the Blue Mountain Inlier superimposed with an intricate fault pattern reflective of polyphase deformation due to overprinting of tectonic events. The mountainous terrain consists of densely fractured rocks that have been exposed to long periods of deep weathering, and are highly susceptible to landslides. At the vicinity of the repeater station there were no visible discontinuities at the surface

2.3.2.3 SURFICIAL DEPOSITS

Soil development at the target site in the Shotover area is generally poor. The area is covered by a stony loam, brown-yellowish colour siting on limestone bedrock (See fig.6).

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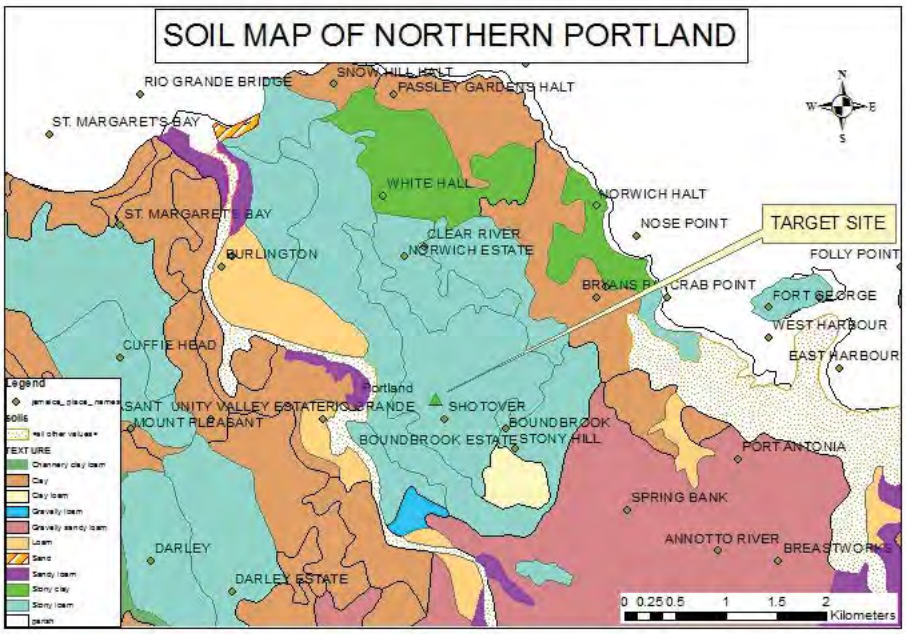

Figure 6 Soil map of the Northern section of Portland

At the site within the fenced area the ground is covered with a thin, dark organic matter which lies just below the vegetation which quickly transitions to a yellow-brown stony (limestone gravels and pebbles) loam. The soil development here however reflects some modification to the original soil horizons as a top layer of gravels, which consist of a darker gravelly layer, is reminiscent of the local supply of alluvial aggregate sourced from nearby rives. (See fig 7). Particle size distribution analysis indicate a poorly graded gravel. The site is covered by a fairly thick undergrowth of short grasses. The surrounding hillside exhibits a similar poor soil development supporting irregular subsistence farming

Figure 7 Picture showing unearthed soil at site

2.3.2.4 SURFACE WATER AND GROUNDWATER

Groundwater was not encountered during the field activity. Reports indicate that nearby wells (Berridale, Portland) water was struck in excess of sixty feet some six kilometers to the southeast.

3.0 GEOTECHNICAL ASSESSMENT

3.1 INTRODUCTION

The scope of work involved the following:

- Subsurface drilling of a single borehole to a depth of 5m at site where possible.
- Borehole shall be drilled below the footprint or as close as possible to the proposed structure.
- Geological pit shall be excavated to facilitate assessment of underling rock, possible discontinuities, structure, etc as deemed fit by the project geologist
- Samples shall be logged and RQD results calculated from core recovery.
- Moisture content, grainsize distribution analysis and plasticity index will be assessed and determined where applicable.
- Uniaxial Compressive Strength Testing of cores shall be carried out in order to determine bearing capacity of rock material.
- Preliminary geological and geotechnical assessment of the site shall be outlined

3.2 METHODOLOGY

Soil investigations were accomplished by the of the site with portable rock coring machine capable of achieving beyond the target sample depth and allow logging of the subsurface conditions at the site. The boring location was chosen based on discussions with representatives of Yachiyo Engineering Ltd. The borehole was advanced through rock using a semi-automated, gas powered portable rock coring drill with approximately 1.0 metre runs used in lieu of the availability of a truck -mounted drill-rig being able to achieve access due to grade and road conditions and also employed to expedite completion of project. Field logs were used to develop the report logs in the Appendices. The logs depict subsurface conditions at the Shotover Repeater Station for the date of exploration. Boring was advanced to achieve target depth of five (5) meters below the existing grade. Boring was backfilled with drill cuttings. A backhoe/ bucket excavator was employed to produce geological pit for creation of log sections

Conditions encountered at the boring location is indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil and rock types; in-situ, the transition between materials may be gradual. Details of each boring can be found on the bore logs in Appendices of this report.

Atterberg Limits (ASTM 04318) were determined for soil encountered at the site. Where a rock core is retrieved, the determination of Unconfined Compressive Strengths (ASTM 07012-C) was employed. ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass guided the determination of soil moisture where applicable. Results of the tests performed are presented in Appendices to this report; soil description and classification are in accordance with the Unified Soil Classification System (USCS).

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3.3 SOIL INVESTIGATIONS RESULTS / FINDINGS

Presentation of the findings will indicate results of the field exercise and laboratory analysis. A physical description of downhole conditions will be provided accompanied by the results geotechnical tests on won samples.

3.3.1 SHOTOVER, PORTLAND

3.3.1.1 BORINGS

We attempted drilling of the site with portable rock coring machine capable of achieving beyond the target sample depth and allow logging of the subsurface conditions at the site. (See fig.8)

Figure 8 Picture showing initial boring of hole, Shotover, Portland

A single borehole was dug through topsoil for approximately one meter through the top and lower soil horizons. A hard limestone was then encountered. This limestone represents a cap (hardened / recrystallized limestone) typical relict karstified surface found in similar geology in Jamaica. Drilling was attempted until refusal then a bucket excavator/ bucket loader (JCB 214) was employed to dig a geological pit to give access to lower horizons.

Figure 9 Picture of equipment used in digging of geological pit

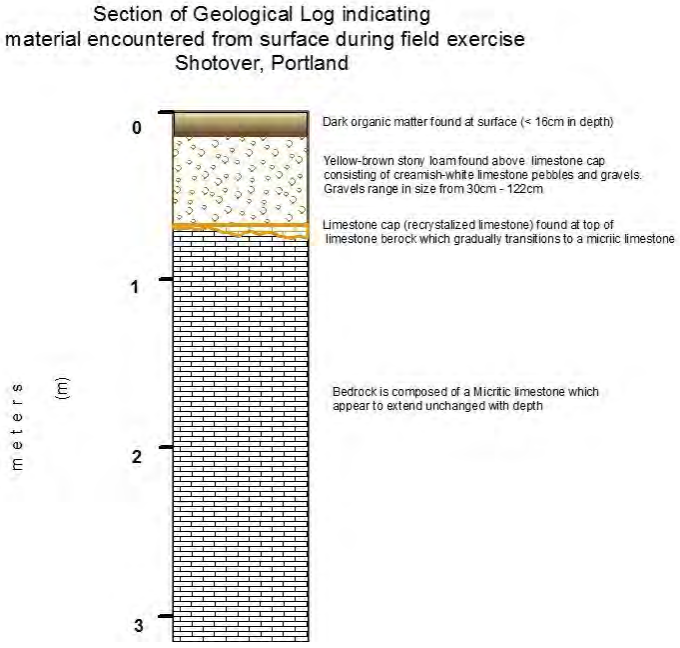

Figure 10. Lithological profile generated from borelog, Shotover, Portland

3.3.1.2 LAB REPORT

Two bulk samples of soil were recovered from field exercise for soil moisture, Atterberg Limits specifications, particle size distribution and moisture content while one (1) rock sample was won for the determination of Unconfined Compressive Strengths (ASTM 07012-C). Soil description and classification are in accordance with the Unified Soil Classification System (USCS)

Unconfined Compression Strength (Rock)

One (1) specimen from the core sample returned was submitted for unconfined compressive strength testing and summary of results obtained are shown in the table below. A more detailed report can be obtained from lab report attached in the Appendices. The analysis indicates an average density of 159.0 pounds per cubic foot (p.c.f) and compressive strength in excess of three thousand five hundred pounds per square inch (psi)

UNCONFINED COMPRESSION TEST RESULTS	
Location	**Shotover, Portland**
Specimen Number (Comp. Strength Specimen No.)	1
Specimen Depth	3'-8'
Density p.c.f	159.0
Compressive Strength - Mpa (cylinder)	24.50
Compressive Strength - PSI (cylinder)	3501

Atterberg Limits

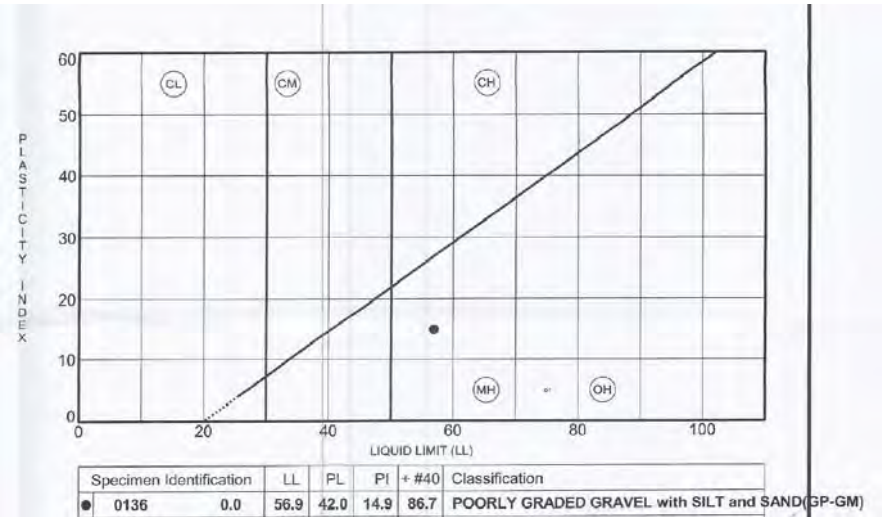

Figure 11. Plasticity chart for sample, Shotover, Portland

The results of the Atterberg limits testing was plotted on the Plasticity Chart and the sample plotted below the Casagrande A-Line in the MH region of the Chart and thus classifies as a soil with moderate plasticity with liquid limit of 56.9 percent, plastic limit of 42.0 percent and plasticity index of 14.9 percent and average moisture content of 24.2 percent.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

The evaluation of subsoil parameters for the site is generally made by assuming that the sampling of the site is representative of the site. It is explicitly a stochastic process and our confidence in these assumptions and the probability that an evaluation will yield a design suitable for problem free construction and long-term performance, is a function of the available database as well as the intrinsic variability of the subsoils on the site. In cases, where a single borehole only was requested, larger factors of safety will be applied to recommended values in an attempt to counteract even greater assumptions along with the caveat that our recommendations hold as long as the subsoil encountered during construction is similar to what was encountered in the borehole.

The base material underlying the Repeater Station at Shotover, Portland is from the White Limestone series of Jamaica and as such tends to contain solution cavities due to its permeable and porous nature. It is practically impossible to determine the extent of possible cavities from borehole exploration only, and generally, geophysical methods are needed for suitable determination. During the assessment of the

underlying bedrock at this site, there was no indication of open or unfilled cavities. There were no surface manifestations of possible cavities observed on any of the sites.

The table below show the generalized bearing capacities associated with the formation at the Shotover site. The information provided acts as a guide but design should be guided by local conditions and analysis

Geological Formation	Bearing Capacity	Permeability	Method of Excavation	Slope Stability	Construction Problem
Gibraltar-Bonny Gate, Formation Consists of evenly bedded white micrites typically chalky and porous	In sound rock ~ 4000KN/M^2 In depression where soil is stiff and clay content is high ~ 40 – 500KN/m^2	Primary Permeability is generally low. Secondary permeability may be very high.	Variable Blast/ Rip	Reasonable in sound rocks, while on soil near vertical cuts should be stable, given that soil cohesion is high.	Landslip along fault scarps Underground cavities Flood risk in depressions Depth of bedrock may be variable

4.1 SHOTOVER, PORTLAND

4.1.1 EARTHWORKS

The estimation of rock parameters to determine its strength in-situ was done using the Hoek-Brown Method and the results obtained are presented. (See fig.12). The rock is estimated to have a cohesion (c) of 3.72 MPa and a friction angle (ϕ) of 34.31 degrees. Using the Hoek-Brown Method, a Geological Strength Index (GSI) of 63 was obtained and a global strength of 14.08 MPa. It is theorized that rocks with a GSI of up to 40 can be dug while those with global strength of above 1 MPa can be ripped. If rock is to be excavated on site for foundations or other reasons, we would recommend the use of ripping equipment like a D8 or equivalent along with bucket and hammer attachments for operation or use of hydraulic jackhammer given the limited operating space at the repeater station.

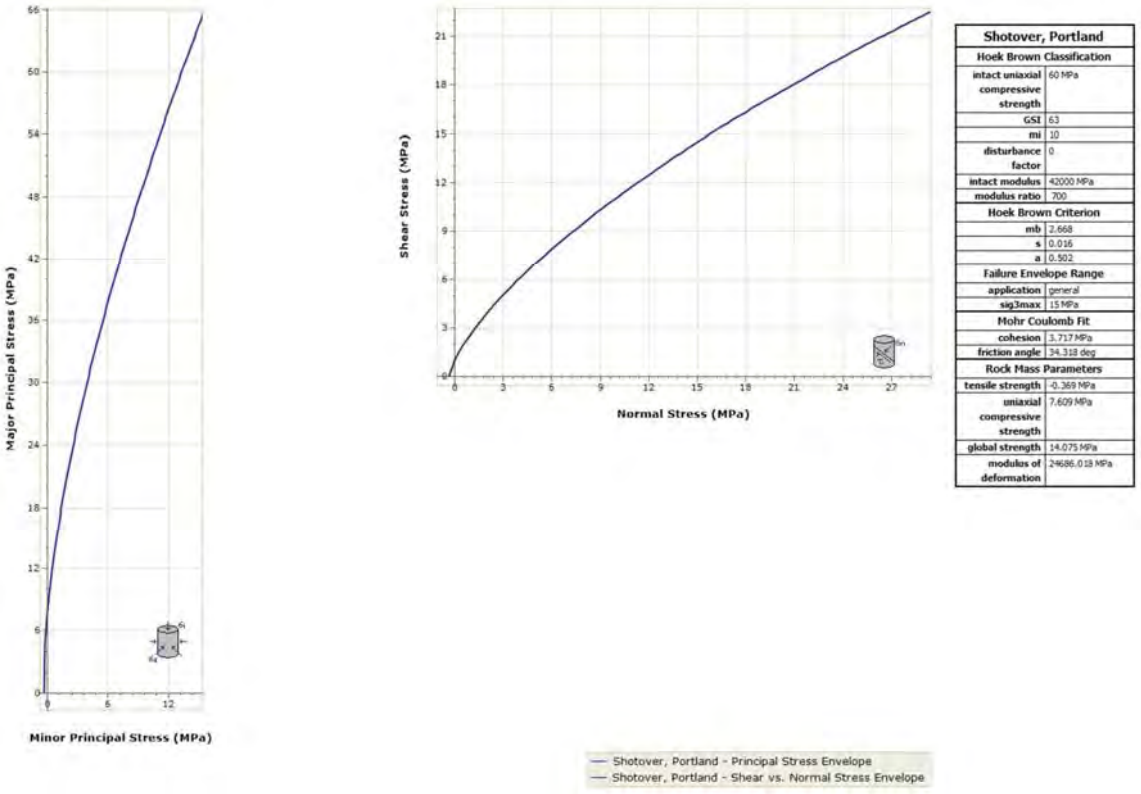

Figure 12. Diagram showing average principal and normal vs shear stress envelopes, Shotover, Portland

4.1.2 FOUNDATIONS

Foundations on site can be founded to a depth of 3ft within limestone encountered at the surface. Foundations on rock should have no bearing capacity or settlement issues, and in-fact our recommendations for ultimate and allowable bearing capacities for foundations in rock at this site range are indicated in the table below.

SHOTOVER		
NO	**ITEM DESCRIPTION**	**mPa**
1	AVERAGE UCS	24.5
2	ALLOWABLE BEARING CAPACITY	17.15
3	ULTIMATE BEARING CAPACITY	102.9
SAFETY FACTOR = 7 - Limestone cap found 2-3' below soil. Some small vugs seen		

Figure 13Table showing average, allowable and ultimate bearing capacities

5.0 REFERENCES

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Robinson, E & Mitchell, S.F. 1999. Middle Eocene to Oligocene Stratigraphy and Palaeogeography in Jamaica: a window on the Nicaragua Rise, Prepared for the Fourth Annual Meeting of IGCP 393, 12-18 July, 1999. Contributions to Geology #4, 1-47.

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APPENDICES

APPENDIX A1 - EXPLORATION LOGS – SHOTOVER, PORTLAND
APPENDIX A2 - LAB REPORT – SHOTOVER, PORTLAND
APPENDIX A3 – PRINICIPAL AND SHEAR STRENGTH GRAPHS – SHOTOVER, PORTLAND

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Client	Yachiyo Engineering	Location Reference	TYPE/SIZE
Project	Geotechnical Soil Testing at Shotover, Portland Repeater Station	NORTHINGS: EASTINGS	
Address:	Community of Shotover, Portland	DATUM: ELEVATION:	

SAMPLE TYPE **Bulk** WASH GRAB SPLIT SPOON T.W. TUBE R.CORE

SAMPLE TYPE	DEPTH DRIVEN / RECOVERY	CASING DEPTH DRIVEN	SAMPLE NO. / SAMPLE DEPTH	BLOWS PER 6" DRIVEN	DEPTH OF	SAMPLE	LAYER INTERFACE	WATER LEVEL					START	FINISH
								TIME					TIME	TIME
								DATE					DATE	DATE
								CASING DEPTH						
Bulk					0									
					1									
					2	2		Two bulk samples - composited						
					3									
					4	1		Rock sample (boulder)						
					5									
					6									
					7									
					8									
					9									
					10									
					11									
					12									
					13									
					14									
					15									
					16									
					17									
					18									
					19									
					20									

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STARTED	Aug 11 2016	JOB NO.	
COMPLETION	Aug 11 2016	SHEET	1 OF 1
FINAL W.L.		FIG NO.	

OFFICE BOREHOLE RECORDS

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

REPORT ON ROCK STRENGTH TESTS:

Client:	Geo-Edge Limited	Ref:	L16032
Project:	Repeater Station Soil Investigation	Report No.	G/805/01572
Reported To:	Mr. Damian Williams	Location:	Shotover, Portland
Report Date:	8/19/2016	Date Cored:	8/19/2016
Test Specification:	ASTM D7012 - 14	Date Tested:	8/19/2016
Compiled By:	Ms. Stacy-ann Garwood	Tested by:	Mr. Craig Campbell

TEST RESULTS

Curing Conditions: N/A

Specimen Number	1			
Sample Identification	0137			
Specimen Depth	-			
Element Cored	ROCK			
Location	GEOTECH OFFICE			
Diameter - inches	1.625			
Length uncapped - inches	3.25			
Length capped - inches	N/A			
Length/Diameter	2			
Correction Factor	-			
Density p.c.f	159.0			
Compressive Strength - Mpa (cylinder)	24.50			
Compressive Strength - PSI (cylinder)	3501			

Checked by: Garwood

Signed by:

Notes:

JETS LABORATORIES LIMITED

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Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

LABORATORY TEST REPORT

OUR REF:	CLIENT AUTHORISATION:	REPORT NUMBER	REPORT DATE:
L16032	Verbal	G/805/01570	August 17, 2016

CLIENT: Geo-Edge Limited

ADDRESS: 14 Caledonia Road, Mandeville

PROJECT: Repeater Station Soil Investigation

REPORTED TO: Mr. Damian Williams

SAMPLING DATA: 2 Bags of Soil Sample

SOURCE: Shotover, Portland

CLIENT REP:	SAMPLES TAKEN BY:			DATE SAMPLE RECEIVED:	TEST SPECIFICATION:
	CLIENT	JETS	GEOTECH		
Mr. Damian Williams	X			August 12, 2016	ASTM D 2216

MOISTURE CONTENT DETERMINATION

SAMPLE IDENTIFICATION	MOISTURE CONTENT (%)
136	24.2

DATE TESTED:	TECHNICIAN:	CERTIFIED BY:
August 12, 2016	M. Lee	

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756; Fax No. (876) 929-2515

LABOARTORY TEST REPORT

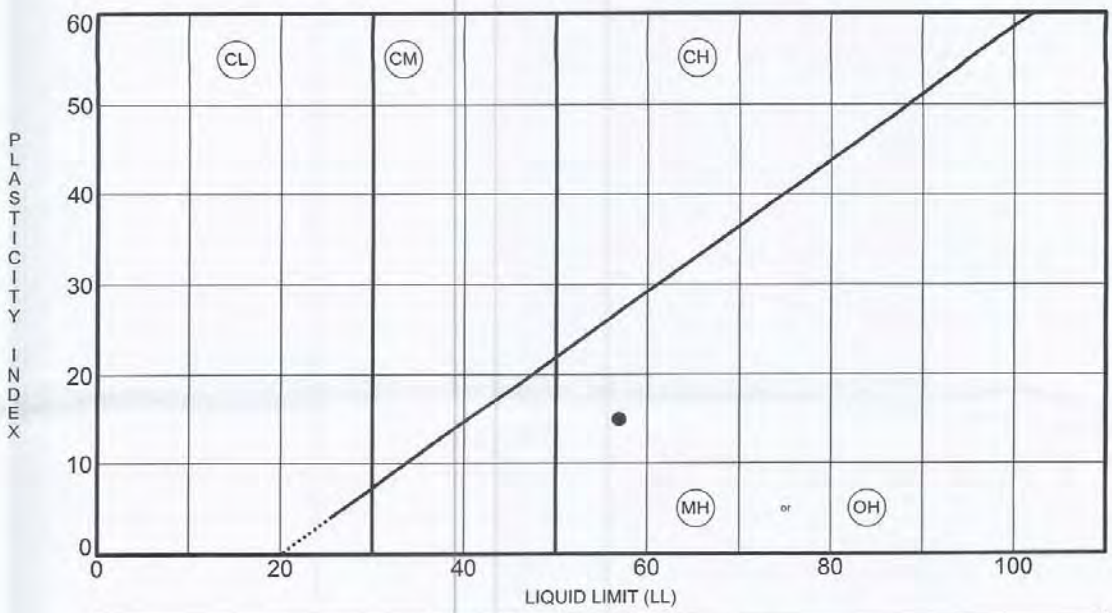
OUR REF:	CLIENT AUTHORISATION:	REPORT NUMBER	REPORT DATE:
L16032	Verbal	G/805/01570	August 17, 2016

CLIENT: Geo-Edge Limited	REPORTED TO: Mr. Damian Williams
ADDRESS: 14 Caledonia Road, Mandeville	SAMPLING DATA: 2 Bags of Soil Sample
PROJECT: Repeater Station Soil Investigation	SOURCE: Shotover, Portland

CLIENT REP:	SAMPLES TAKEN BY:			DATE SAMPLES RECEIVED	TEST SPECIFICATION:
	CLIENT	JETS	GEOTECH		ASTM D4318
Mr. Damian Williams	X			August 12, 2016	

APPENDIX I
ATTERBERG LIMITS TEST DATA

DATE TESTED:	TECHNICIAN	CERTIFIED BY:
15/8/16 - 16/8/16	L. Maxam	APPROVED BY:



Specimen Identification		LL	PL	PI	+ #40	Classification
● 0136	0.0	56.9	42.0	14.9	86.7	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)

PROJECT **Repeater Stations Soil Investigation - Shotover, Portland**

JOB NO. **L16032**

DATE **16-8-16**

ATTERBERG LIMITS

JETS Laboratories Ltd.

Kingston

JETS LABORATORIES LIMITED

14 a Hope Road, P.O. Box 402, Kingston 10, Jamaica West Indies
Telephone Nos. (876) 926-2201/2, 926-7756: Fax No. (876) 929-2515

LABORATORY TEST REPORT

OUR REF:	CLIENT AUTHORISATION:	REPORT NUMBER	REPORT DATE:
L16032	Verbal	G/805/01570	August 17, 2016

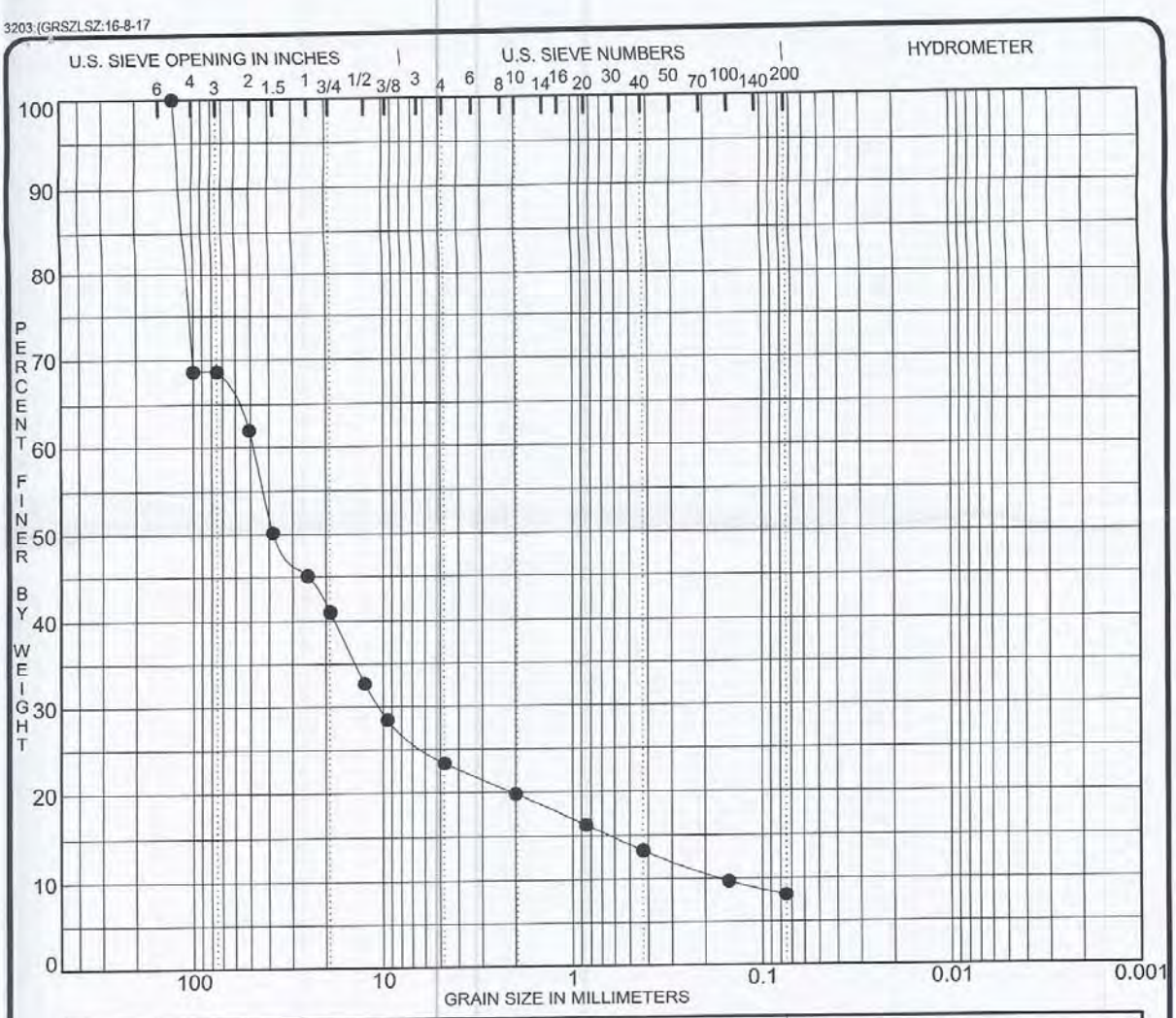
CLIENT:	Geo-Edge Limited	REPORTED TO:	Mr. Damian Williams
ADDRESS:	14 Caledonia Road, Mandeville	SAMPLING DATA:	2 Bags of Soil Sample
PROJECT:	Repeater Station Soil Investigation	SOURCE:	Shotover, Portland

CLIENT REP:	SAMPLES TAKEN BY:			DATE SAMPLE RECEIVED:	TEST SPECIFICATION:
	CLIENT	JETS	GEOTECH		ASTM C 117
Mr. Damian Williams	X			August 12, 2016	ASTM C 136

GRAIN SIZE ANALYSIS		WET SIEVE		
U.S SIEVE SIZES		PERCENTAGE PASSING		
SAMPLE IDENTIFICATION		136		
Imperial	Metric (mm)			
5"	125	100.00		
4"	100	68.70		
3"	75	68.70		
2"	50.8	62.00		
1 1/2"	38.1	50.30		
1"	25.000	45.20		
3/4"	19.000	41.10		
1/2"	12.500	32.80		
3/8"	9.500	28.60		
#4	4.750	23.50		
#10	2.000	19.90		
#20	0.850	16.30		
#40	0.425	13.40		
#100	0.150	9.80		
#200	0.075	8.20		

DATE TESTED:	TECHNICIAN:	CERTIFIED BY:
August 15, 2016	L. Maxam / M. Lee	

3203:(GRSZLSZ:16-8-17



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	0136	0.0	POORLY GRADED GRAVEL with SILT and SAND GP-GM		57	42	15	13.84	295.9

	Specimen Identification		D50	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	0136	0.0	37.41	48.45	10.479	0.1637	45.2	15.3	8.1	

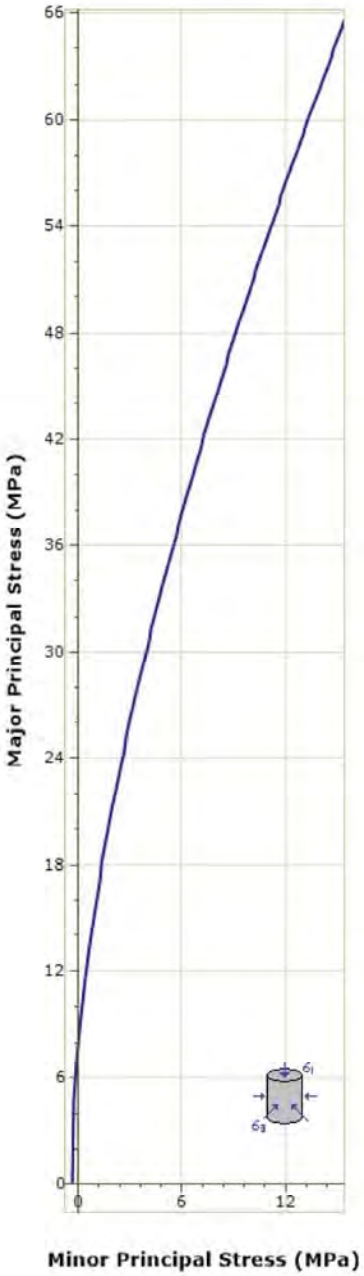
PROJECT Repeater Stations Soil Investigation - Shotover, Portland

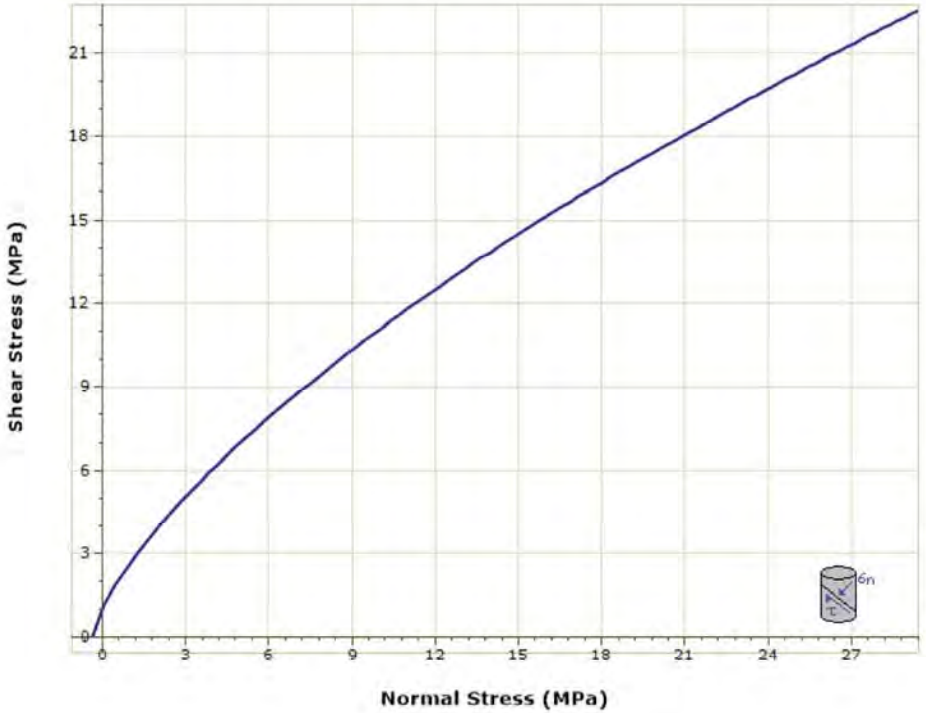
JOB NO. L16032

DATE 16-8-17

GRADATION CURVES

Kingston





Shotover, Portland	
Hoek Brown Classification	
intact uniaxial compressive strength	60 MPa
GSI	63
mi	10
disturbance factor	0
intact modulus	42000 MPa
modulus ratio	700
Hoek Brown Criterion	
mb	2.668
s	0.016
a	0.502
Failure Envelope Range	
application	general
sig3max	15 MPa
Mohr Coulomb Fit	
cohesion	3.717 MPa
friction angle	34.318 deg
Rock Mass Parameters	
tensile strength	-0.369 MPa
uniaxial compressive strength	7.609 MPa
global strength	14.075 MPa
modulus of deformation	24686.018 MPa

— Shotover, Portland - Principal Stress Envelope
— Shotover, Portland - Shear vs. Normal Stress Envelope