Luhlaza
Advisory and Consulting (Pty) Ltd

Geotechnical Investigations
Hydrogeological Investigations
Geophysical Investigations
Dolomite Stability Investigations
NHBRC Classifications

IN ASSOCIATION WITH

GATES LAND SOLUTIONS
GEOTECH ARCHITECTURE TOWNPLANNING ENVIRONMENTAL SURVEY

REPORT TO SEDNA CONSULTING ENGINEERS (PTY) LTD ON THE RESULTS OF A GEOTECHNICAL INVESTIGATION FOR THE PROPOSED LANGAVILLE EXTENSION 12 PIPELINE, GAUTENG

LC037-20.R01
24 November 2020

Prepared For:

Sedna Consulting Engineers

Compiled by:
Nishen Govender Pr. Sci. Nat.
MSc Geohydrology

LUHLAZA ADVISORY AND CONSULTING (PTY) LTD

Registration No.: 2016/073744/07

41 VERDI AVENUE, RISIDALE, RANDBURG, 2194

Email: avinash@luhlazaconsulting.co.za

Luhlaza
Advisory and Consulting (Pty) Ltd

Geotechnical Investigations

Hydrogeological Investigations

Geophysical Investigations

Dolomite Stability Investigations

NHBRC Classifications

REPORT TO SEDNA CONSULTING ENGINEERS (PTY) LTD ON THE RESULTS OF A GEOTECHNICAL INVESTIGATION FOR THE PROPOSED LANGAVILLE EXTENSION 12 PIPELINE, GAUTENG

LC037-20.R01
24 November 2020

Prepared For:

Sedna Consulting Engineers

Compiled by:
Nishen Govender Pr. Sci. Nat.
MSc Geohydrology

LUHLAZA ADVISORY AND CONSULTING (PTY) LTD

Registration No.: 2016/073744/07

41 VERDI AVENUE, RISIDALE, RANDBURG, 2194

Email: avinash@luhlazaconsulting.co.za

REPORT TO SEDNA CONSULTING ENGINEERS (PTY) LTD ON THE RESULTS OF A GEOTECHNICAL INVESTIGATION FOR THE PROPOSED LANGAVILLE EXTENSION 12 PIPELINE, GAUTENG

LC037-20.R01
24 November 2020

Prepared For:

Sedna Consulting Engineers (Pty) Ltd

Compiled by:
Nishen Govender Pr. Sci. Nat.
BSc Hon and MSc Geohydrology

Approval of Document		
Date:	**24 November 2020**	
Reference:	**LC037-20.R01**	
Professional Name	**SACNASP No**	**Signature**
Nishen Govender Pr. Sci. Nat. MSc Geohydrology	**400138/17**	
Kumendrie Naidoo Pr. Sci. Nat. MSc Mining Engineering	**400080/2000**	

TABLE OF CONTENTS

Contents

Table of Abbreviations

AASHTO	American Association of State Highway and Transportation
begl	Below existing ground level
CBR	California Bearing Ratio
DCP	Dynamic Cone Penetrometer Test
E	East
GM	grading modulus
IMC	insitu moisture content
kN/m²	kilonewtons per metre square
LL	liquid limit
LS	linear shrinkage
Luhlaza	Luhlaza Advisory and Consulting Pty Ltd
m	metre (s)
MDD	maximum dry density
mm	millimetre
No.	number
N	North
OMC	optimum moisture content
PI	plasticity index
SANS	South African National Standards
S	South
TP	Test Pits
TRH	Technical Recommendations for Highways (1985)
WULA	Water Use License Application

1. TERMS OF AGREEMENT AND SCOPE OF SERVICES

Luhlaza Advisory and Consulting (Pty) Ltd (Luhlaza) in association with GATES Land Solutions, was requested by Sedna Consulting Engineers (Pty) Ltd to provide a budget estimate to carry out a geotechnical investigation for the proposed Langaville Ext 10 pipeline. Once the budget was approved by the client, Luhlaza were formerly appointed in a letter referenced Sep-20-12 and dated 16 October 2020.

Luhlaza has proposed to carry out the following:

- Hand excavated inspections pit to depths between 1.5m and 3.0m;
- Dynamic cone penetration tests to 3.0m;
- Sampling of soil for further laboratory testing;
- Prepare a geotechnical report.

This geotechnical report referenced LC037-20.R01 provides the results of the geotechnical investigation and provides recommendations in terms of subgrade materials, foundations, slope stability, excavatability, earthworks, stormwater drainage, and material usage.

2. CODES OF PRACTICE AND STANDARDS

The services were carried out in accordance to the current level of geotechnical standards practiced by professional in Southern Africa.

The document referenced for use is "*Site Investigation Code of Practice, 1st Edition, South African Institution of Civil Engineering – Geotechnical Division, January, 2010*"

The nature of geotechnical engineering is such that variations in soil conditions may occur even where sites seem to be consistent. Variations from what is reported here may become evident during construction and it is thus imperative that an appropriately qualified and experienced competent person inspects all critical stages of development including, but not limited to excavations, to ensure that conditions at variance with those predicted do not occur and to undertake an interpretation of the facts supplied in this report.

It is possible that certain indications of ground stability, contamination, or groundwater levels were latent or otherwise not visible. Opinions are based on what was visible at the time the investigation was conducted.

3. REFERENCED INFORMATION

The following information was used for the project:

i. A google KML file issued by Sedna Consulting Engineers Pty Ltd showing the layout of the proposed pipeline route.

ii. A regional geological map titled "*2628 East Rand*", dated 1988 and prepared by the Council for Geoscience to a scale of 1:250 000; and

iii. Low-resolution satellite imagery sourced from Google Earth (2020).

4. INVESTIGATION ACTIVITIES

The field portion of the investigation was carried out over the course of three days from 26 October 2020 to 29 October 2020 and comprised the following:

a. Excavation of test pits by hand tools; and
b. CBR Dynamic Cone Penetrometer (DCP) testing.

4.1 Test Pitting and Profiling

Approximately thirty-seven test pits were excavated at selected points along the proposed route alignment. The test pits have been designated by prefixes TP01 to TP37 and were excavated using hand tools to approximate refusal depths in the range 0.8m (TP02) to 3.2m (TP19) below existing ground level (begl). The test pits were profiled in accordance to the South African Geoterminology Guidelines (Brink and bruin, 2002).

The test pits were profiled in accordance to the South African Geoterminology Guidelines (Brink and bruin, 2002). The test pit profiles are given in Appendix A at the end of this report.

4.2 DCP Testing

A DCP test was carried out adjacent to each test pit and a total of thirty-seven DCP tests were completed. The DCP tests have been designated by prefixes DCP01 to DCP37 and extended to approximate refusal/final depths in the range 0.5m (DCP25) to 2.9m (DCP15) begl. The DCP test results are given in Appendix B at the end of this report.

5. DESCRIPTION OF THE STUDY AREA

The site is located approximately 7km south of Springs in Gauteng. The area is locally known as Langaville Extension 12. The proposed pipeline routes traverse through a residential area.

There are four proposed water pipeline routes and a single proposed sewer pipeline route.

Access to the site is along multiple main roads as shown in Figure 1.

The locality of the site is shown in Figures 1.

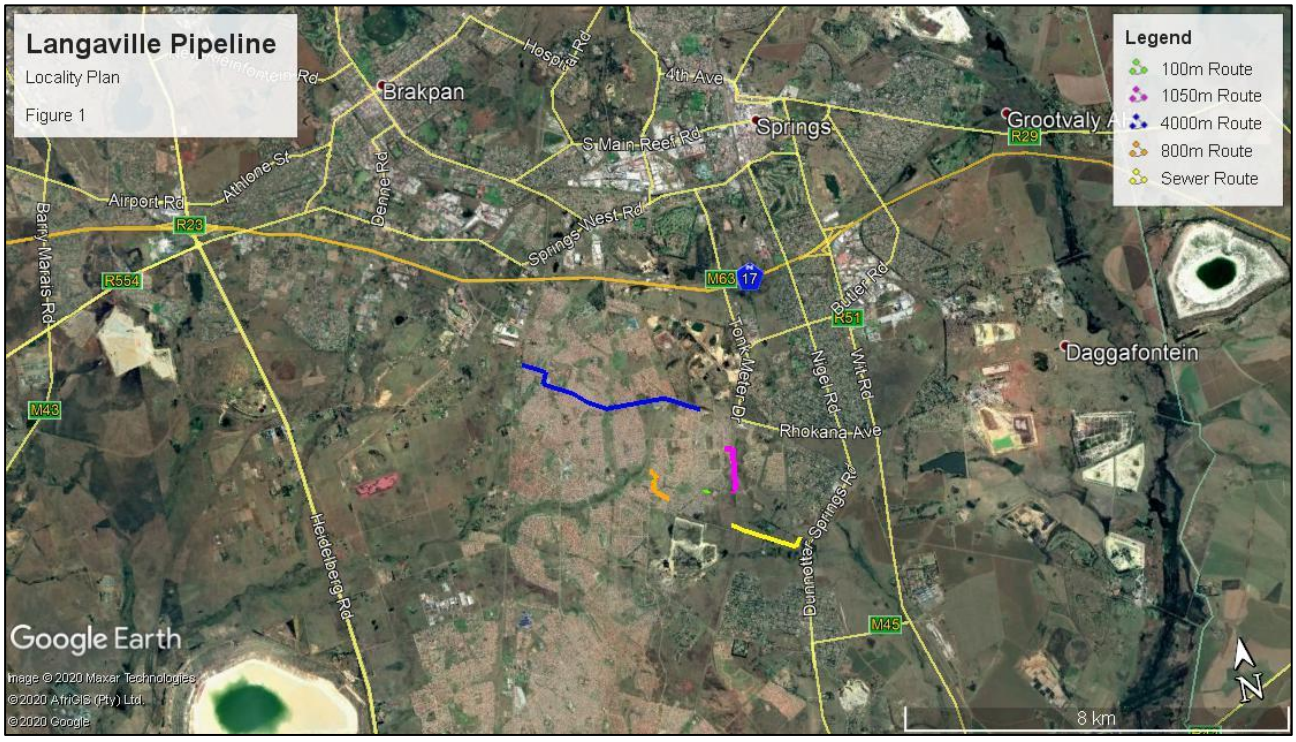


Figure 1: Locality of the site (Google Earth, 25 November 2020)

6. GENERAL GEOLOGY OF THE SITE

According to the Geological Map Sheet "*2628 East Rand*" as shown in Figure 2, the site is underlain by Vryheid Formation sandstone and shale, Dwyka Formation tillite and Jurassic Age dolerite rock.

The site is also situated in an area that is underlain by dolomite at depth and is regarded as potentially dolomitic.

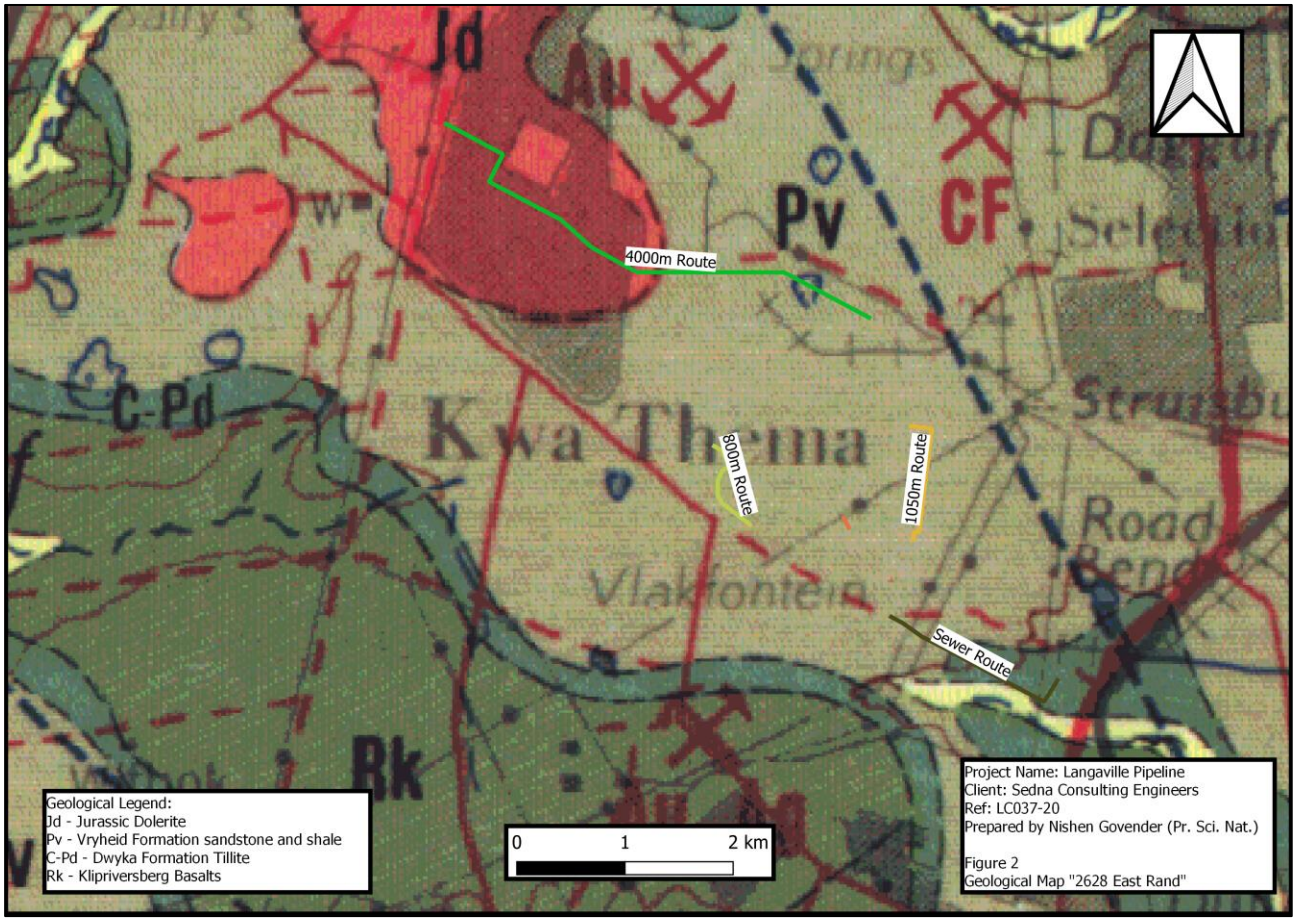


Figure 2: Geological Map of the study area "2628 Eastrand"

The positions investigated at the site comprised fill, colluvium, ferricrete, residual Shale, and residual dolerite. A summary of the soil descriptions are given in Tables 1 and 2.

Table 1: Summary of the Geology and DCP test results along the pipeline routes

Test Pit No	Depth	Description of Soil	DCP No	Refusal Depth
SEWER PIPELINE				
1	0,6	silty SAND - Colluvium.	1	1,7
	0,9	Gravel - Nodular Ferricrete (Refusal)		
2	0,3	silty SAND - Colluvium.	2	0,6
	0,8	Gravel - Nodular Ferricrete (Refusal)		
3	0,5	silty SAND - Colluvium.	3	2,3
	1,2	Gravel - Nodular Ferricrete (Refusal)		
4	0,5	silty SAND - Colluvium.	4	2
	1,6	Gravel - Nodular Ferricrete (Refusal)		
5	0,6	silty SAND - Colluvium.	5	2,2
	2,2	Gravel - Nodular Ferricrete (Refusal)		
6	0,5	silty SAND - Colluvium.	6	1,8
	2	Gravel - Nodular Ferricrete (Refusal)		
7	0,6	silty SAND - Colluvium.	7	2,3
	1,9	Gravel - Nodular Ferricrete (Refusal)		
8	0,6	silty SAND - Colluvium.	8	2,6
	2,3	Gravel - Nodular Ferricrete (Refusal)		
9	0,6	silty SAND - Colluvium.	9	2
	2	Gravel - Nodular Ferricrete (Refusal)		
WATER PIPELINE 1				
10	0,3	silty SAND - Colluvium.	10	2,9
	1,2	Gravel - Nodular Ferricrete (Refusal)		
11	0,1	silty SAND - Colluvium.	11	1,4
	1,2	Gravel - Nodular Ferricrete (Refusal)		
12	0,6	silty SAND - Colluvium.	12	2,4
	2	Gravel - Nodular Ferricrete (Refusal)		
13	0,3	silty SAND - Colluvium.	13	2,4
	1,3	Gravel - Nodular Ferricrete (Refusal)		
14	0,5	silty SAND - Colluvium.	14	2,1
	1,9	Gravel - Nodular Ferricrete (Refusal)		
15	0,3	silty SAND - Colluvium.	15	2,9
	0,5	Gravel - Nodular Ferricrete (Refusal)		
WATER PIPELINE 2				
16	1,3	silty SAND - Colluvium and Alluvium	16	2,8
	2	Gravel - Nodular Ferricrete (Refusal)		
17	0,4	silty SAND - Colluvium and Alluvium	17	2,2
	2,8	Gravel - Nodular Ferricrete (Refusal)		
WATER PIPELINE 3				
18	0,1	clayey silty SAND - Fill	18	2,3
	1,2	silty SAND - Colluvium and Alluvium		
	2,2	Gravel - Nodular Ferricrete (Refusal)		
19	0,1	clayey silty SAND - Fill	19	2,9

Test Pit No	Depth	Description of Soil	DCP No	Refusal Depth
	0,3	silty SAND - Colluvium and Alluvium		
	3,2	Gravel - Nodular Ferricrete (Refusal)		
20	0,2	silty SAND - Colluvium and Alluvium	20	1,7
	1,7	Gravel - Nodular Ferricrete (Refusal)		
21	0,3	silty SAND - Colluvium	21	1,9
	1,9	gravelly sandy CLAY - Residual sandstone (Refusal)		
22	0,3	silty SAND - Colluvium	22	2
	1,8	Gravel - Nodular Ferricrete (Refusal)		
WATER PIPELINE 4				
23	0,7	clayey silty SAND - Fill (Refusal)	23	1,6
24	0,7	clayey silty SAND - Fill (Refusal)	24	0,3
25	0,5	sandy silty CLAY - Colluvium	25	2,4
	2,5	silty CLAY - Residual Shale (Refusal)		
26	0,5	sandy silty CLAY - Colluvium	26	0,5
	0,8	silty CLAY - Residual Shale (Refusal)		
27	0,3	silty CLAY - Colluvium	27	1,1
	1	silty CLAY - Residual dolerite. (Refusal on soft rock)		
28	0,3	sandy silty CLAY - Colluvium	28	0,9
	0,9	silty CLAY - Residual Shale (Refusal)		
29	0,4	silty SAND - Colluvium.	29	1,5
	1,1	Gravel - Nodular Ferricrete (Refusal)		
30	0,4	silty SAND - Colluvium.	30	2,1
	1,1	Gravel - Nodular Ferricrete (Refusal)		
31	0,4	silty CLAY - Colluvium	31	1,3
	2,5	silty CLAY - Residual dolerite.		
32	0,3	silty CLAY - Colluvium	32	1,7
	1,1	silty CLAY - Residual dolerite.		
	1,8	Gravel - Nodular Ferricrete (Refusal)		
33	0,1	clayey silty SAND - Fill	33	2,4
	0,5	silty SAND - Colluvium and Alluvium		
	2,3	Gravel - Nodular Ferricrete (Refusal)		
34	0,3	clayey silty SAND - Fill	34	2,2
	0,6	silty CLAY - Colluvium		
	2,3	silty CLAY - Residual dolerite. (Refusal on soft rock)		
35	0,6	clayey silty SAND - Fill	35	0,4
	0,9	silty CLAY - Residual Shale (Refusal)		
36	0,3	silty CLAY - Colluvium	36	1,2
	1,2	silty CLAY - Residual dolerite (Refusal)		
37	0,3	clayey silty SAND - Fill	37	1,1
	0,5	sandy silty CLAY - Colluvium		
	1,2	silty CLAY - Residual Shale (Refusal)		

A layout of the test pit positions are shown in Figures 3 to 7.

Photographs of subsurface profiles observed in the inspection pits are given in Photographs 1 to 4.

Photograph 1: Typical view of colluvium and ferricrete

Photograph 2: Material Encountered in the existing trenches on site for the pipeline

Photograph 3: Typical view of residual dolerite material

Photograph 4: Typical view of colluvium and residual shale material

7. GROUNDWATER

No groundwater seepage was encountered in any of the test pits excavated on site.

It must be noted that groundwater activity is, however, generally expected across the entire site on an intermittent / periodic basis and is also likely to fluctuate because of seasonal rainfall patterns.

There is a significant concern for an elevated groundwater condition, particularly during periods of rainfall. It is therefore recommended that the appropriate measures be implemented to counteract the potential groundwater activity on site, i.e. subsurface drainage.

Table 2: Summary of the Subsurface Geology along the Pipeline Route

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
SEWER PIPELINE ROUTE				
0+000 to 1+900 (TP1 to TP9)	0-0.6 0.6-2.3	Silty SAND – Colluvium. Sandy GRAVEL – Nodular Ferricrete.	0-2.3m – Soft >2.3m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities. • Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be increased to between 75 kN/m^2 and 100 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
WATER PIPELINE ROUTE 1 (1050m)				
0+000 to 1+050 (TP10 to TP15)	0-0.5 0.5-2.0	Silty SAND – Colluvium. Sandy GRAVEL – Nodular Ferricrete.	0-2.0m – Soft >2.0m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities. • Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				increased to between 75 kN/m^2 and 100 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
WATER PIPELINE ROUTE 2 (100m)				
0+000 to 0+100 (TP16 and TP17)	0-0.9 0.9-2.8	Silty SAND – Colluvium. Sandy GRAVEL – Nodular Ferricrete.	0-2.8m – Soft >2.8m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities. • Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be increased to between 75 kN/m^2 and 100 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
WATER PIPELINE ROUTE 3 (800m)				
0+000 to 0+400 (TP18 and TP19)	0-0.1 0.1-0.7 0.7-3.2	Clayey silty SAND – Fill. Silty SAND – Colluvium. Sandy GRAVEL – Nodular Ferricrete.	0-3.2m – Soft >3.2m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities.

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				• Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be increased to between 75 kN/m^2 and 100 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
0+400 to 0+800 (TP20 to TP22)	0-0.3 0.3-1.9	Silty SAND – Colluvium. Sandy GRAVEL – Nodular Ferricrete.	0-1.9m – Soft >1.9m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities. • Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be increased to between 75 kN/m^2 and 100 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
WATER PIPELINE ROUTE 4 (4000m)				
0+000 to 0+300 (TP23 and TP24)	0-0.7	Clayey silty SAND – Fill.	0-0.7m – Soft >0.7m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				activities. • Fill material can accommodate foundation loads of less than 10 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
0+300 to 0+750 (TP25 and TP26)	0-0.5 0.5-2.5	Sandy silty CLAY – Colluvium. Silty CLAY – Residual shale.	0-2.5m – Soft >2.5m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet. • Residual material can accommodate foundation loads of less than 50 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
0+750 to 0+950 (TP27)	0-0.3 0.3-1.0	silty CLAY – Colluvium. Silty CLAY – Residual dolerite.	0-1.0m – Soft >1.0m Intermediate to Hard (Refusal on soft rock at 1.0)	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet. • Residual material can accommodate foundation loads of less than 50 kN/m^2.

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				• Soft rock can accommodate foundation loads of less than 150 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
0+950 to 1+200 (TP28)	0-0.3 0.3-0.9	Sandy silty CLAY – Colluvium. Silty CLAY – Residual shale.	0-0.9m – Soft >0.9m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet. • Residual material can accommodate foundation loads of less than 50 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
1+750 to 1+700 (TP29 and TP30)	0-0.4 0.4-1.1	Silty SAND – Colluvium. Sandy GRAVEL – Nodular Ferricrete.	0-1.1m – Soft >1.1m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities. • Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				increased to between 75 kN/m^2 and 100 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
1+700 to 2+200 (TP31)	0-0.4 0.4-2.5	Silty CLAY – Colluvium. Silty CLAY – Residual dolerite.	0-2.5m – Soft >2.5m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet. • Residual material can accommodate foundation loads of less than 50 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
2+200 to 2+600 (TP32)	0-0.3 0.3-1.1 1.1-1.8	Silty CLAY – Colluvium. Silty CLAY – Residual dolerite. Sandy GRAVEL – Nodular Ferricrete	0-1.8m – Soft >1.8m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities. • Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be increased to between 75 kN/m^2

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				and 100 kN/m^2. • Residual material can accommodate foundation loads of less than 50 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
2+600 to 3+000 (TP33)	0-0.1 0.1-0.5 0.5-2.3	Clayey sandy SILT – Fill. Silty SAND – Colluvium. Sandy GRAVEL – Ferricrete.	0-2.3m – Soft >2.3m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Ferricrete layer will hinder excavation activities. • Ferricrete can accommodate a load of approximately 50 kN/m^2 in some are where there is hard pan ferricrete, this load can be increased to between 75 kN/m^2 and 100 kN/m^2. There is also a dolomite risk to the site and a dolomite stability investigation is required.
3+000 to 3+350 (TP34)	0-0.3 0.3-0.6 0.6-2.3	Clayey sandy SILT – Fill. Silty CLAY – Colluvium. Silty CLAY – Residual Dolerite.	0-2.3m – Soft >2.3m Intermediate to Hard (Refusal on soft rock at 2.3)	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet.

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				• Residual material can accommodate foundation loads of less than 50 kN/m^2. • Soft rock can accommodate foundation loads of less than 150 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
3+350 to 3+600 (TP35)	0-0.6 0.6-0.9	Clayey silty SAND – Fill. Silty CLAY – Residual Shale.	0-0.9m – Soft >0.9m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet. • Residual material can accommodate foundation loads of less than 50 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.
3+600 to 3+900 (TP36)	0-0.3 0.3-1.2	Silty CLAY – Colluvium. Silty CLAY – Residual dolerite.	0-1.2m – Soft >1.2m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet. • Residual material can

Chainage (km) (TP No.)	Depth (mbegl)	Subsurface Profile	Trenchability (Ecavatability mbegl)	Comments
				accommodate foundation loads of less than 50 kN/m^2. There is also a dolomite risk to the site and a dolomite stability investigation is required.
3+900 to 4=050 (TP37)	0-0.3 0.3-0.5	Clayey silty SAND – Fill. Sandy silty CLAY – Colluvium.	0-0.5m – Soft >0.5m Intermediate to Hard	• Material not suitable for use as pipe bedding. • Large fragments and other objects may hinder excavation activities. • Clayey material will be impassable to traffic when wet. • Colluvial material can accommodate foundation loads of less than 10 kN/m^2. • There is also a dolomite risk to the site and a dolomite stability investigation is required.

m – metres mbegl – metres below existing ground level

8. SOIL LABORATORY RESULTS

The following tests were carried out on insitu soil samples to determine the engineering properties:

i) Grading Analysis, Atterberg Limits;
ii) Modified AASHTO;
iii) California Bearing;
iv) Moisture Content;
v) Compactability Factor.

The results of the laboratory tests are given in Appendix C and summarised in Table 3.

Table 3: Summary of Results of Grading Analysis, Atterberg Limit Determinations, Modified AASHTO and California Bearing Ratio

TP No.	Depth (m)	Description	Particle Size %				Atterberg Limits %			GM	OMC (%)	MDD (kg/m3)	IMC (%)	COLTO Classification	H.R.B Classification
			Clay	Silt	Sand	Gravel	LL	PI	LS						
COLLUVIUM															
TP1	0-0,6	Dark brown, silty SAND	73		22	5	-	NP	-	0,51	10,8	1895	4,2	-	A-4(0)
TP6	0-0,5	Dark brown, sandy SILT	11	22	67	0	26	10	5	0,56	-	-	7,5	-	A-4(4)
TP17	0-0,4	Dark brown, silty SAND	75		2	3	-	NP	-	0,43	8,8	1817	5,3	-	A-4(0)
FERRICRETE															
TP3	0,5-1,2	Yellowish brown, sandy GRAVEL	54		14	32	23	10	5,5	1,17	10,9	2035	7,3	G7	A-4(0)
TP9	0,6-1,9	Yellowish brown, sandy GRAVEL	83		15	2	24	9	4,5	0,28	11,6	1949	8,8	-	A-4(0)
TP11	0,15-1,0	Yellowish brown, sandy GRAVEL	81		13	6	31	7	3,5	0,4	9,4	1872	10,3	-	A-4(0)
TP13	0,3-1,3	Yellowish brown, sandy GRAVEL	53		11	36	28	7	3,5	1,27	10,4	1885	8	G7	A-4(0)
TP20	0,2-1,7	Yellowish brown, sandy GRAVEL	81		12	7	30	10	5	0,4	10,4	1717	14,4	-	A-4(0)
TP30	0,7-2,5	Dark Red, sandy CLAY	33	17	48	2	35	18	9	0,43	-	-	13,3	-	A-6(10)
TP33	0,5-2,4	Yellowish brown, sandy GRAVEL	76		15	9	27	6	3	0,51	10,1	1723	13,6	-	A-4(0)
RESIDUAL MATERIAL															
TP25	2,0-2,5	Dark olive, CLAY - Residual SHALE	67	13	18	2	62	25	12	0,2	-	-	28,9	-	A-7-5(8)
TP27	0,3-1,0	Reddish orange, silty CLAY	78		21	1	25	7	3,5	0,34	10,5	1864	5,7	-	A-4(0)
TP36	0,3-1,2	Reddish orange, silty CLAY	69		11	20	36	18	9,5	0,77	13,4	1658	13	-	A-6(0)

LL - Liquid Limit OMC - Optimum Moisture Content PI - Plasticity Index MDD - Maximum Dry Density
LS - Linear Shrinkage G8 - Classification in Terms of TRH14 (1985) IMC - Insitu Moisture Content

9. DISCUSSION

9.1 Proposed Development

Information supplied by the client indicates that the proposed development will comprise a new sewer and water pipeline.

Detailed designs of the structures are not known at present and it is recommended that this be discussed with a geotechnical specialist once finalized.

9.2 Site Stability

During the geotechnical investigation the excavation were generally stable over the short term, nonetheless, all excavations will require lateral support and battering of slopes. As a general rule, the slopes should be battered to 1 vertical (V) and 2 horizontal (H).

All excavation needs to be carried out in accordance with SANS 1200.

The following should be considered to trench excavations down to a maximum depth of 2m begl:

- Fill, colluvial, granular material should be battered to approximately 1V:1H to a depth of at least 2m. Excavations greater than 2m but less than 3m will need to be formed at 1V:2H. If groundwater seepage occurs then shoring is required.

- Clayey residual material will need to be battered to 1V:0.5H down to 2m. Excavations greater than 2m but less than 3m will need to be formed at 1V:2H.

- Highly to moderately weathered bedrock may be vertical, provided there is no daylighting of bedding planes or any clay gouge within the bedrock. Should the bedrock be jointed then 1V:0.5H may be considered. This should be confirmed/verified by a geotechnical practitioner on site during the excavations.

- Lateral support should be used in all situations where there is groundwater activity or instability identified.

It is imperative that all excavations are inspected and approved by a geotechnical practitioner to detect any potentially unstable areas during the construction phase.

The recommendations given in this report should be followed for the stability statement to be valid.

Precautionary measures amounting to no more than sound development practices appropriate to the site conditions anticipated and the nature of the proposed development known at the time of preparation of this report.

9.3 Subsurface Conditions Beneath the Proposed Pipeline Route

The proposed pipeline route has been assessed in terms of trenchability of the existing subsurface layers and comment has already been given in Table 2. It should be noted that all excavation guidelines are based on SANS 1200D.

In general, based on the results of the geotechnical investigation, the site is considered easily excavatable to final depths of the field tests. (Refer to TPs and DCP results for accurate information)

Should soft rock be encountered it is assumed that the material can easily be removed by a 20 to 30 tonne excavator and pneumatic tools. However, in areas where medium hard to hard bedrock is encountered, depending on the fracturing of the bedrock, a 20 to 30 tonne excavator may be applicable for the excavation activity. However, if the bedrock is medium hard to hard with minimal fractures, then the option of blasting will need to be considered. Should blasting be required, the an assessment of the site by a explosive specialist will need to be carried out as this activity may cause damage to the surrounding area.

9.4 General Earthworks

Earthwork activities will need to be carried out strictly in accordance with the current SANS 1200 guidelines to ensure safe working procedures and maintain stability of the site.

Where possible, the lowering of ground levels is to be avoided to reduce the risk of encountering problematic shallow groundwater seepage anticipated to occur intermittently within 1.0m begl. Where this is not feasible, allowance is to be made for suitable subsoil drainage to engineer's detail.

Placement of fill layers should be undertaken in layers not exceeding 150mm thick when placed loose and compacted using suitable compaction plant to achieve 93% of Modified AASHTO maximum dry density.

If natural ground slopes are steeper than 9 degrees, the fill must be benched into the slope.

Terraces should be graded to direct water away from the fill edges, and small earth bunds should be constructed along the crests of fills, to prevent overtopping and erosion of fill embankment slopes.

Acceptance and process density control testing of placed fill material should be undertaken at regular intervals during fill construction as part of process and acceptance quality assurance monitoring.

Cut and fill slopes in soils should be formed to batters not exceeding 26° and to a height not greater than 2 metres where retaining walls are not provided.

Engineered fill slopes should be over constructed and thereafter trimmed back to the required position.

Although not encountered in the investigation, it should be noted that cuts in highly weathered bedrock should not exceed gradients of 50°. Inspection of cuts in weathered bedrock by a competent engineering geologist or geotechnical engineer may indicate that the angle of cut batter slopes needs to be varied locally to promote stability of the site.

Cut and fill heights greater than the heights and configurations specified above would need to be inspected and approved by an engineering geologist or geotechnical engineer.

Workers should not enter any excavations deeper than 1.5m that are not shored or battered back as described above, as sidewalls in the low strength soils resembling those encountered on site will be prone to collapse. All excavations must be inspected daily by a competent person and records must be kept. It remains the responsibility of the Contractor/Developer to comply with the current requirements of the Occupational Health and Safety Act.

9.5 The Trechability/Excavatability on Site

The excavations have been assessed based on SANS 1200 (Latest version). Based on the results of the field investigation, it is inferred that the subsurface classifies as soft excavation down to the final depths of the field tests (TP and DCP results refers).

In such instances, it is considered that the material may be easily excavated by a tractor loader backhoe (TLB).

However, due to likely geological variations, it is also possible that intermediate to hard excavations may be encountered at a shallower depth. Therefore, a contingency amount is recommended in the construction budget.

9.6 Pipe Jacking Guidelines

It is understood that pipe jacking may be carried in some areas, however, the details of these have not been provided by the client.

It is recommended that all pipe jacking follow the guidelines as set out in SANS 1200 LG (1983).

It is necessary to carry out the thrust and reception pits and pipe jack to the very best standards to ensure that roads and any underground services if present are totally unaffected by the pipe jacking and associated operations.

In particular, where pipes are to be jacked under fills, precautions must be taken to ensure that thrust and reception pits and the jacking operation do not in any way cause the slope face of fills to erode, slide, slump or move. Consideration should be given to introducing lateral support into the jacking pits and/or reception and thrust pits.

Settlement above the pipe is to be kept to a minimum. Both stormwater runoff and groundwater seepage is to be controlled during construction. In particular, surface drainage must be controlled to prevent runoff entering the jacking or reception pits and all pipe joints should be sealed to prevent groundwater seepage into the jacked pipes.

Backfilling of the thrust and reception pits and pipe trenches should be done using, where possible, *in situ* material, provided this material is not predominantly boulders or rock fragments and can be uniformly compacted to the required compaction. Final layers of backfilling should be raised above the natural ground level to compensate for long term settlement and to prevent ponding of stormwater at the pit positions once settlement is complete.

The backfill in thrust and reception pits must be compacted to a minimum of 95% Modified AASHTO density throughout the full depth of the pits. Other fills should be compacted to a minimum of 93% Modified AASHTO dry density.

During the jacking operation, excavation must be such that overbreak is kept to a minimum.

9.7 Classification of Materials and Recommendations for Pipeline Bedding

The materials for the site have been classified according to the bedding backfill guidelines given in SANS 1200 LB.

The typical pipeline route will comprise a bedding cradle of ***selected granular material***, a fill blanket layer (***selected fill***) and a ***main fill***. The material over the fill blanket layer is usually “backfill” material that has been removed from the trench. The selected granular material is described as granular, has a grading between 0.6 mm and 9 mm on sieve analysis, free draining and has a compactability factor that does not exceed 0.4.

The selected fill is described as material in which the plasticity index does not exceed 6 and is free from vegetation and granular material that is less than 30 mm in diameter.

The main fill is generally the material that has been removed from the trench during the excavation.

The compactability factor of the materials are given in Table 4.

Table 4: Compactability Factor Results

TP No.	Depth (m)	Description	Compactability Factor
TP6	0-0.5	Colluvium	0.19
TP17	0-0.4	Colluvium	0.15
TP25	2-2.5	Residual Shale	0.13
TP30	0.7-2.5	Ferricrete	0.13

Based on the previous experience with similar soils, visual inspection of the material, and laboratory tests, the materials are not likely to classify suitable for use as selected granular material and selected fill.

Insitu material rarely meet the requirements of SANS 1200 LB due to the strict grading and plasticity index requirements.

As limited samples where extracted for laboratory testing, it is recommended that additional testing be carried out on site during construction to confirm the material quality and volumes available.

9.8 General Backfill and Erosion Guidelines

The site is considered susceptible to erosion and over time the pipe trenches may develop in to large scale erosion features which can lead to the failure of the proposed pipeline. Should the pipeline traverse at ninety degrees to the contours and at a steep gradient, then it is recommended that every 5m intervals the backfill material is stabilized with cement or lime. The general guideline is that the stabilized material should be approximately 2m in length. It is recommended that the trench be immediately backfilled upon completion of laying the pipeline and the top be covered grass which may act as an erosion prevention measure.

The general backfill should be placed at layers not exceeding 200mm and compacted to at least 90% Modified AASHTO density over the bedding layer to minimise the potential settlement over pipes.

The clayey material on site maybe problematic and will require undercutting and replacement by granular material.

9.9 Drainage Guidelines along the Proposed Route

To promote stability on site it is recommended that control measures be implemented to remove surface and groundwater from the construction area.

The drainage measures should be constructed in a way to:

- Prevent ponding of high volumes of surface/groundwater both during construction and after construction.
- Terraces should be graded to direct water away from the excavations and pipeline foundation.
- Temporary dewatering may be required during the construction phase as there is a potential for an elevated groundwater condition.

10. DOLOMITE STABILITY OF THE SITE

The site is situated in an area that is potentially dolomite. If the development is to proceed then a dolomite stability investigation as required in SANS 1936-2 will need to be carried out at the site.

No development should proceed until the dolomite investigation is carried out.

11. CONCLUDING REMARKS

This report was prepared to assist with the understanding of the subsurface profile along the proposed pipeline route.

The subsurface profile is described along the proposed route in Tables 1 and 2 and recommendations are provided in the subsequent sections.

Earthwork activities will need to be carried out strictly in accordance with the current SANS 1200 guidelines in order to ensure safe working procedures and maintain stability of the site.

In terms of pipe bedding materials will need to be sourced commercially.

The site is also situated on potentially dolomite land and a dolomite stability investigation is required.

The ground conditions given in this report refer specifically to the field tests carried out on site. It is therefore, quite possible that conditions at variance with those given in this report may be encountered elsewhere on site during construction.

It is therefore recommended that a geotechnical practitioner be appointed to carry out periodic inspections during construction.

12. REFERENCES

i. Brink, A. B. & Bruin, R. M., 2002. Guidelines for Soil and Rock Logging in South Africa. s.l., Association of Engineering Geologists, South African Institute Civil Engineering - Geotechnical Division, and South Africa Institue for Engineering and Environmental Geologists, p. 47.

ii. Committee of State Road Authorities, 1985. TRH14: Technical Recommendations for Highways - Guidelines for Road Construction Materials. Pretoria: Department of Transport.

iii. G.Byrne & A.D.Berry, 2008. A Guide to Practical Geotechnical Engineering in South Africa. s.l.: Franki.

iv. Google Earth, 2020. AfriGIS (Pty) Ltd. [Online] Available at: www.googlearth.com [Accessed 15 June 2020].

v. South African Bureau of Standards, 1990. SANS 1200 DA - Standardised Specification for Civil Engineering Construction - Earthworks (Small Works). s.l.: South African Bureau of Standards.

vi. South African Bureau of Standards, 1983. SANS 1200 LB - Standardised Specification for Civil Engineering Construction - Bedding (Pipelines). s.l.: South African Bureau of Standards.

vii. South African Department of Labour, 1991. Occupational Health and Safety Amendment Act, No. 181 of 1993. s.l.: Department of Labour - South Africa

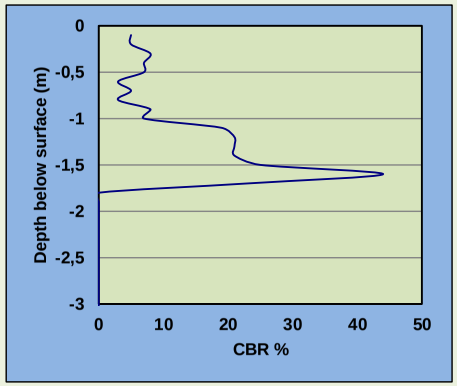
APPENDIX A: TEST PIT PROFILES

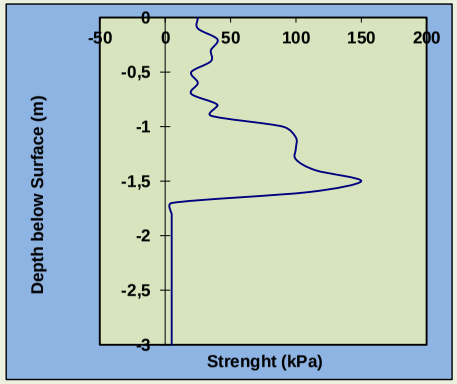
APPENDIX B: DCP TEST RESULTS

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 1
Final Depth:	*1,7 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	3	Loose	30 deg
0,3	5	Med.Dense	32 deg
0,4	4	Med.Dense	30 deg
0,5	4	Med.Dense	30 deg
0,6	2	Loose	30 deg
0,7	3	Loose	30 deg
0,8	2	Loose	30 deg
0,9	5	Med.Dense	32 deg
1	4	Med.Dense	30 deg
1,1	11	Dense	36 deg
1,2	12	Dense	36 deg
1,3	12	Dense	36 deg
1,4	12	Dense	36 deg
1,5	14	Dense	37 deg
1,6	23	Dense	38 deg
1,7	13	Dense	37 deg
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			
3			





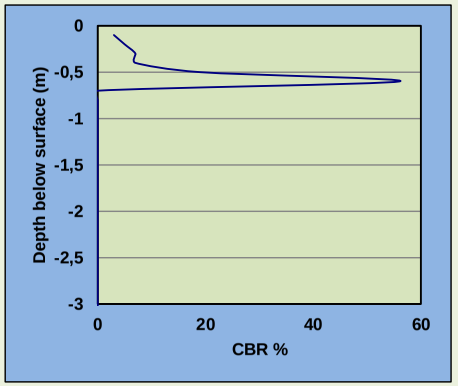
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

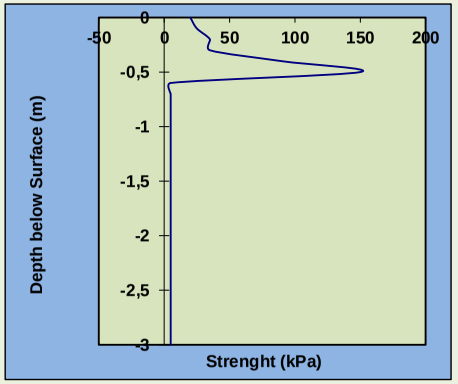
TP1

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 2
Final Depth:	*0,6 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	2	Loose	30 deg
0,2	3	Loose	30 deg
0,3	4	Med.Dense	30 deg
0,4	4	Med.Dense	30 deg
0,5	11	Dense	36 deg
0,6	28	Very Dense	38 deg
0,7			
0,8			
0,9			
1			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			
3			





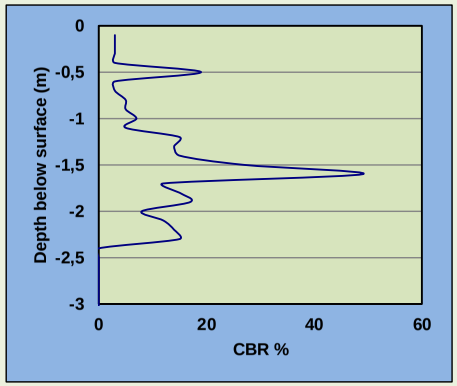
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

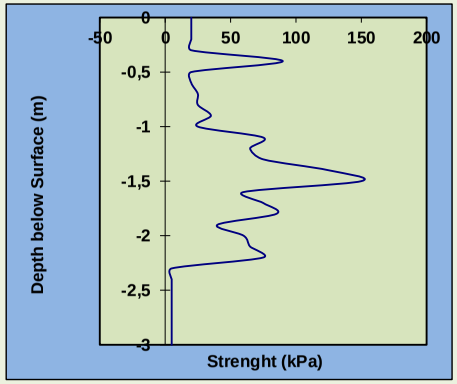
TP2

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 3
Final Depth:	*2,3 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	2	Loose	30 deg
0,2	2	Loose	30 deg
0,3	2	Loose	30 deg
0,4	2	Loose	30 deg
0,5	11	Dense	36 deg
0,6	2	Loose	30 deg
0,7	2	Loose	30 deg
0,8	3	Loose	30 deg
0,9	3	Loose	30 deg
1	4	Med.Dense	30 deg
1,1	3	Loose	30 deg
1,2	9	Med.Dense	35 deg
1,3	8	Med.Dense	35 deg
1,4	9	Med.Dense	35 deg
1,5	15	Dense	37 deg
1,6	25	Dense	38 deg
1,7	7	Med.Dense	34 deg
1,8	9	Med.Dense	35 deg
1,9	10	Med.Dense	36 deg
2	5	Med.Dense	32 deg
2,1	7	Med.Dense	34 deg
2,2	8	Med.Dense	35 deg
2,3	9	Med.Dense	35 deg
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			
3			





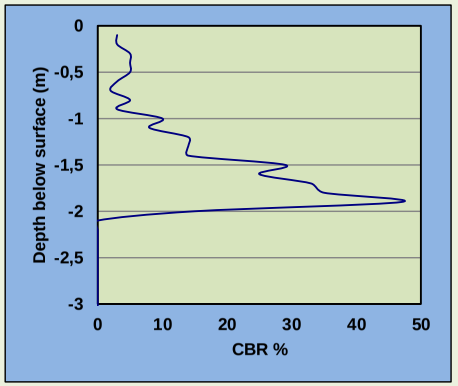
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

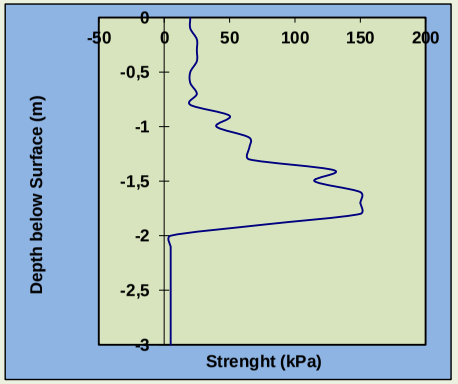
TP3

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 4
Final Depth:	*2 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	2	Loose	30 deg
0,2	2	Loose	30 deg
0,3	3	Loose	30 deg
0,4	3	Loose	30 deg
0,5	3	Loose	30 deg
0,6	2	Loose	30 deg
0,7	1	Very Loose	29 deg
0,8	3	Loose	30 deg
0,9	2	Loose	30 deg
1	6	Med.Dense	33 deg
1,1	5	Med.Dense	32 deg
1,2	8	Med.Dense	35 deg
1,3	8	Med.Dense	35 deg
1,4	8	Med.Dense	35 deg
1,5	16	Dense	37 deg
1,6	14	Dense	37 deg
1,7	18	Dense	37 deg
1,8	19	Dense	37 deg
1,9	24	Dense	38 deg
2	9	Med.Dense	35 deg
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			
3			





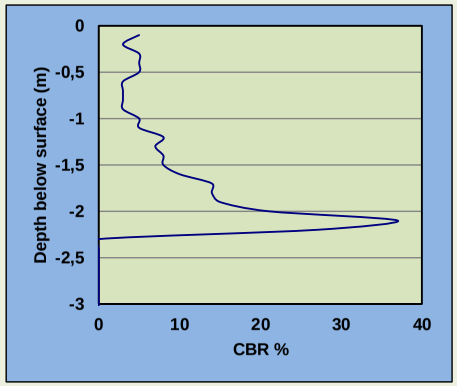
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

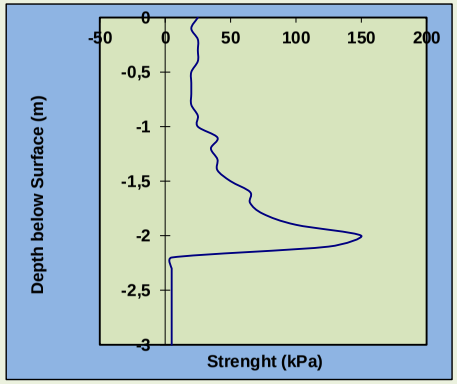
TP4

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 5
Final Depth:	*2,2 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	2	Loose	30 deg
0,3	3	Loose	30 deg
0,4	3	Loose	30 deg
0,5	3	Loose	30 deg
0,6	2	Loose	30 deg
0,7	2	Loose	30 deg
0,8	2	Loose	30 deg
0,9	2	Loose	30 deg
1	3	Loose	30 deg
1,1	3	Loose	30 deg
1,2	5	Med.Dense	32 deg
1,3	4	Med.Dense	30 deg
1,4	5	Med.Dense	32 deg
1,5	5	Med.Dense	32 deg
1,6	6	Med.Dense	33 deg
1,7	8	Med.Dense	35 deg
1,8	8	Med.Dense	35 deg
1,9	9	Med.Dense	35 deg
2	12	Dense	36 deg
2,1	20	Dense	38 deg
2,2	15	Dense	37 deg
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





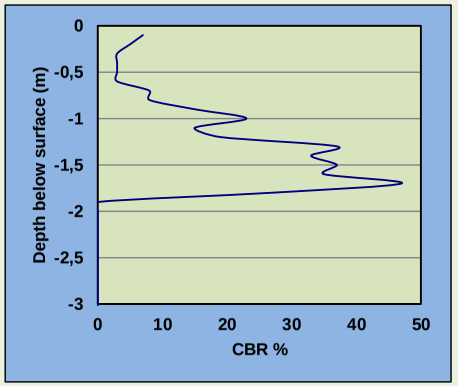
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

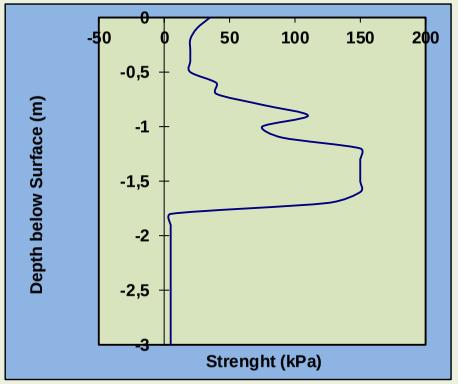
TP5

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 6
Final Depth:	*1,8 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	4	Med.Dense	30 deg
0,2	3	Loose	30 deg
0,3	2	Loose	30 deg
0,4	2	Loose	30 deg
0,5	2	Loose	30 deg
0,6	2	Loose	30 deg
0,7	5	Med.Dense	32 deg
0,8	5	Med.Dense	32 deg
0,9	9	Med.Dense	35 deg
1	13	Dense	37 deg
1,1	9	Med.Dense	35 deg
1,2	11	Dense	36 deg
1,3	20	Dense	38 deg
1,4	18	Dense	37 deg
1,5	20	Dense	38 deg
1,6	19	Dense	37 deg
1,7	24	Dense	38 deg
1,8	15	Dense	37 deg
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





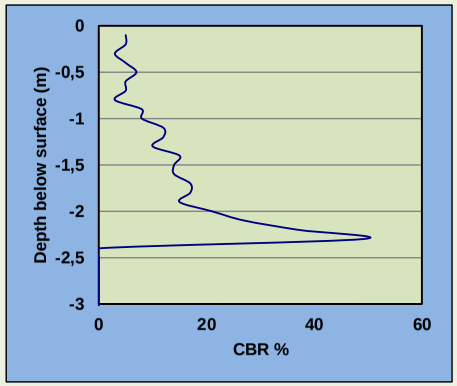
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

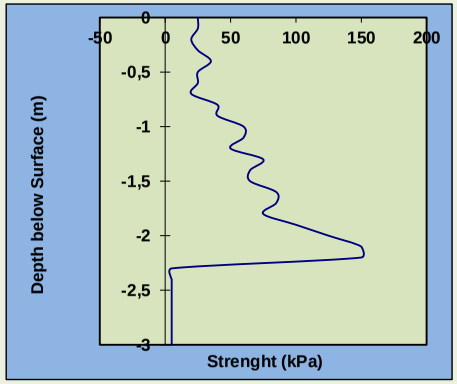
TP6

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 7
Final Depth:	*2,3 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	3	Loose	30 deg
0,3	2	Loose	30 deg
0,4	3	Loose	30 deg
0,5	4	Med.Dense	30 deg
0,6	3	Loose	30 deg
0,7	3	Loose	30 deg
0,8	2	Loose	30 deg
0,9	5	Med.Dense	32 deg
1	5	Med.Dense	32 deg
1,1	7	Med.Dense	34 deg
1,2	7	Med.Dense	34 deg
1,3	6	Med.Dense	33 deg
1,4	9	Med.Dense	35 deg
1,5	8	Med.Dense	35 deg
1,6	8	Med.Dense	35 deg
1,7	10	Med.Dense	36 deg
1,8	10	Med.Dense	36 deg
1,9	9	Med.Dense	35 deg
2	12	Dense	36 deg
2,1	15	Dense	37 deg
2,2	20	Dense	38 deg
2,3	25	Very Dense	38 deg
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



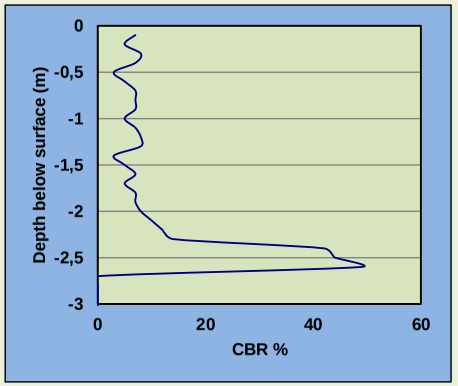


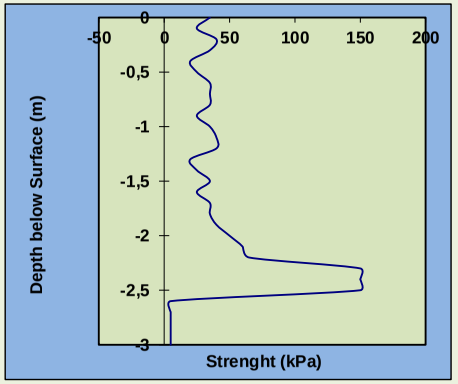
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 8
Final Depth:	*2,6 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	4	Med.Dense	30 deg
0,2	3	Loose	30 deg
0,3	5	Med.Dense	32 deg
0,4	4	Med.Dense	30 deg
0,5	2	Loose	30 deg
0,6	3	Loose	30 deg
0,7	4	Med.Dense	30 deg
0,8	4	Med.Dense	30 deg
0,9	4	Med.Dense	30 deg
1	3	Loose	30 deg
1,1	4	Med.Dense	30 deg
1,2	5	Med.Dense	32 deg
1,3	5	Med.Dense	32 deg
1,4	2	Loose	30 deg
1,5	3	Loose	30 deg
1,6	4	Med.Dense	30 deg
1,7	3	Loose	30 deg
1,8	4	Med.Dense	30 deg
1,9	4	Med.Dense	30 deg
2	5	Med.Dense	32 deg
2,1	6	Med.Dense	33 deg
2,2	7	Med.Dense	34 deg
2,3	8	Med.Dense	35 deg
2,4	22	Dense	38 deg
2,5	23	Dense	38 deg
2,6	25	Dense	38 deg
2,7			
2,8			
2,9			5
3			



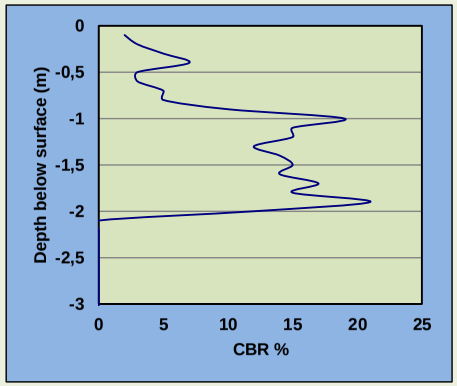


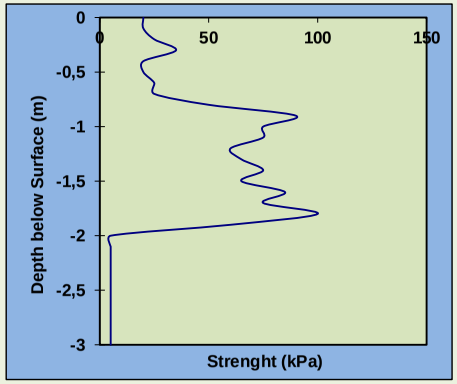
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 9
Final Depth:	2 m

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	1	Very Loose	29 deg
0,2	2	Loose	30 deg
0,3	3	Loose	30 deg
0,4	4	Med.Dense	30 deg
0,5	2	Loose	30 deg
0,6	2	Loose	30 deg
0,7	3	Loose	30 deg
0,8	3	Loose	30 deg
0,9	6	Med.Dense	33 deg
1	11	Dense	36 deg
1,1	9	Med.Dense	35 deg
1,2	9	Med.Dense	35 deg
1,3	7	Med.Dense	34 deg
1,4	8	Med.Dense	35 deg
1,5	9	Med.Dense	35 deg
1,6	8	Med.Dense	35 deg
1,7	10	Med.Dense	36 deg
1,8	9	Med.Dense	35 deg
1,9	12	Dense	36 deg
2	7	Med.Dense	34 deg
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





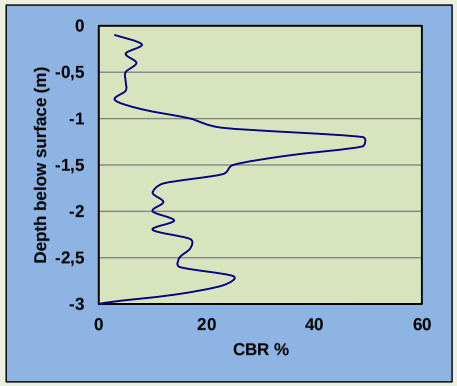
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

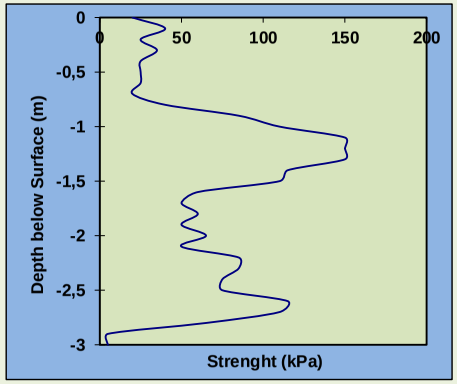
TP9

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 10
Final Depth:	2,9 m

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	2	Loose	30 deg
0,2	5	Med.Dense	32 deg
0,3	3	Loose	30 deg
0,4	4	Med.Dense	30 deg
0,5	3	Loose	30 deg
0,6	3	Loose	30 deg
0,7	3	Loose	30 deg
0,8	2	Loose	30 deg
0,9	5	Med.Dense	32 deg
1	10	Med.Dense	36 deg
1,1	13	Dense	37 deg
1,2	25	Very Dense	38 deg
1,3	25	Dense	38 deg
1,4	19	Dense	37 deg
1,5	14	Dense	37 deg
1,6	13	Dense	37 deg
1,7	7	Med.Dense	34 deg
1,8	6	Med.Dense	33 deg
1,9	7	Med.Dense	34 deg
2	6	Med.Dense	33 deg
2,1	8	Med.Dense	35 deg
2,2	6	Med.Dense	33 deg
2,3	10	Med.Dense	36 deg
2,4	10	Med.Dense	36 deg
2,5	9	Med.Dense	35 deg
2,6	9	Med.Dense	35 deg
2,7	14	Dense	37 deg
2,8	13	Dense	37 deg
2,9	8	Med.Dense	5 deg
3			





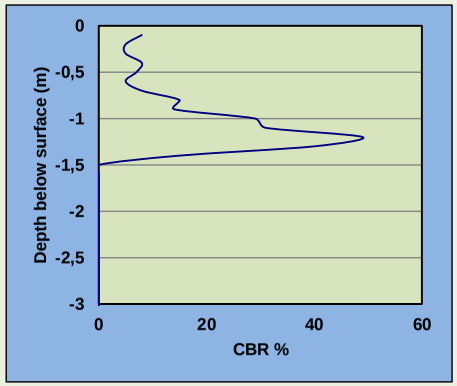
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

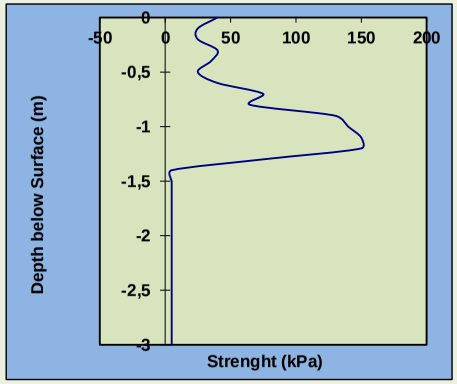
TP10

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 11
Final Depth:	*1,4 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	5	Med.Dense	32 deg
0,2	3	Loose	30 deg
0,3	3	Loose	30 deg
0,4	5	Med.Dense	32 deg
0,5	4	Med.Dense	30 deg
0,6	3	Loose	30 deg
0,7	5	Med.Dense	32 deg
0,8	9	Med.Dense	35 deg
0,9	8	Med.Dense	35 deg
1	16	Dense	37 deg
1,1	17	Dense	37 deg
1,2	25	Very Dense	38 deg
1,3	21	Dense	38 deg
1,4	9	Med.Dense	35 deg
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



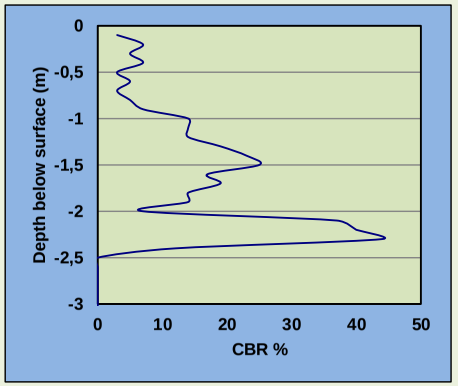


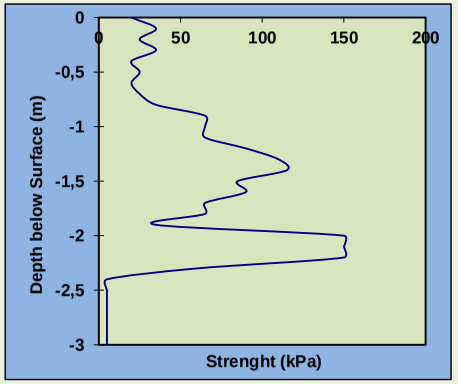
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 12
Final Depth:	*2,4 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	2	Loose	30 deg
0,2	4	Med.Dense	30 deg
0,3	3	Loose	30 deg
0,4	4	Med.Dense	30 deg
0,5	2	Loose	30 deg
0,6	3	Loose	30 deg
0,7	2	Loose	30 deg
0,8	3	Loose	30 deg
0,9	4	Med.Dense	30 deg
1	8	Med.Dense	35 deg
1,1	8	Med.Dense	35 deg
1,2	8	Med.Dense	35 deg
1,3	11	Dense	36 deg
1,4	13	Dense	37 deg
1,5	14	Dense	37 deg
1,6	10	Med.Dense	36 deg
1,7	11	Dense	36 deg
1,8	8	Med.Dense	35 deg
1,9	8	Med.Dense	35 deg
2	4	Med.Dense	30 deg
2,1	20	Dense	38 deg
2,2	21	Dense	38 deg
2,3	23	Dense	38 deg
2,4	7	Med.Dense	34 deg
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



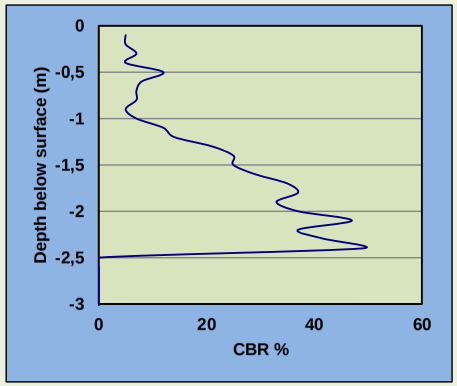


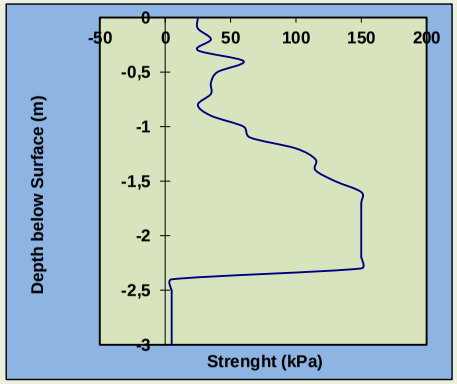
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 13
Final Depth:	*2,4 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	3	Loose	30 deg
0,3	4	Med.Dense	30 deg
0,4	3	Loose	30 deg
0,5	7	Med.Dense	34 deg
0,6	5	Med.Dense	32 deg
0,7	4	Med.Dense	30 deg
0,8	4	Med.Dense	30 deg
0,9	3	Loose	30 deg
1	4	Med.Dense	30 deg
1,1	7	Med.Dense	34 deg
1,2	8	Med.Dense	35 deg
1,3	12	Dense	36 deg
1,4	14	Dense	37 deg
1,5	14	Dense	37 deg
1,6	16	Dense	37 deg
1,7	19	Dense	37 deg
1,8	20	Dense	38 deg
1,9	18	Dense	37 deg
2	20	Dense	38 deg
2,1	24	Dense	38 deg
2,2	20	Dense	38 deg
2,3	22	Dense	38 deg
2,4	25	Dense	38 deg
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



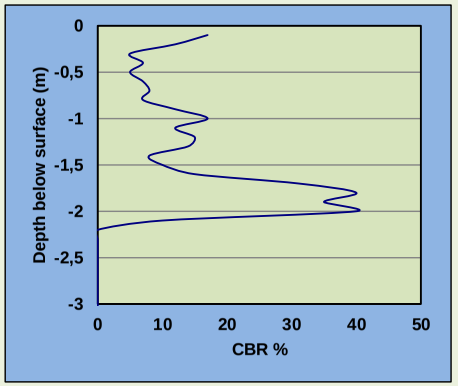


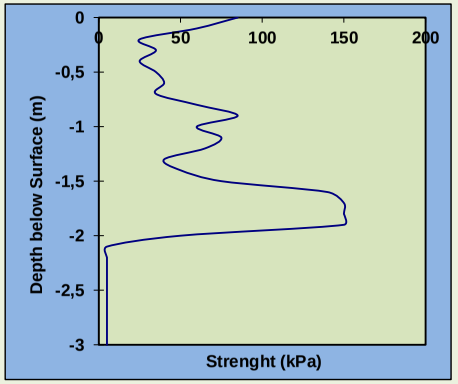
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 14
Final Depth:	*2,1 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	10	Med.Dense	36 deg
0,2	7	Med.Dense	34 deg
0,3	3	Loose	30 deg
0,4	4	Med.Dense	30 deg
0,5	3	Loose	30 deg
0,6	4	Med.Dense	30 deg
0,7	5	Med.Dense	32 deg
0,8	4	Med.Dense	30 deg
0,9	7	Med.Dense	34 deg
1	10	Med.Dense	36 deg
1,1	7	Med.Dense	34 deg
1,2	9	Med.Dense	35 deg
1,3	8	Med.Dense	35 deg
1,4	5	Med.Dense	32 deg
1,5	6	Med.Dense	33 deg
1,6	9	Med.Dense	35 deg
1,7	17	Dense	37 deg
1,8	21	Dense	38 deg
1,9	19	Dense	37 deg
2	21	Dense	38 deg
2,1	6	Med.Dense	33 deg
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



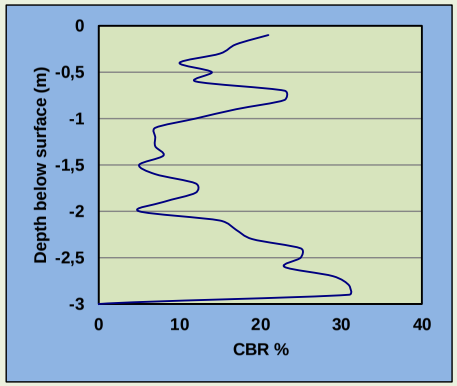


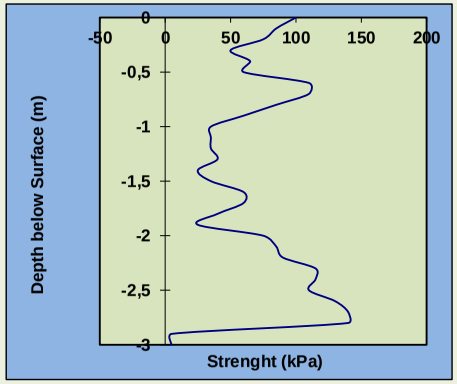
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 15
Final Depth:	*2,9 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	12	Dense	36 deg
0,2	10	Med.Dense	36 deg
0,3	9	Med.Dense	35 deg
0,4	6	Med.Dense	33 deg
0,5	8	Med.Dense	35 deg
0,6	7	Med.Dense	34 deg
0,7	13	Dense	37 deg
0,8	13	Dense	37 deg
0,9	10	Med.Dense	36 deg
1	7	Med.Dense	34 deg
1,1	4	Med.Dense	30 deg
1,2	4	Med.Dense	30 deg
1,3	4	Med.Dense	30 deg
1,4	5	Med.Dense	32 deg
1,5	3	Loose	30 deg
1,6	4	Med.Dense	30 deg
1,7	7	Med.Dense	34 deg
1,8	7	Med.Dense	34 deg
1,9	5	Med.Dense	32 deg
2	3	Loose	30 deg
2,1	9	Med.Dense	35 deg
2,2	10	Med.Dense	36 deg
2,3	11	Dense	36 deg
2,4	14	Dense	37 deg
2,5	14	Dense	37 deg
2,6	13	Dense	37 deg
2,7	16	Dense	37 deg
2,8	17	Dense	37 deg
2,9	17	Dense	5 deg
3			



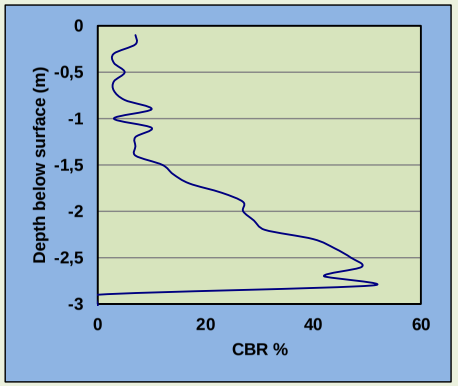


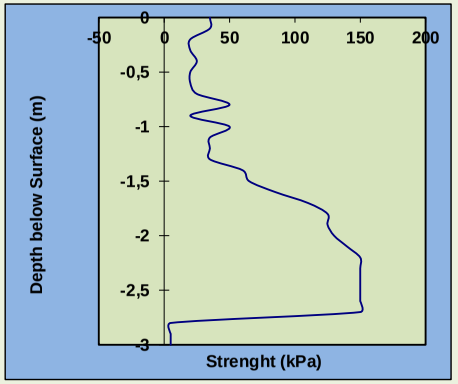
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 16
Final Depth:	*2,8 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	4	Med.Dense	30 deg
0,2	4	Med.Dense	30 deg
0,3	2	Loose	30 deg
0,4	2	Loose	30 deg
0,5	3	Loose	30 deg
0,6	2	Loose	30 deg
0,7	2	Loose	30 deg
0,8	3	Loose	30 deg
0,9	6	Med.Dense	33 deg
1	2	Loose	30 deg
1,1	6	Med.Dense	33 deg
1,2	4	Med.Dense	30 deg
1,3	4	Med.Dense	30 deg
1,4	4	Med.Dense	30 deg
1,5	7	Med.Dense	34 deg
1,6	8	Med.Dense	35 deg
1,7	10	Med.Dense	36 deg
1,8	13	Dense	37 deg
1,9	15	Dense	37 deg
2	15	Dense	37 deg
2,1	16	Dense	37 deg
2,2	17	Dense	37 deg
2,3	21	Dense	38 deg
2,4	23	Dense	38 deg
2,5	24	Dense	38 deg
2,6	25	Dense	38 deg
2,7	22	Dense	38 deg
2,8	26	Very Dense	38 deg
2,9			5
3			



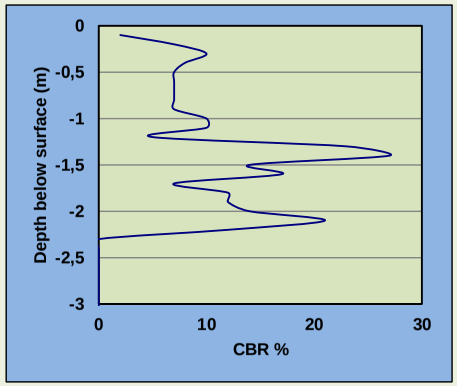


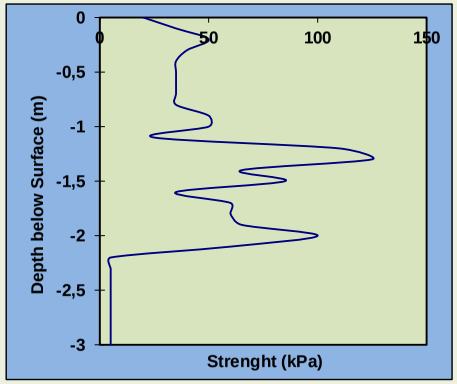
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 17
Final Depth:	*2,2 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	1	Very Loose	29 deg
0,2	4	Med.Dense	30 deg
0,3	6	Med.Dense	33 deg
0,4	5	Med.Dense	32 deg
0,5	4	Med.Dense	30 deg
0,6	4	Med.Dense	30 deg
0,7	4	Med.Dense	30 deg
0,8	4	Med.Dense	30 deg
0,9	4	Med.Dense	30 deg
1	6	Med.Dense	33 deg
1,1	6	Med.Dense	33 deg
1,2	3	Loose	30 deg
1,3	13	Dense	37 deg
1,4	15	Dense	37 deg
1,5	8	Med.Dense	35 deg
1,6	10	Med.Dense	36 deg
1,7	4	Med.Dense	30 deg
1,8	7	Med.Dense	34 deg
1,9	7	Med.Dense	34 deg
2	8	Med.Dense	35 deg
2,1	12	Dense	36 deg
2,2	7	Med.Dense	34 deg
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



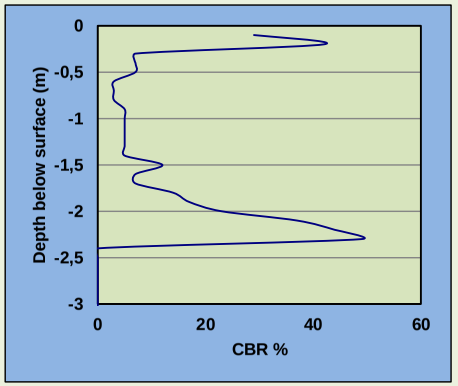


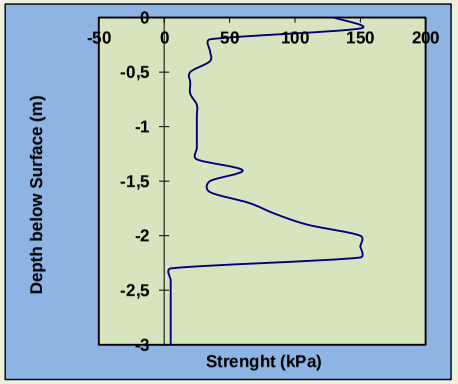
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 18
Final Depth:	*2,3 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	16	Dense	37 deg
0,2	22	Dense	38 deg
0,3	4	Med.Dense	30 deg
0,4	4	Med.Dense	30 deg
0,5	4	Med.Dense	30 deg
0,6	2	Loose	30 deg
0,7	2	Loose	30 deg
0,8	2	Loose	30 deg
0,9	3	Loose	30 deg
1	3	Loose	30 deg
1,1	3	Loose	30 deg
1,2	3	Loose	30 deg
1,3	3	Loose	30 deg
1,4	3	Loose	30 deg
1,5	7	Med.Dense	34 deg
1,6	4	Med.Dense	30 deg
1,7	4	Med.Dense	30 deg
1,8	8	Med.Dense	35 deg
1,9	10	Med.Dense	36 deg
2	13	Dense	37 deg
2,1	20	Dense	38 deg
2,2	23	Dense	38 deg
2,3	25	Very Dense	38 deg
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



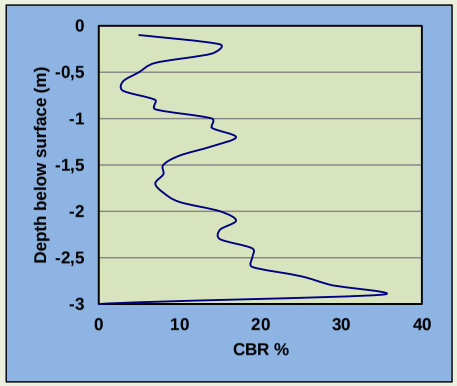


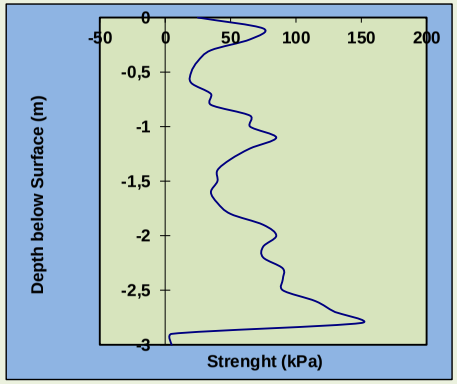
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	10/11/2020
DCP No.:	DCP 19
Final Depth:	*2,9 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	9	Med.Dense	35 deg
0,3	8	Med.Dense	35 deg
0,4	4	Med.Dense	30 deg
0,5	3	Loose	30 deg
0,6	2	Loose	30 deg
0,7	2	Loose	30 deg
0,8	4	Med.Dense	30 deg
0,9	4	Med.Dense	30 deg
1	8	Med.Dense	35 deg
1,1	8	Med.Dense	35 deg
1,2	10	Med.Dense	36 deg
1,3	8	Med.Dense	35 deg
1,4	6	Med.Dense	33 deg
1,5	5	Med.Dense	32 deg
1,6	5	Med.Dense	32 deg
1,7	4	Med.Dense	30 deg
1,8	5	Med.Dense	32 deg
1,9	6	Med.Dense	33 deg
2	9	Med.Dense	35 deg
2,1	10	Med.Dense	36 deg
2,2	9	Med.Dense	35 deg
2,3	9	Med.Dense	35 deg
2,4	11	Dense	36 deg
2,5	11	Dense	36 deg
2,6	11	Dense	36 deg
2,7	14	Dense	37 deg
2,8	16	Dense	37 deg
2,9	19	Dense	5 deg
3			



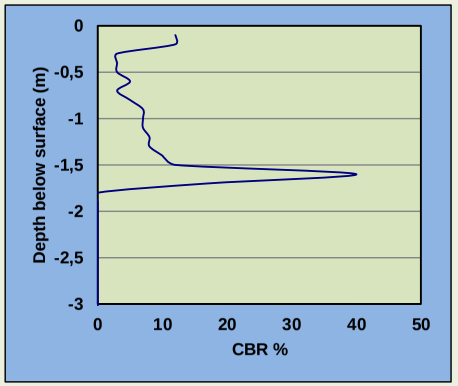


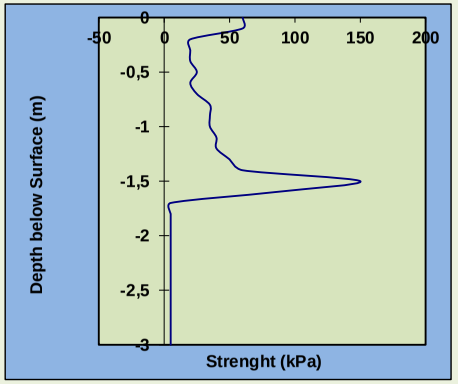
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 20
Final Depth:	*1,7 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	7	Med.Dense	34 deg
0,2	7	Med.Dense	34 deg
0,3	2	Loose	30 deg
0,4	2	Loose	30 deg
0,5	2	Loose	30 deg
0,6	3	Loose	30 deg
0,7	2	Loose	30 deg
0,8	3	Loose	30 deg
0,9	4	Med.Dense	30 deg
1	4	Med.Dense	30 deg
1,1	4	Med.Dense	30 deg
1,2	5	Med.Dense	32 deg
1,3	5	Med.Dense	32 deg
1,4	6	Med.Dense	33 deg
1,5	7	Med.Dense	34 deg
1,6	21	Dense	38 deg
1,7	10	Med.Dense	36 deg
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



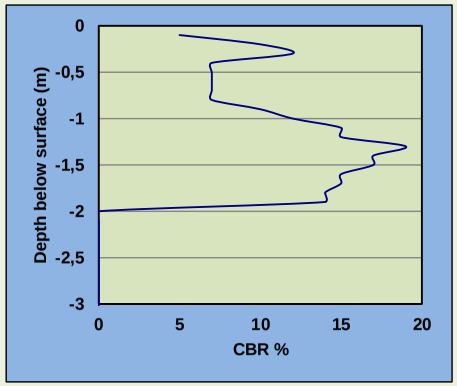


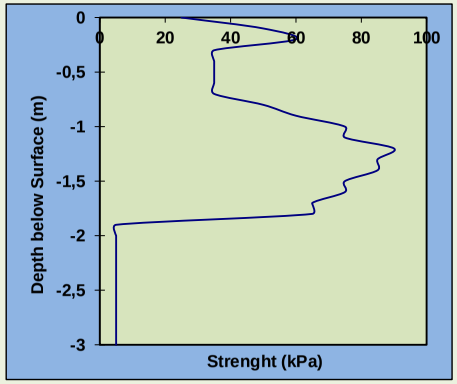
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 21
Final Depth:	*1,9 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	6	Med.Dense	33 deg
0,3	7	Med.Dense	34 deg
0,4	4	Med.Dense	30 deg
0,5	4	Med.Dense	30 deg
0,6	4	Med.Dense	30 deg
0,7	4	Med.Dense	30 deg
0,8	4	Med.Dense	30 deg
0,9	6	Med.Dense	33 deg
1	7	Med.Dense	34 deg
1,1	9	Med.Dense	35 deg
1,2	9	Med.Dense	35 deg
1,3	11	Dense	36 deg
1,4	10	Med.Dense	36 deg
1,5	10	Med.Dense	36 deg
1,6	9	Med.Dense	35 deg
1,7	9	Med.Dense	35 deg
1,8	8	Med.Dense	35 deg
1,9	8	Med.Dense	35 deg
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



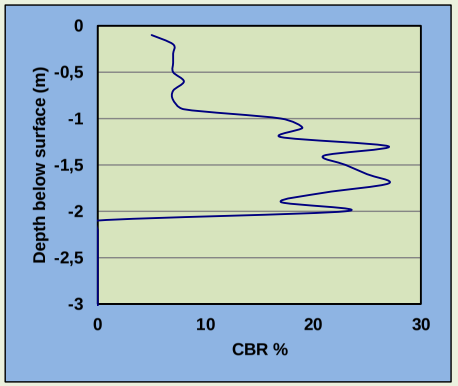


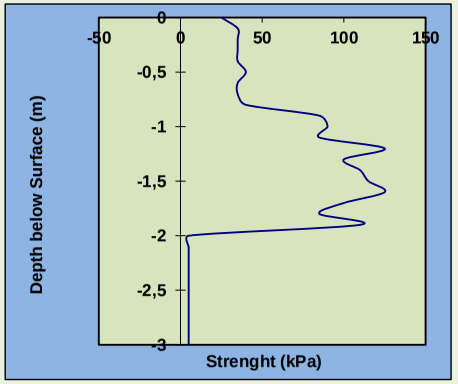
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 22
Final Depth:	*2 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	4	Med.Dense	30 deg
0,3	4	Med.Dense	30 deg
0,4	4	Med.Dense	30 deg
0,5	4	Med.Dense	30 deg
0,6	5	Med.Dense	32 deg
0,7	4	Med.Dense	30 deg
0,8	4	Med.Dense	30 deg
0,9	5	Med.Dense	32 deg
1	10	Med.Dense	36 deg
1,1	11	Dense	36 deg
1,2	10	Med.Dense	36 deg
1,3	15	Dense	37 deg
1,4	12	Dense	36 deg
1,5	13	Dense	37 deg
1,6	14	Dense	37 deg
1,7	15	Dense	37 deg
1,8	12	Dense	36 deg
1,9	10	Med.Dense	36 deg
2	13	Dense	37 deg
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



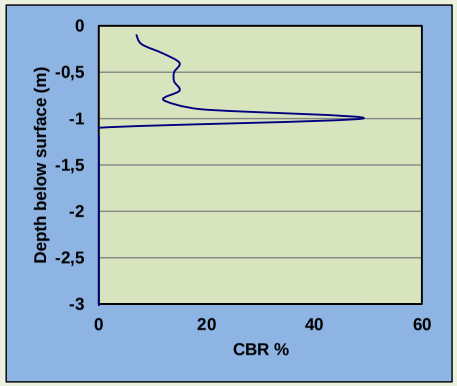


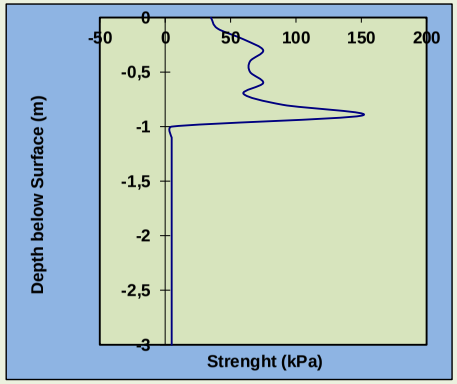
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 23
Final Depth:	*1 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	4	Med.Dense	30 deg
0,2	5	Med.Dense	32 deg
0,3	7	Med.Dense	34 deg
0,4	9	Med.Dense	35 deg
0,5	8	Med.Dense	35 deg
0,6	8	Med.Dense	35 deg
0,7	9	Med.Dense	35 deg
0,8	7	Med.Dense	34 deg
0,9	11	Dense	36 deg
1	25	Very Dense	38 deg
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



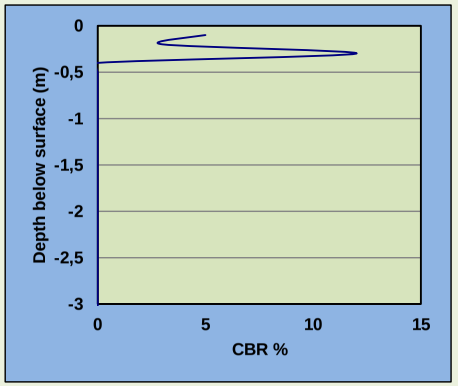


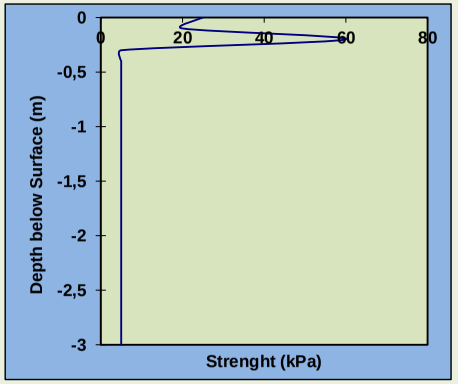
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 24
Final Depth:	*0,3 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	2	Loose	30 deg
0,3	7	Med.Dense	34 deg
0,4			
0,5			
0,6			
0,7			
0,8			
0,9			
1			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



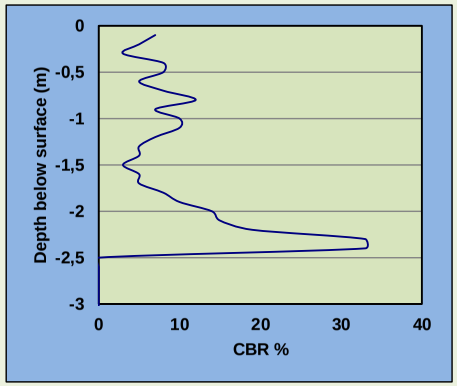


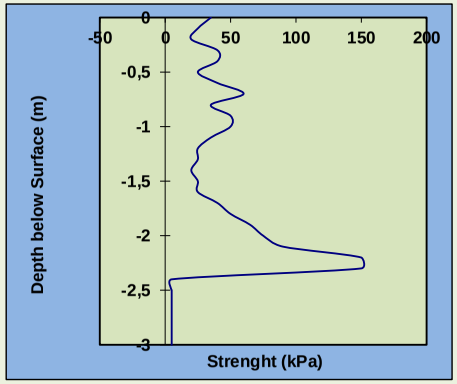
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 25
Final Depth:	*2,4 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	4	Med.Dense	30 deg
0,2	3	Loose	30 deg
0,3	2	Loose	30 deg
0,4	5	Med.Dense	32 deg
0,5	5	Med.Dense	32 deg
0,6	3	Loose	30 deg
0,7	5	Med.Dense	32 deg
0,8	7	Med.Dense	34 deg
0,9	4	Med.Dense	30 deg
1	6	Med.Dense	33 deg
1,1	6	Med.Dense	33 deg
1,2	4	Med.Dense	30 deg
1,3	3	Loose	30 deg
1,4	3	Loose	30 deg
1,5	2	Loose	30 deg
1,6	3	Loose	30 deg
1,7	3	Loose	30 deg
1,8	5	Med.Dense	32 deg
1,9	6	Med.Dense	33 deg
2	8	Med.Dense	35 deg
2,1	9	Med.Dense	35 deg
2,2	11	Dense	36 deg
2,3	18	Dense	37 deg
2,4	18	Dense	37 deg
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



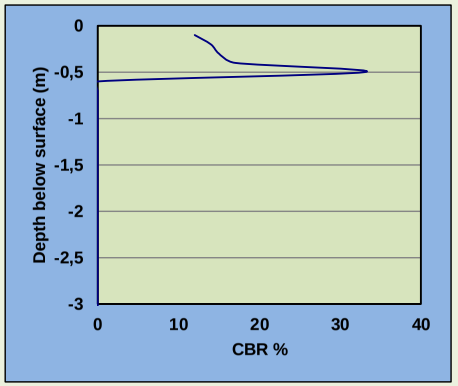


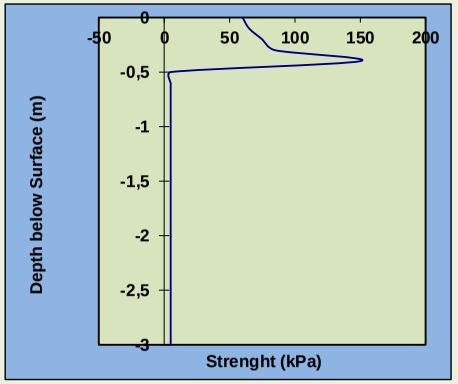
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 26
Final Depth:	*0,5 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	7	Med.Dense	34 deg
0,2	8	Med.Dense	35 deg
0,3	9	Med.Dense	35 deg
0,4	10	Med.Dense	36 deg
0,5	18	Dense	37 deg
0,6			
0,7			
0,8			
0,9			
1			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



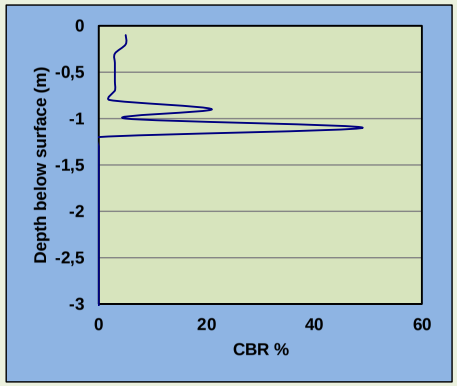


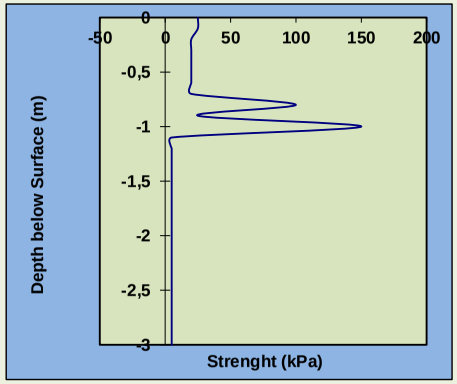
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 27
Final Depth:	*1,2 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	3	Loose	30 deg
0,3	2	Loose	30 deg
0,4	2	Loose	30 deg
0,5	2	Loose	30 deg
0,6	2	Loose	30 deg
0,7	2	Loose	30 deg
0,8	1	Very Loose	29 deg
0,9	12	Dense	36 deg
1	3	Loose	30 deg
1,1	25	Dense	38 deg
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



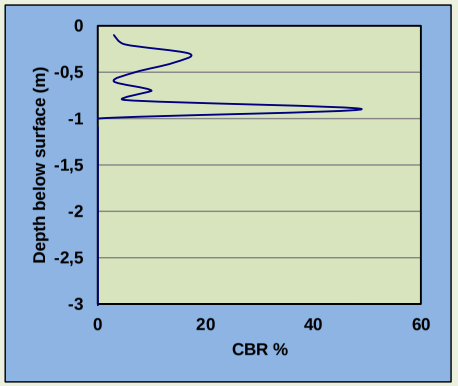


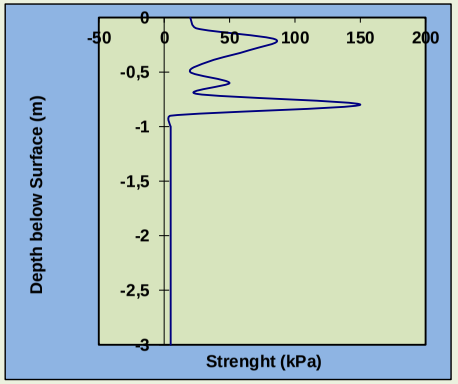
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 28
Final Depth:	*0,9 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	2	Loose	30 deg
0,2	3	Loose	30 deg
0,3	10	Med.Dense	36 deg
0,4	8	Med.Dense	35 deg
0,5	4	Med.Dense	30 deg
0,6	2	Loose	30 deg
0,7	6	Med.Dense	33 deg
0,8	3	Loose	30 deg
0,9	25	Very Dense	38 deg
1			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



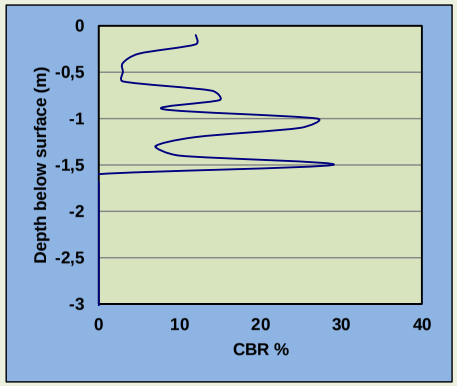


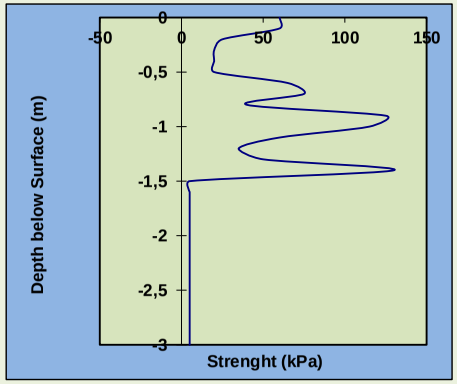
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 29
Final Depth:	*1,5 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	7	Med.Dense	34 deg
0,2	7	Med.Dense	34 deg
0,3	3	Loose	30 deg
0,4	2	Loose	30 deg
0,5	2	Loose	30 deg
0,6	2	Loose	30 deg
0,7	8	Med.Dense	35 deg
0,8	9	Med.Dense	35 deg
0,9	5	Med.Dense	32 deg
1	15	Dense	37 deg
1,1	14	Dense	37 deg
1,2	7	Med.Dense	34 deg
1,3	4	Med.Dense	30 deg
1,4	6	Med.Dense	33 deg
1,5	16	Dense	37 deg
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



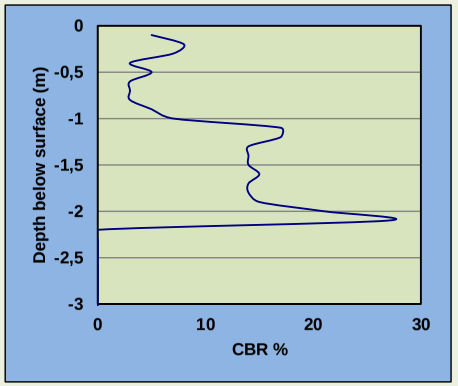


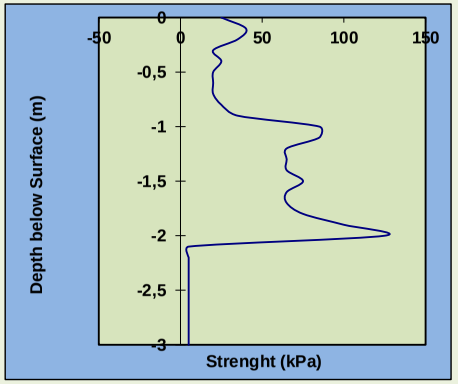
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 30
Final Depth:	*2,1 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	5	Med.Dense	32 deg
0,3	4	Med.Dense	30 deg
0,4	2	Loose	30 deg
0,5	3	Loose	30 deg
0,6	2	Loose	30 deg
0,7	2	Loose	30 deg
0,8	2	Loose	30 deg
0,9	3	Loose	30 deg
1	4	Med.Dense	30 deg
1,1	10	Med.Dense	36 deg
1,2	10	Med.Dense	36 deg
1,3	8	Med.Dense	35 deg
1,4	8	Med.Dense	35 deg
1,5	8	Med.Dense	35 deg
1,6	9	Med.Dense	35 deg
1,7	8	Med.Dense	35 deg
1,8	8	Med.Dense	35 deg
1,9	9	Med.Dense	35 deg
2	12	Dense	36 deg
2,1	15	Dense	37 deg
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



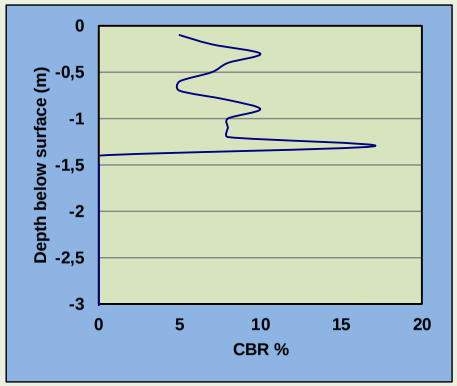


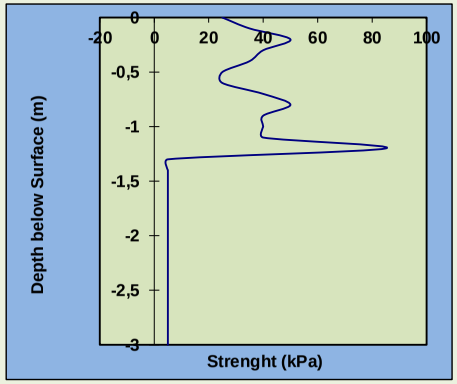
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 31
Final Depth:	*1,3 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	4	Med.Dense	30 deg
0,3	6	Med.Dense	33 deg
0,4	5	Med.Dense	32 deg
0,5	4	Med.Dense	30 deg
0,6	3	Loose	30 deg
0,7	3	Loose	30 deg
0,8	5	Med.Dense	32 deg
0,9	6	Med.Dense	33 deg
1	5	Med.Dense	32 deg
1,1	5	Med.Dense	32 deg
1,2	5	Med.Dense	32 deg
1,3	10	Med.Dense	36 deg
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





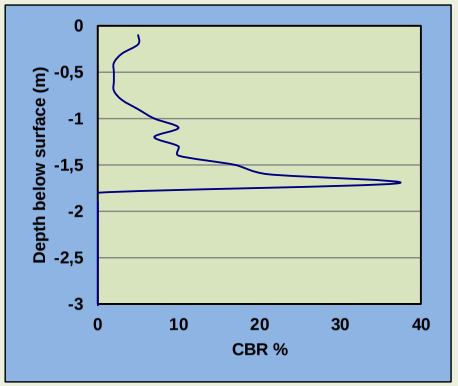
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

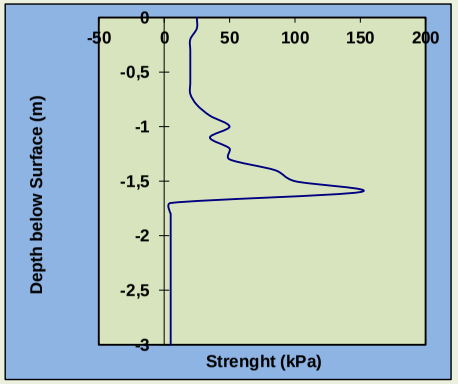
TP31

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 32
Final Depth:	*1,7 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	3	Loose	30 deg
0,2	3	Loose	30 deg
0,3	2	Loose	30 deg
0,4	1	Very Loose	29 deg
0,5	1	Very Loose	29 deg
0,6	1	Very Loose	29 deg
0,7	1	Very Loose	29 deg
0,8	2	Loose	30 deg
0,9	3	Loose	30 deg
1	4	Med.Dense	30 deg
1,1	6	Med.Dense	33 deg
1,2	4	Med.Dense	30 deg
1,3	6	Med.Dense	33 deg
1,4	6	Med.Dense	33 deg
1,5	10	Med.Dense	36 deg
1,6	12	Dense	36 deg
1,7	20	Dense	38 deg
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





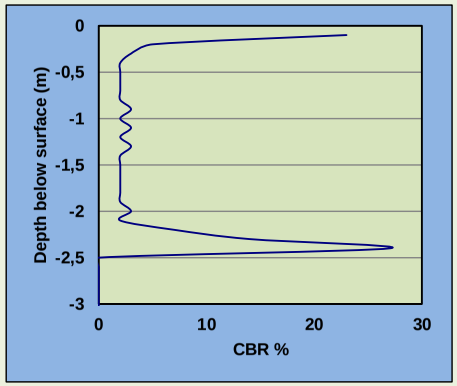
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

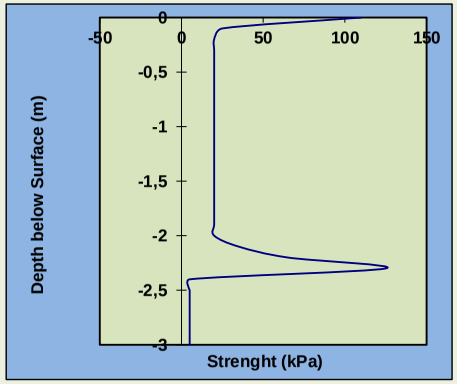
TP32

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 33
Final Depth:	*2,4 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	13	Dense	37 deg
0,2	3	Loose	30 deg
0,3	2	Loose	30 deg
0,4	1	Very Loose	29 deg
0,5	1	Very Loose	29 deg
0,6	1	Very Loose	29 deg
0,7	1	Very Loose	29 deg
0,8	1	Very Loose	29 deg
0,9	2	Loose	30 deg
1	1	Very Loose	29 deg
1,1	2	Loose	30 deg
1,2	1	Very Loose	29 deg
1,3	2	Loose	30 deg
1,4	1	Very Loose	29 deg
1,5	1	Very Loose	29 deg
1,6	1	Very Loose	29 deg
1,7	1	Very Loose	29 deg
1,8	1	Very Loose	29 deg
1,9	1	Very Loose	29 deg
2	2	Loose	30 deg
2,1	1	Very Loose	29 deg
2,2	4	Med.Dense	30 deg
2,3	8	#N/A	35 deg
2,4	15	Dense	37 deg
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





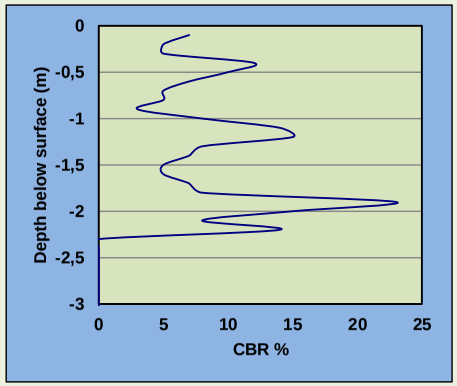
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

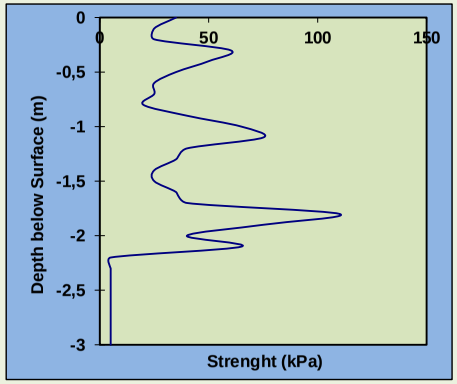
TP33

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 34
Final Depth:	*2,2 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	4	Med.Dense	30 deg
0,2	3	Loose	30 deg
0,3	3	Loose	30 deg
0,4	7	Med.Dense	34 deg
0,5	6	Med.Dense	33 deg
0,6	4	Med.Dense	30 deg
0,7	3	Loose	30 deg
0,8	3	Loose	30 deg
0,9	2	Loose	30 deg
1	5	Med.Dense	32 deg
1,1	8	Med.Dense	35 deg
1,2	9	Med.Dense	35 deg
1,3	5	Med.Dense	32 deg
1,4	4	Med.Dense	30 deg
1,5	3	Loose	30 deg
1,6	3	Loose	30 deg
1,7	4	Med.Dense	30 deg
1,8	5	Med.Dense	32 deg
1,9	13	Dense	37 deg
2	9	Med.Dense	35 deg
2,1	5	Med.Dense	32 deg
2,2	8	Med.Dense	35 deg
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





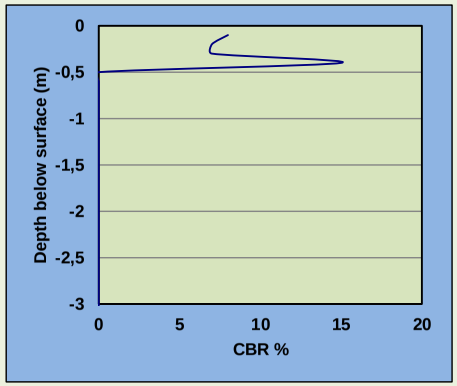
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

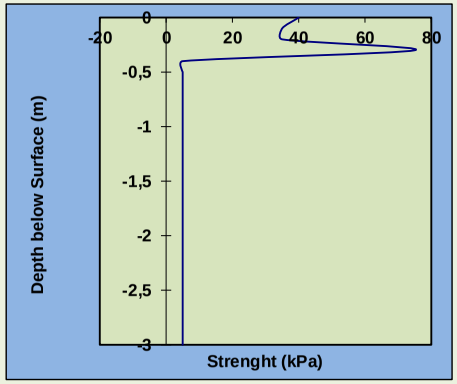
TP34

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 35
Final Depth:	*0,4 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	5	Med.Dense	32 deg
0,2	4	Med.Dense	30 deg
0,3	4	Med.Dense	30 deg
0,4	9	Med.Dense	35 deg
0,5			
0,6			
0,7			
0,8			
0,9			
1			
1,1			
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			



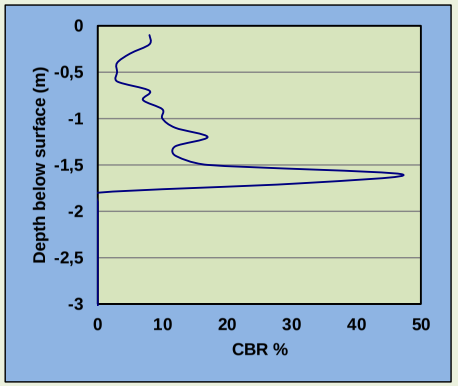


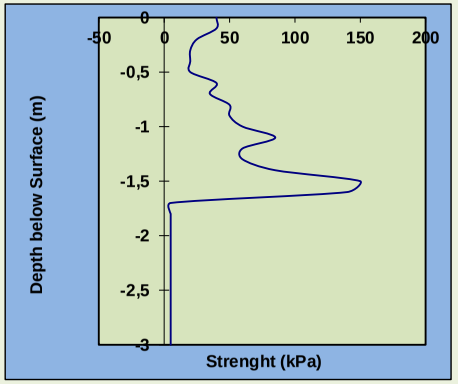
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 36
Final Depth:	*1,7 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	5	Med.Dense	32 deg
0,2	5	Med.Dense	32 deg
0,3	3	Loose	30 deg
0,4	2	Loose	30 deg
0,5	2	Loose	30 deg
0,6	2	Loose	30 deg
0,7	5	Med.Dense	32 deg
0,8	4	Med.Dense	30 deg
0,9	6	Med.Dense	33 deg
1	6	Med.Dense	33 deg
1,1	7	Med.Dense	34 deg
1,2	10	Med.Dense	36 deg
1,3	7	Med.Dense	34 deg
1,4	7	Med.Dense	34 deg
1,5	10	Med.Dense	36 deg
1,6	24	Dense	38 deg
1,7	17	Dense	37 deg
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





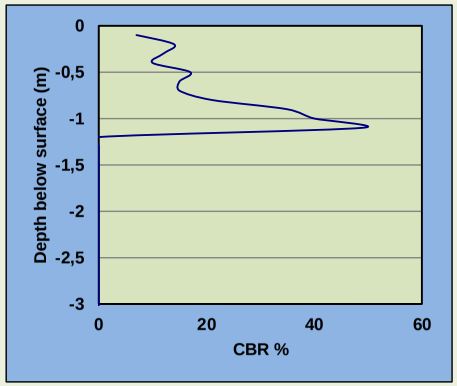
The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

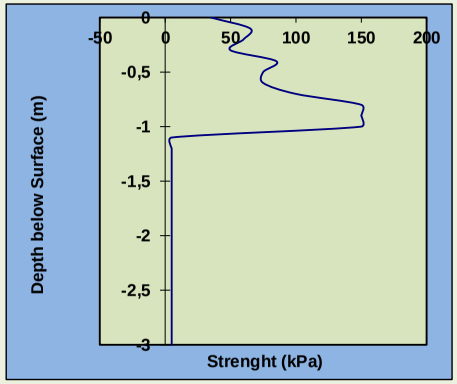
Luhlaza
Advisory and Consulting (Pty) Ltd

Client Name	
Reference:	LC037-20
Project:	LANGAVILLE
Date:	11/11/2020
DCP No.:	DCP 37
Final Depth:	*1,1 m*

The shear strength values are based on empirical calculations and should be used as a guide only

Depth (m)	Blows/ 0.1m	Inferred Consistency	Shear Strength
0			
0,1	4	Med.Dense	30 deg
0,2	8	Med.Dense	35 deg
0,3	7	Med.Dense	34 deg
0,4	6	Med.Dense	33 deg
0,5	10	Med.Dense	36 deg
0,6	9	Med.Dense	35 deg
0,7	9	Med.Dense	35 deg
0,8	12	Dense	36 deg
0,9	19	Dense	37 deg
1	21	Dense	38 deg
1,1	25	Dense	38 deg
1,2			
1,3			
1,4			
1,5			
1,6			
1,7			
1,8			
1,9			
2			
2,1			
2,2			
2,3			
2,4			
2,5			
2,6			
2,7			
2,8			
2,9			5
3			





The results shown here are based on calculations using the DCP test. These are classified as indicative values and need to be verified by other testing methods.

APPENDIX C: LABORATORY TEST RESULTS

GEOMAT LABORATORY SERVICES cc

Reg no: 2008/142232/23 - Vat Reg No: 4540251537

Civil Engineering Materials Testing Laboratories

12 Nerina Road, Kyalami
Tel: 011 046 8944, Cell: 073 2099 161
E-mail : midrand@geomatlab.co.za

TEST REPORT: SANS 3001 (GR1, GR10,GR12,GR30,GR40, GR53,GR54)

Client Name:	Luhlaza Advisory & Consulting (Pty) Ltd	Date Analysed:	17-11-2020
Client Address:	41 Verde Avenue Risidale, Randburg Johannesburg, 2194	Client No:	2084
Project Name:	Langaville LC037-20		
Attention:	Mr N Govender		

SAMPLE No		A5701	A5703	A5705	A5707
CONTAINER USED FOR SAMPLING		Black Sampling Bags	Black Sampling Bags	Black Sampling Bags	Black Sampling Bags
SIZE / WEIGHT OF SAMPLE		70KG	70KG	70KG	70KG
MOISTURE CONDITION OF SAMPLE		Slightly Moist	Slightly Moist	Slightly Moist	Slightly Moist
HOLE No. / Km. / CHAINAGE		TP13	TP17	TP20	TP27
ROAD No. OR NAME		-	-	-	-
LAYER TESTED / SAMPLED FROM		0.3 - 1.3	0.0 - 0.4	0.2 - 1.7	0.3 - 1.0
DATE SAMPLED		04-11-2020	04-11-2020	04-11-2020	04-11-2020
DATE RECEIVED		04-11-2020	04-11-2020	04-11-2020	04-11-2020
DATE TESTED		12-11-2020	12-11-2020	12-11-2020	12-11-2020
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Clayey Sand	Silty Sand	Sandy Clay	Silty Clay
SIEVE ANALYSIS	100.0 mm	100	100	100	100
	75.0 mm	100	100	100	100
	63.0 mm	100	100	100	100
	50.0 mm	100	100	100	100
	37.5 mm	100	100	100	100
	28.0 mm	100	100	100	100
	20.0 mm	100	100	100	100
	14.0 mm	100	98	100	100
	5.00 mm	82	98	95	100
	2.00 mm	64	97	93	99
	0.425 mm	56	85	86	89
	0.075 mm	53	75	81	78
SOIL MORTAR					
COARSE SAND < 2.0mm > 0.425mm		12	12	8	10
FINE SAND < 0.425mm > 0.075mm		5	10	5	11
COARSE SAND < 0.075mm		83	78	87	79
ATTERBERG LIMITS	LL%	28,0	-	30,0	25,0
	P.I.	7,0	NP	10,0	7,0
	LS%	3,5	-	5,0	3,5
	GM	1,27	0,43	0,40	0,34
CLASSIFI - CATION	H.R.B.	A-4(0)	A-4(0)	A-4(0)	A-4(0)
	COLTO	G7	-	-	-
MOD AASHTO	OMC%	10,4	8,8	10,4	10,5
	MDD(KG/M^3)	1885	1817	1717	1864
	COMP MC	10,4	8,8	10,4	10,5
SWELL %	Mod	0,11	0,00	0,76	0,09
	Nrb	0,19	0,08	0,88	0,22
	Proctor	0,30	0,11	0,96	0,36
U.C.S.	100%	24	14	19	27
	98%	22	12	16	21
C.B.R.	97%	21	10	15	17
	95%	19	8	12	11
	93%	15	6	9	9
	90%	9	4	4	6
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE	NEAT	NEAT	NEAT	NEAT
TEST TYPE		IND,MOD,CBR	IND,MOD,CBR	IND,MOD,CBR	IND,MOD,CBR
SAMPLED BY		Client	Client	Client	Client
DELIVERED BY		Client	Client	Client	Client
SAMPLING METHOD		TMH 5	TMH 5	TMH 5	TMH 5
ENVIRONMENTAL CONDITION WHEN SAMPLED		Hot	Hot	Hot	Hot
REMARKS					

Remarks :

Data Reported above relates only to the sample tested.
Test reports shall not be reproduced unless in its Full context.

Kind Regards,

Technical Manager
Kogalin Reddy

GEOMAT LABORATORY SERVICES cc

Reg no: 2008/142232/23 - Vat Reg No: 4540251537

Civil Engineering Materials Testing Laboratories

12 Nerina Road, Kyalami
Tel: 011 046 8944, Cell: 073 2099 161
E-mail : midrand@geomatlab.co.za

TEST REPORT: SANS 3001 (GR1, GR10,GR12,GR30,GR40, GR53,GR54)

Client Name:	Luhlaza Advisory & Consulting (Pty) Ltd	Date Analysed:	17-11-2020
Client Address:	41 Verde Avenue Risidale, Randburg Johannesburg, 2194	Client No:	2084
Project Name:	Langaville LC037-20		
Attention:	Mr N Govender		

SAMPLE No		A5709	A5710		
CONTAINER USED FOR SAMPLING		Black Sampling Bags	Black Sampling Bags		
SIZE / WEIGHT OF SAMPLE		70KG	70KG		
MOISTURE CONDITION OF SAMPLE		Slightly Moist	Slightly Moist		
HOLE No. / Km. / CHAINAGE		TP33	TP36		
ROAD No. OR NAME		-	-		
LAYER TESTED / SAMPLED FROM		0.5 - 2.4	0.3 - 1.2		
DATE SAMPLED		04-11-2020	04-11-2020		
DATE RECEIVED		04-11-2020	04-11-2020		
DATE TESTED		12-11-2020	12-11-2020		
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Sandy Clay	Silty Clay		
SIEVE ANALYSIS	100.0 mm	100	100		
	75.0 mm	100	100		
	63.0 mm	100	100		
	50.0 mm	100	100		
	37.5 mm	100	100		
	28.0 mm	100	100		
	20.0 mm	100	100		
	14.0 mm	100	98		
	5.00 mm	97	89		
	2.00 mm	91	80		
	0.425 mm	82	74		
	0.075 mm	76	69		
SOIL MORTAR					
COARSE SAND < 2.0mm > 0.425mm		10	8		
FINE SAND < 0.425mm > 0.075mm		7	6		
COARSE SAND < 0.075mm		83	86		
ATTERBERG LIMITS	LL%	27,0	36,0		
	P.I.	6,0	18,0		
	LS%	3,0	9,5		
	GM	0,51	0,77		
CLASSIFI - CATION	H.R.B.	A-4(0)	A-6(0)		
	COLTO	-	-		
MOD AASHTO	OMC%	10,1	13,4		
	MDD(KG/M^3)	1723	1658		
	COMP MC	10,1	13,4		
SWELL %	Mod	0,05	2,24		
	Nrb	0,14	2,90		
	Proctor	0,25	3,48		
U.C.S. C.B.R.	100%	10	23		
	98%	8	21		
	97%	8	19		
	95%	6	17		
	93%	4	14		
	90%	2	9		
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE	NEAT	NEAT		
TEST TYPE		IND,MOD,CBR	IND,MOD,CBR		
SAMPLED BY		Client	Client		
DELIVERED BY		Client	Client		
SAMPLING METHOD		TMH 5	TMH 5		
ENVIRONMENTAL CONDITION WHEN SAMPLED		Hot	Hot		
REMARKS					

Remarks :

Data Reported above relates only to the sample tested.
Test reports shall not be reproduced unless in its Full context.

Kind Regards,

Technical Manager
Kogalin Reddy

GEOMAT LABORATORY SERVICES cc

Reg no: 2008/142232/23 - Vat Reg No: 4540251537

Civil Engineering Materials Testing Laboratories

12 Nerina Road, Kyalami
Tel: 011 046 8944, Cell: 073 2099 161
E-mail : midrand@geomatlab.co.za

TEST REPORT: SANS 3001 (GR1, GR10,GR12,GR30,GR40, GR53,GR54)

Client Name: Luhlaza Advisory & Consulting (Pty) Ltd

Date Analysed: 17-11-2020

Client Address: 41 Verde Avenue
Risidale, Randburg
Johannesburg, 2194

Client No: 2084

Project Name: Langaville LC037-20

Attention: Mr N Govender

SAMPLE No		A5716	A5717	A5719	A5700
CONTAINER USED FOR SAMPLING		Black Sampling Bags	Black Sampling Bags	Black Sampling Bags	Black Sampling Bags
SIZE / WEIGHT OF SAMPLE		70KG	70KG	70KG	70KG
MOISTURE CONDITION OF SAMPLE		Slightly Moist	Slightly Moist	Slightly Moist	Slightly Moist
HOLE No. / Km. / CHAINAGE		TP1	TP3	TP9	TP11
ROAD No. OR NAME		-	-	-	-
LAYER TESTED / SAMPLED FROM		0.0 - 0.6	0.5 - 1.2	0.6 - 1.9	0.15 - 1.0
DATE SAMPLED		04-11-2020	04-11-2020	04-11-2020	04-11-2020
DATE RECEIVED		04-11-2020	04-11-2020	04-11-2020	04-11-2020
DATE TESTED		12-11-2020	12-11-2020	12-11-2020	12-11-2020
DESCRIPTION OF SAMPLE (COLOUR & TYPE)		Silty Sand	Silty Sand	Clayey Sand	Clayey Sand
SIEVE ANALYSIS	100.0 mm	100	100	100	100
	75.0 mm	100	100	100	100
	63.0 mm	100	100	100	100
	50.0 mm	100	100	100	100
	37.5 mm	100	100	100	100
	28.0 mm	100	100	100	100
	20.0 mm	100	100	100	100
	14.0 mm	99	94	100	100
	5.00 mm	97	75	99	97
	2.00 mm	95	68	98	94
	0.425 mm	81	61	91	85
	0.075 mm	73	54	83	81
SOIL MORTAR					
COARSE SAND < 2.0mm > 0.425mm		15	10	7	10
FINE SAND < 0.425mm > 0.075mm		8	10	8	4
COARSE SAND < 0.075mm		77	80	85	86
ATTERBERG LIMITS	LL%	-	23,0	24,0	31,0
	P.I.	NP	10,0	9,0	7,0
	LS%	-	5,5	4,5	3,5
	GM	0,51	1,17	0,28	0,40
CLASSIFI - CATION	H.R.B.	A-4(0)	A-4(0)	A-4(0)	A-4(0)
	COLTO	-	G7	-	-
MOD AASHTO	OMC%	10,8	10,9	11,6	9,4
	MDD(KG/M^3)	1895	2035	1949	1872
	COMP MC	10,8	10,9	11,6	9,4
SWELL %	Mod	0,06	0,68	0,16	0,08
	Nrb	0,09	0,87	0,69	0,17
	Proctor	0,17	1,56	0,76	0,33
U.C.S.	100%	11	32	20	13
	98%	9	29	16	11
C.B.R.	97%	8	27	15	9
	95%	6	24	11	7
	93%	5	17	7	6
	90%	4	7	2	5
COMPACTION (100%) : ITS (kPa)					
STABILISED WITH	IN LAB				
	ON SITE	NEAT	NEAT	NEAT	NEAT
TEST TYPE		IND,MOD,CBR	IND,MOD,CBR	IND,MOD,CBR	IND,MOD,CBR
SAMPLED BY		Client	Client	Client	Client
DELIVERED BY		Client	Client	Client	Client
SAMPLING METHOD		TMH 5	TMH 5	TMH 5	TMH 5
ENVIRONMENTAL CONDITION WHEN SAMPLED		Hot	Hot	Hot	Hot
REMARKS					

Remarks :

Data Reported above relates only to the sample tested.
Test reports shall not be reproduced unless in its Full context.

Kind Regards,

Technical Manager
Kogalin Reddy

GEOMAT LABORATORY SERVICES cc

Reg no: 2008/142232/23 - Vat Reg No: 4540251537
Civil Engineering Materials Testing Laboratories

12 Nerina Road, Kyalami
Tel: 011 046 8944, Cell: 073 2099 161
E-mail : midrand@geomatlab.co.za

TEST REPORT - MOISTURE CONTENT

Client Name: Luhlaza Advisory & Consulting (Pty) Ltd Date Analysed : 17-11-2020

Client Address: 41 Verde Avenue
Risidale, Randburg Client No: 2084
Johannesburg, 2194

Project Name: Langaville LC037-20

Attention: Mr N Govender

Sample Number	Hole,KM,Chainage	Layer	Depth		Moisture %
A5700	TP11		0,15-1,0		10,3
A5701	TP13		0,3-1,3		8,0
A5703	TP17		0,0-0,4		5,3
A5705	TP20		0,2-1,7		14,6
A5707	TP27		0,3-1,0		5,7
A5709	TP33		0,5-2,4		13,6
A5710	TP36		0,3-1,2		13,0
A5716	TP1		0,0-0,6		4,2
A5717	TP3		0,5-1,2		7,3
A5719	TP9		0,6-1,9		8,8

Technical Manager
Kogalin Reddy

GEOMAT LABORATORY SERVICES cc

Reg no: 2008/142232/23 - Vat Reg No: 4540251537
Civil Engineering Materials Testing Laboratories

12 Nerina Road, Kyalami
Tel: 011 046 8944, Cell: 073 2099 161
E-mail : midrand@geomatlab.co.za

TEST REPORT - COMPACTABILITY FACTOR

Client Name: Luhlaza Advisory & Consulting (Pty) Ltd

Date Analysed: 17-11-2020

Client Address: 41 Verde Avenue
Risidale, Randburg
Johannesburg, 2194

Client No: 2084

Project Name: Langaville LC037-20

Attention: Mr N Govender

Sample Number	Hole,KM,Chainage	Layer	Depth		Compactability Factor
A5703	TP17		0,0-0,4		0,15
A5706	TP25		2,0-2,5		0,17
A5708	TP30		0,7-2,5		0,13
A5718	TP6		0,0-0,5		0,19

Technical Manager
Kogalin Reddy

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax :
Email : martinus.schwartz@sgs.com

sanas Testing Laboratory T0025

CLIENT :	LUHLAZA ADVISORY & CONSULTING (PTY)LTD	OUR REF.:	PL/41214
ADDRESS :	41 VREDE AVENUE RISIDALE,RANDBURG JOHANNESBURG 2194	YOUR REF.:	
ATTENTION :	Mr N.Govender	DATE :	17.11.2020

PROJECT : Langaville

SGS MATROLAB

a SANAS Accredited Testing Laboratory, No. T0025

Tests marked * "Not SANAS Accredited" in this Report are not included in the SANAS Schedule of Accreditation for the laboratory.

TEST REPORT / RESULTS

Sample/s: Sampled by : Client
Date Received / Sampled : 11.11.2020
Date Tested : 11-17.11.2020

Sampling method : By Client

Section / Position tested identified by : Client - Refer to Test Results

Number of pages in this Report : 3

General : Samples were delivered to Laboratory by client.

Opinions and interpretations expressed herein are outside the Scope of SANAS Accreditation.
Results only have bearing on the samples tested.
This report may only be reproduced in full without any omittance.
Sections may only be reproduced with written approval from SGS MATROLAB

S/Breiting

Technical Signatory : Martinus Schwartz/Lizette Breiting

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax :
Email : martinus.schwartz@sgs.com

sanas Testing Laboratory T0025

TEST RESULTS

LUHLAZA ADVISORY & CONSULTING (PTY)LTD
41 VREDE AVENUE
RISIDALE,RANDBURG
JOHANNESBURG 2194
Attention: Mr N.Govender

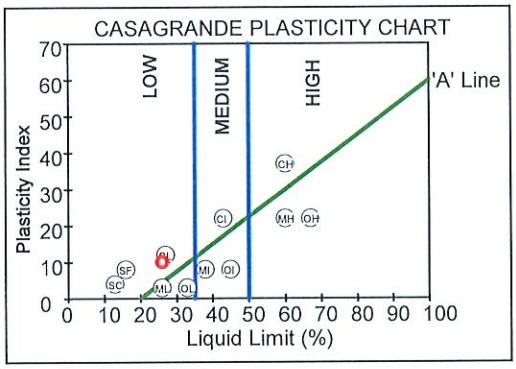
Project : Langaville
Your Ref :
Our Ref : PL/41214
Date Reported : 17.11.2020

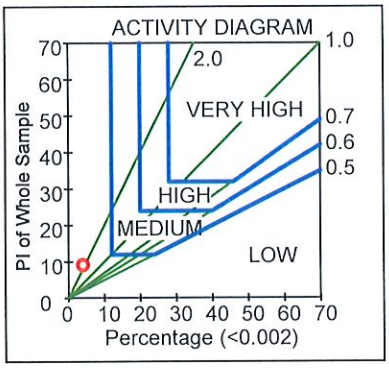
FOUNDATION INDICATOR (ASTM: D422)

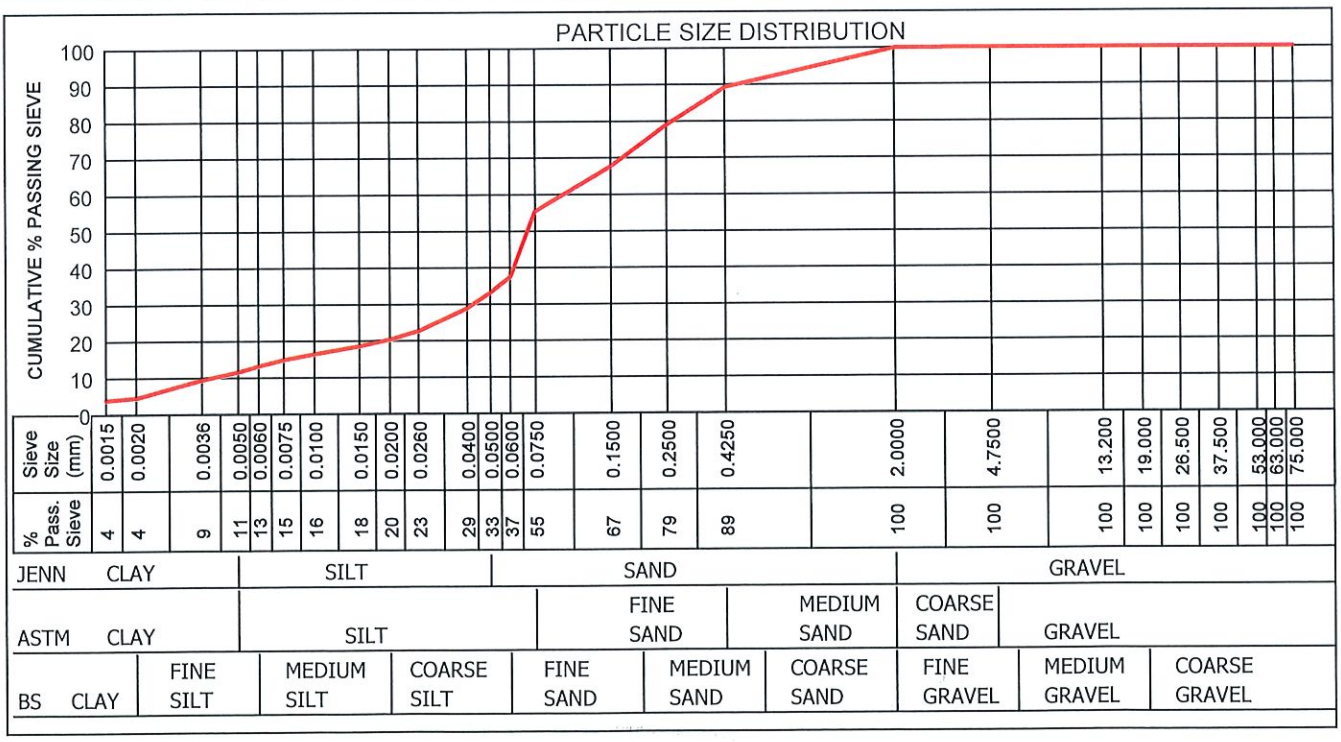
Sample No.	: A20/2954
Hole No.	: TP6
Depth	: 0-500
Liquid Limit (%)	: 26
Plasticity Index	: 10
Linear Shrinkage (%)	: 5.0
PI of Whole Sample	: 9
P.R.A. Classification	: A-4(4)
Unified Soil Classificati	: CL
Activity	: 2.25
Heave Classification	: LOW
Grading Modulus	: 0.56
Percentage (<0.002)	: 4.0
Moisture Content (%)	: 7.5

Material Description : Dark brown SANDY SILT

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	11.4	21.6	66.8	0.2	SILTY SAND
Astm	11.4	43.8	44.8	0.0	SANDY SILT
British Standard	4.4	33.0	62.4	0.2	SILTY SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	4	4	9	11	13	15	16	18	20	23	29	33	37	55	67	79	89	100	100	100	100	100	100	100	100	100

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT			FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL		
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Martinus Schwartz/Lizette Breiting

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax :
Email : martinus.schwartz@sgs.com

sanas Testing Laboratory T0025

TEST RESULTS

LUHLAZA ADVISORY & CONSULTING (PTY)LTD
41 VREDE AVENUE
RISIDALE,RANDBURG
JOHANNESBURG 2194
Attention: Mr N.Govender

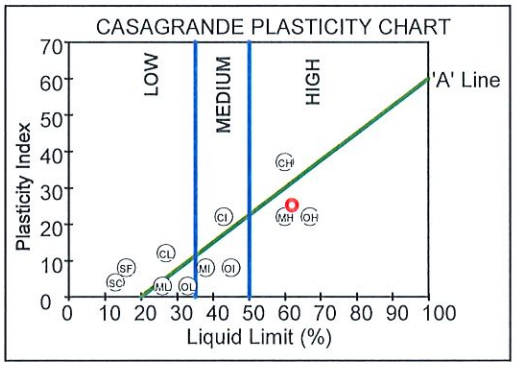
Project : Langaville
Your Ref :
Our Ref : PL/41214
Date Reported : 17.11.2020

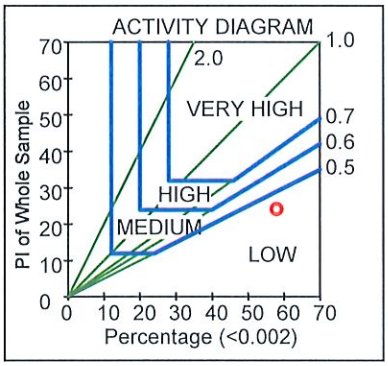
FOUNDATION INDICATOR (ASTM: D422)

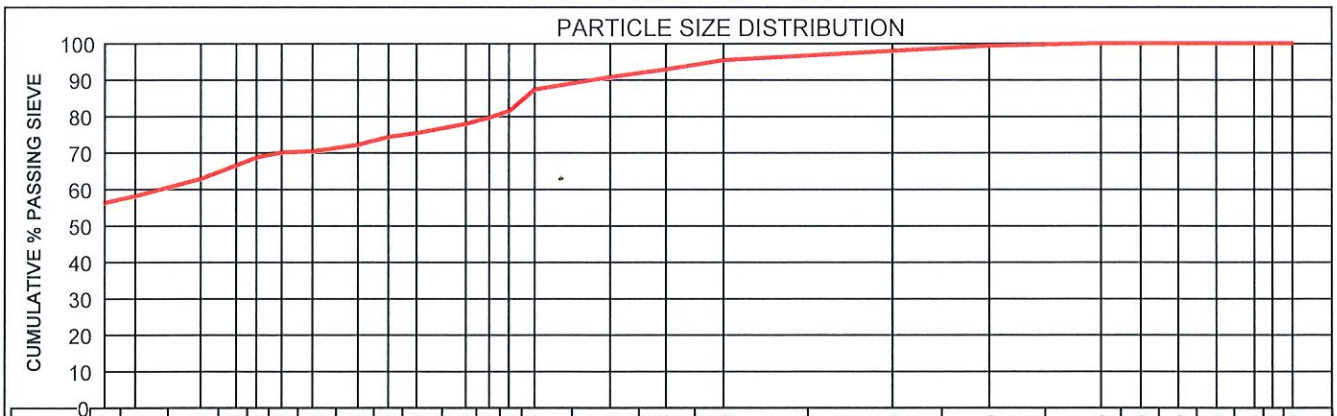
Sample No.	: A20/2955
Hole No.	: TP25
Depth	: 2000-2500
Liquid Limit (%)	: 62
Plasticity Index	: 25
Linear Shrinkage (%)	: 12.0
PI of Whole Sample	: 24
P.R.A. Classification	: A-7-5(18)
Unified Soil Classificati	: OH
Activity	: 0.41
Heave Classification	: LOW
Grading Modulus	: 0.20
Percentage (<0.002)	: 58.0
Moisture Content (%)	: 28.9

Material Description : Dark olive CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	66.6	13.0	18.3	2.1	CLAY
Astm	66.6	20.7	12.0	0.8	CLAY
British Standard	58.0	23.3	16.5	2.1	CLAY







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	56	58	63	67	69	70	70	72	74	75	78	80	81	87	91	93	95	98	99	100	100	100	100	100	100	100

JENN	CLAY		SILT			SAND			GRAVEL	
ASTM	CLAY		SILT			FINE SAND		MEDIUM SAND	COARSE SAND	GRAVEL
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Martinus Schwartz/Lizette Breiting

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/021980/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T0025

256 Brander Street,Jan Niemand Park,Pretoria.
P.O Box 912387,Silverton,0127
Tel. : (012) 800 1299
Fax :
Email : martinus.schwartz@sgs.com

sanas Testing Laboratory T0025

TEST RESULTS

LUHLAZA ADVISORY & CONSULTING (PTY)LTD
41 VREDE AVENUE
RISIDALE,RANDBURG
JOHANNESBURG 2194
Attention: Mr N.Govender

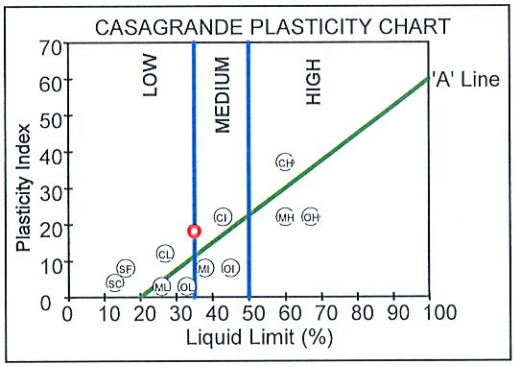
Project : Langaville
Your Ref :
Our Ref : PL/41214
Date Reported : 17.11.2020

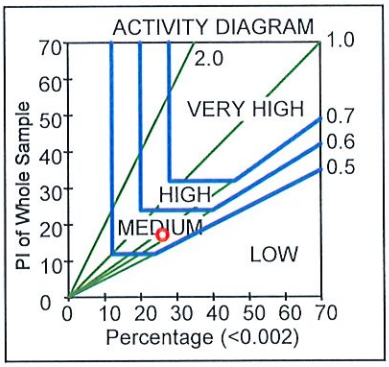
FOUNDATION INDICATOR (ASTM: D422)

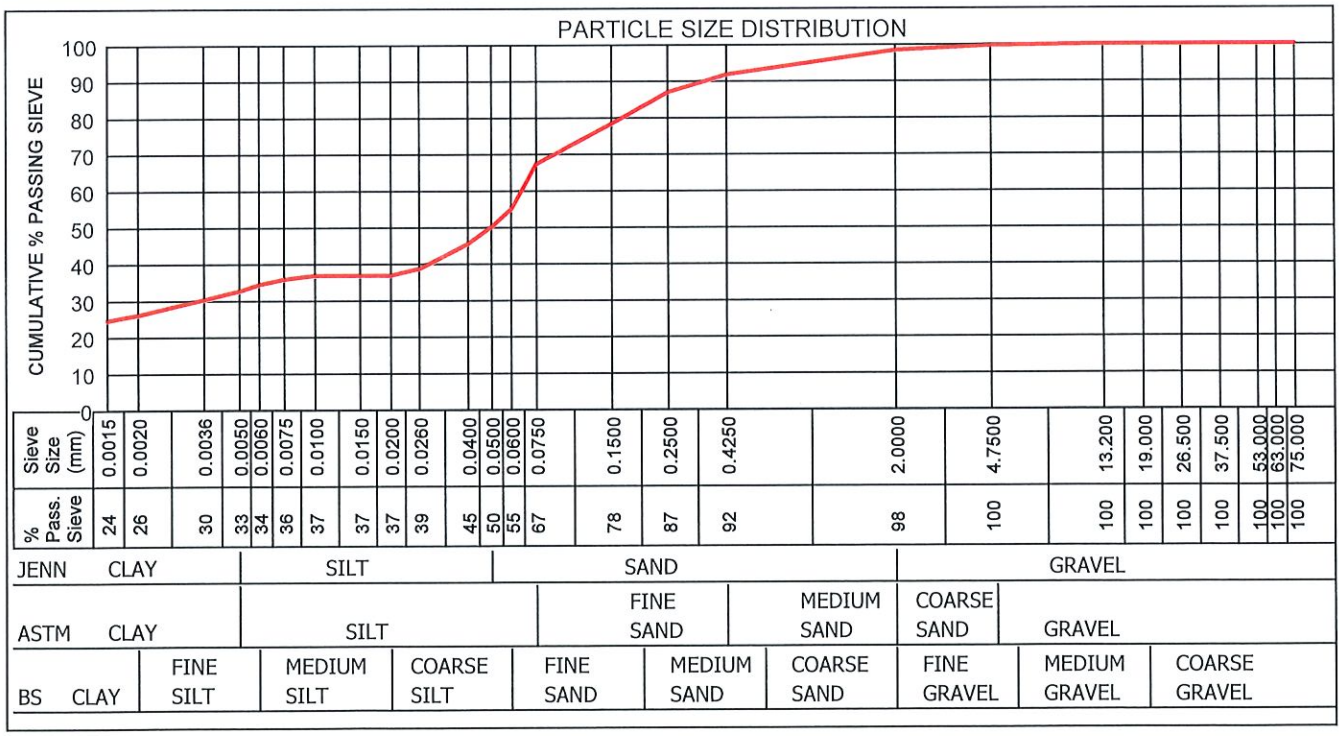
Sample No.	: A20/2956
Hole No.	: TP30
Depth	: 700-2500
Liquid Limit (%)	: 35
Plasticity Index	: 18
Linear Shrinkage (%)	: 9.0
PI of Whole Sample	: 17
P.R.A. Classification	: A-6(10)
Unified Soil Classificati	: CL
Activity	: 0.65
Heave Classification	: MEDIUM
Grading Modulus	: 0.43
Percentage (<0.002)	: 26.0
Moisture Content (%)	: 13.3

Material Description : Dark red SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	32.5	17.5	48.2	1.7	SANDY CLAY
Astm	32.5	34.6	32.4	0.5	SANDY CLAY
British Standard	26.0	28.9	43.3	1.7	CLAYEY SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	24	26	30	33	34	36	37	37	37	39	45	50	55	67	78	87	92	98	100	100	100	100	100	100	100	100

JENN	CLAY		SILT			SAND			GRAVEL	
ASTM	CLAY		SILT			FINE SAND		MEDIUM SAND	COARSE SAND	GRAVEL
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks : Sampled by client.

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Martinus Schwartz/Lizette Breiting

MATROLAB IS NOW PART OF SGS, THE WORLDS'S LEADING INSPECTION, VERFICATION, TESTING AND CERTIFICATION COMPANY.