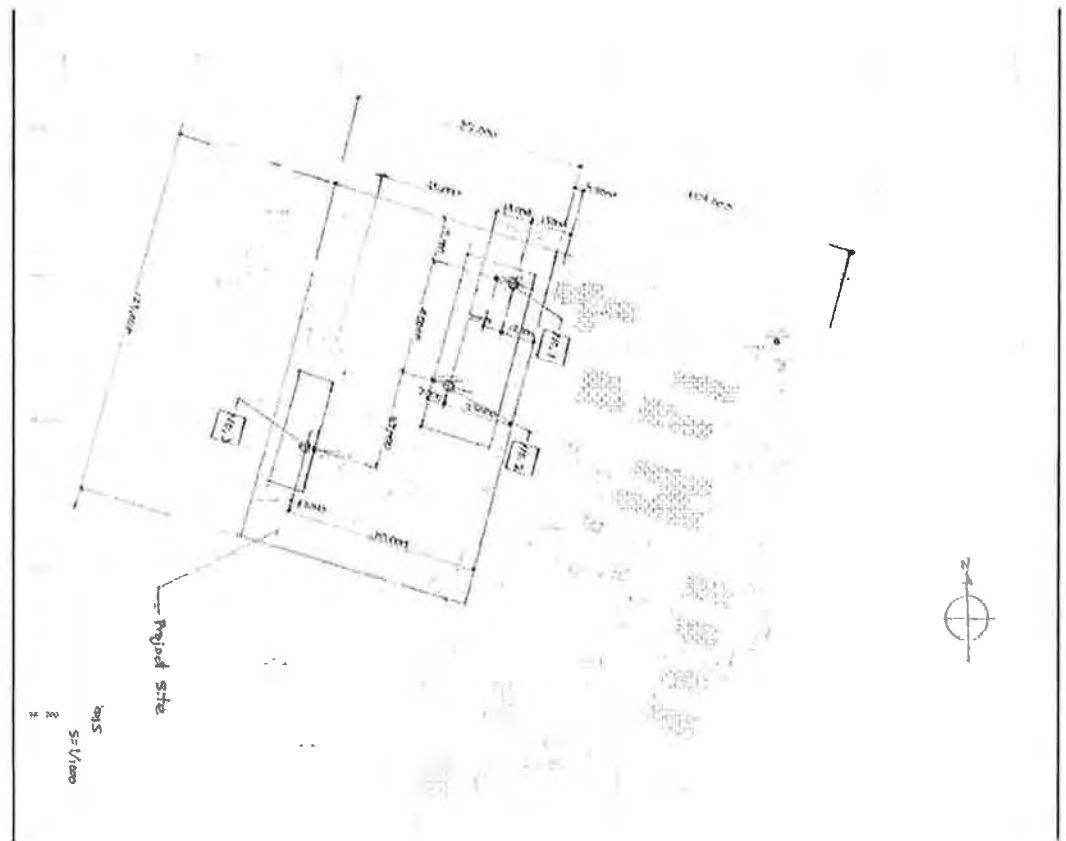


**3.0 SITE LOCATION AND GEOLOGICAL OVERVIEW**

**3.1 Site Location:-**

The Proposed Site for the Nairobi National Vaccine Facilities is located in the Kitengela Health Centre premises in Kitengela. Kitengela is located in Mavoko Municipality of Kajiado District of the Rift Valley Province of Kenya. It is approximately 35km east of Nairobi. It is 1580m above sea level.



**Figure I: Layout of Borehole Locations**

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

### 7.1 Observations

The site investigations have shown that the Kapiti Phonolites dominate this site. Black clay overlays the hard rocks.

### 7.2 Soil Bearing Capacities

The bearing capacities of the rock material and soil layers subjected to SPTs are as shown in the tables below.

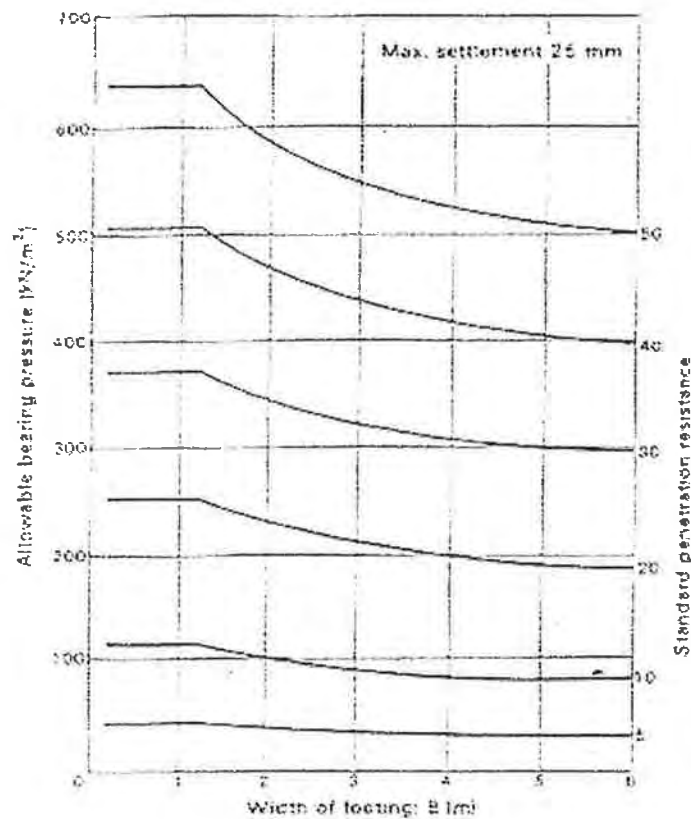


Fig. 8.8 Relationship between standard penetration resistance and allowable bearing pressure. (Reproduced from K. Terzaghi and R. B. Peck (1967) *Soil Mechanics in Engineering Practice*, by permission of John Wiley and Sons, Inc.)

**Figure 1** Relationship between Allowable Bearing Pressure and SPTs.

ITEM	B/H No.	DEPTH(m)	N-VALUES	Safe Bearing Capacity (kN/m <sup>2</sup> )
1	<b>1</b>	2.45	37	375
2		3.55	95	1000
3	<b>2</b>	2.45	58	575

**Table I.** Safe Bearing Capacities from SPTs Test Results in the 3 Boreholes

ITEM	B/H No.	DEPTH (m)	COMPRESSIVE STRENGTH (N/mm <sup>2</sup> )	ALLOWABLE BEARING PRESURE (kN/m <sup>2</sup> )
1	<b>1</b>	2.45	-	375
2		4.00	-	375
3		6.00	-	500
4		7.50	-	1000
5		11.00	96.1	10,000
6		12.95	71.5	10,000
7		13.85	62.4	10,000
8		14.65	111.7	10,000
9		15.35	46.77	9,354
10		16.35	59.8	10,000
11		17.50	101.3	10,000
12		18.75	78.00	10,000
13		19.30	57.17	10,000
1	<b>2</b>	2.45	-	575
2		4.00	-	750
3		5.75	39.00	7,800
4		6.25	36.40	7,280
5		6.95	59.80	10,000
6		8.05	25.98	5,196
7		8.65	20.80	4,160
8		9.55	44.20	8,840
9		9.85	54.60	10,000
10		10.55	41.60	8,320
11		11.50	46.80	9,360
12		12.60	57.20	10,000
14		13.40	33.80	6,760
15		13.85	33.80	6,760
16		14.15	41.60	8,320
17		15.65	75.40	10,000
18		16.35	64.96	10,000
19		16.95	49.37	9,874
20		18.40	75.40	10,000
21		19.45	31.20	6,240
22		20.00	31.20	6,240

ITEM	B/H No.	DEPTH (m)	COMPRESIVE STREGNTH (N/mm <sup>2</sup> )	ALLOWABLE BEARING PRESURE (kN/m <sup>2</sup> )
1	3	2.50	104.00	10,000
2		3.90	124.00	10,000
3		4.40	90.90	10,000
4		5.50	101.30	10,000
5		6.75	70.20	10,000
6		7.25	62.40	10,000
7		7.50	72.80	10,000
8		7.90	62.40	10,000
9		9.00	28.60	5,720
10		9.80	62.40	10,000
11		10.85	67.40	10,000
12		14.75	88.30	10,000
13		15.95	26.00	5,200
14		16.90	52.00	10,000
15		17.40	62.40	10,000
16		18.60	78.00	10,000
17		19.80	75.40	10,000

**Table II:-**Safe Bearing Capacities from Rock Core Compressive Strength Tests

Kitengela Health Centre is supplied with power by Kenya Power and Lighting Company which will be used in the new facility. The town is supplied with water by Mavoko Municipal.

BRITECH LIMITED P O BOX 15130-00509 Lungata, Nairobi, Kenya Mobile: 254 773 210556735 618641 FAX: 880283 E-mail: <a href="mailto:modurtech@suilkenya.com">modurtech@suilkenya.com</a>		Project No. SH/1008		Operator: Lab team		SUMMARY OF SOIL TEST RESULTS		APPENDIX SHEET No. 85167A																							
Project: Vaccine Storage Facilities in Kenya		Checked: EKW		Date: 24/08/2010		COMPACTION		CALIFORNIA BEARING RATIO																							
Client: Yokogawa Architects & Engineers, Inc.		Plasticity Index		Liquid Limit		Plastic Limit		OMC																							
LOCATION		Plasticity Index		Liquid Limit		Plastic Limit		OMC																							
Sample No.	Sample Depth (m)	Natural Moisture Content (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Passing 425 µm (%)	Plasticity Modulus	75 µm	150 µm	212 µm	300 µm	425 µm	600 µm	1.18 mm	2	5	6.35 mm	12.7 mm	19 mm	25 mm	37.5 mm	50 mm	63 mm	75 mm	MOD	G.G	Soaking Period Days	CBR Value	Swell %	REMARKS	
B/H 1	0.0-2.0	26.2	25	31	16	71	2201	60	65	67	68	71	73	79	85	100										30	1.31	4	2	1.1	
B/H 1	2.0-3.20	19.5	27	28	14	66	1848	60	62	63	65	66	68	72	77	100										19	1.39	4	2	1.2	
B/H 2	0.0-2.0	13.0	26	31	16	53	1643	43	47	49	51	53	55	60	68	100										22	1.41	4	2	1.2	
B/H 2	2.0-3.45	19.0	26	30	14	53	1590	44	48	50	51	53	55	63	72	100										14	1.59	4	2	1.1	
Sample Number	Sample Depth (m)	Natural Moisture Content (%)																													
B/H 1	2.45	46.2																													
B/H 1	3.55	14.2																													
B/H 2	2.45	9.2																													
B/H 2	3.45	14.0																													

Site Location: Kitengela

# GIS Geotechnical Investigation Services Ltd

## PRELIMINARY SITE BOREHOLE LOG

LOCATION KIIFENGELA

CARRIED OUT FOR MINISTRY OF HEALTH AND SANITATION  $\approx$  KIIFENGELA DISPENSARY

BOREHOLE No. 1

DIAMETER 150, 101mm

DATES: 30, 31/07/2010

SHEET No. 1




PLANT




LONG YEAR 36

DRAWN BY

M. ANUKU

M	DESCRIPTION	DEPTH m	LEGEND	SAMPLE			REMARKS
				TYPE	NO	DEPTH	
0	BLACK COTTON SOIL	0.00				0.00	
1		0.50			B1		BULK SAMPLE
2	HIGHLY WEATHERED BROWNISH WHITE LIMESTONE					2.00	
					D2	2.45	SPL 7/6/8/10/13 N=37 BLOW
3					B3		BULK SAMPLE
						3.20	
					D4	3.55	SPL 10/20/25/30 N=95 RETUS
4	"						NOTE: HUMID BONDING
							RUN REC WATER% WATER
						4.80	1.50 45 100% BROWN
5							
	"					6.30	1.50 25 " "
6							
	"					7.80	1.50 40 " "
7							
	"					9.30	1.50 35 " "
8							
	"					10.00	
9							
10		10.00					

-  U Piston/U 100 undisturbed sample
-  B Disturbed Bulk Bag Sample
-  D Disturbed Jar Sample

-  S Standard Penetration Test
-  X Vane Test
-  W Water Sample

# GIS Geotechnical Investigation Services Ltd

## PRELIMINARY SITE BOREHOLE LOG

LOCATION **KITENGELA**

CARRIED OUT FOR **MINISTRY OF HEALTH AND SANITATION - KITENGELA DISPENSARY**

BOREHOLE No. **1**

SHEET No. **2**

PLANT

LONG YEAR **86**

DRAWN BY

**M. AYUKU**

DIAMETER **101, 86mm**

DATES: **31/07/2010, 01/08**

M /10	DESCRIPTION	DEPTH 10.00	LEGEND	SAMPLE			REMARKS			
				TYPE	NO	DEPTH				
	SOLID GREYISH		V V				1.50	1.70	"	"
11	PHOLOSITE		V				-10.80			
			V V				1.55	1.55	"	"
12	"		V				-12.35			
			V V				1.50	1.50	"	"
13			V				-13.85			
	"		V V				1.50	1.50	"	"
14			V				-15.35			
			V V				1.50	1.50	"	BROWNISH GREY
15			V				-15.35			
	"		V V				1.45	1.35	"	"
16			V				-16.90			
	"		V V				1.55	1.55	"	"
17			V				-18.45			
	"		V V				1.55	1.55	"	"
18			V				-20.00			
19			V V				1.55	1.55	"	"
20			V				-20.00			

END OF B/H No. 1 AT 20.00M.

- U Piston/U 100 undisturbed sample
- B Disturbed Bulk Bag Sample
- D Disturbed Jar Sample
- S Standard Penetration Test
- X V Vane Test
- W Water Sample

# GIS Geotechnical Investigation Services Ltd

## PRELIMINARY SITE BOREHOLE LOG

LOCATION **KITENGELA**

CARRIED OUT FOR **MINISTRY OF HEALTH AND SANITATION - Kitengela dispensary.**

BOREHOLE No. **- 2**

DIAMETER **150, 101, 86mm.**

DATES: **27, 28/07/2010.**

SHEET No. **1**

PLANT

**Long year 36.**

DRAWN BY

**M. AYUKU.**

M	DESCRIPTION	DEPTH	LEGEND	SAMPLE		REMARKS
				TYPE	NO	
0	Black cotton soil	0.00				
1	SOFT BROWNISH WHITE Limestone (WEATHERED)	0.40		B1		BULK SAMPLE
2	"			D2		SPT 16/15/15/13/5 N=58 blow
3	"			B3		BULK SAMPLE
4	"			D4		SPT 59 at 50 Blows REFUSAL RUN REC
5	GREYISH WEATHERED PHONOOLITE	4.40		B		1.50 50 100% BROWN
6	"					1.20 110 " "
7	"					1.50 110 " BROWNISH GREY
8	"					1.50 110 " "
9	"					
10	"	10.00				

- U Piston/U 100 undisturbed sample
- S Standard Penetration Test
- B Disturbed Bulk Bag Sample
- V Vane Test
- D Disturbed Jar Sample
- W Water Sample



# GIS Geotechnical Investigation Services Ltd

## PRELIMINARY SITE BOREHOLE LOG

LOCATION **KIYENGELA**

CARRIED OUT FOR **MINISTRY OF HEALTH & SANITATION - KIYENGELA DISPENSARY**

BOREHOLE No. **2**

DIAMETER **86mm**

DATES: **28/09/2010**

SHEET No. **2**

PLANT

**Long year 36**

DRAWN BY

**M. AYUKU**

M 10	DESCRIPTION	DEPTH M	LEGEND	SAMPLE			REMARKS		
				TYPE	NO	DEPTH			
10	GREYISH PHONOCLITE	10.00	△				1.50	1.50	" "
11	"		△				11.10		
	<del>water return</del>						11.60		50% "
12	GREYISH PHONOCLITE		△				1.50	1.50	" "
13	"		△				12.60		
			△				1.50	1.50	" "
14	"		△				14.15		
15			△				1.50	1.50	" "
16	"		△				15.65		
			△				1.50	1.50	" "
17	"		△				17.15		
18	"		△				1.50	1.50	" "
			△				18.65		
19	"		△				1.35	1.30	" "

- END OF B/H AT 20.00M.
- U Piston/U 100 undisturbed sample
  - B Disturbed Bulk Bag Sample
  - D Disturbed Jar Sample

- I S Standard Penetration Test
- X V Vane Test
- W Water Sample

# GIS Geotechnical Investigation Services Ltd

## PRELIMINARY SITE BOREHOLE LOG

LOCATION **KITENGELA**

CARRIED OUT FOR **MINISTRY OF HEALTH & SANITATION - KITENGELA DISPENSARY.**

BOREHOLE No. **3**

DIAMETER **150, 101, & 86mm.**

DATES: **22, 23 & 24/04/2010.**

SHEET No. **1**




PLANT




**Long Year 36.**

DRAWN BY

**M. AYUKU.**

M	DESCRIPTION	DEPTH	LEGEND	SAMPLE			REMARKS
				TYPE	NO	DEPTH	
0	Black cotton soil with cables.	0.00	—			0.00	
1		1.20	—			1.20	
2	NESTLED GREY PHONOITE		△				RUN REC water% water cont
						1.30	.95 100% BROWN
3			△			2.50	
	"		△			1.50	1.35 " "
4			△			4.00	
	"		△			1.50	1.20 " "
5			△			5.50	
	"		△			.75	.75 " "
6			△			6.25	
	"		△			.50	.50 " "
7			△			6.75	
	"		△			.75	.70 " "
8			△			7.50	
	"		△			1.50	1.40 " "
9			△			9.00	
	"		△			1.55	1.55 " "
10		10.00	△				

-  U Piston/U 100 undisturbed sample
-  B Disturbed Bulk Bag Sample
-  D Disturbed Jar Sample

-  S Standard Penetration Test
-  V Vane Test
-  W Water Sample

# GIS Geotechnical Investigation Services Ltd

## PRELIMINARY SITE BOREHOLE LOG

LOCATION **KITENGELA**  
 CARRIED OUT FOR **MINISTRY OF HEALTH & SANITATION - KITENGELA DISPENSARY.**  
 BOREHOLE No. **3**

SHEET No. **2**  
 PLANT  
**LONG Year 36**  
 DRAWN BY  
**M. AYUKU**

DIAMETER **86mm**  
 DATES: **24, 26/07/2010**

DEPTH (m)	DESCRIPTION	DEPTH (m)	LEGEND	SAMPLE			REMARKS
				TYPE	NO	DEPTH	
10	GREY RHONDLITE	10.00				-10.35	GREY
11						110 110	" "
12	"					-11.65	
						70 70	" "
13						-12.35	
						150 110	" "
14	"					-13.85	
						150 125	50% "
15						-15.35	
16	"					155 155	" "
17						-16.90	
						150 150	" "
18	"					-18.40	
19						160 165	" "
20		20.00				20.00	

- END OF B/H AT 20.00m.
- U Piston/U 100 undisturbed sample
  - B Disturbed Bulk Bag Sample
  - D Disturbed Jar Sample

- S Standard Penetration Test
- V Vane Test
- W Water Sample

### 3.0 SITE LOCATION AND GEOLOGICAL OVERVIEW

#### 3.1 Site Location

The Proposed Site for the construction of Vaccine Storage Facilities is in Kakamega Town on the compound of Kakamega General Hospital. Kakamega Town doubles as the Headquarters of Western Province, Kakamega District of Kenya. It is about 30km north of the equator and 52km north of Kisumu at 1500 metres above sea level.

Annex-1-3 Location Map for Kakamega

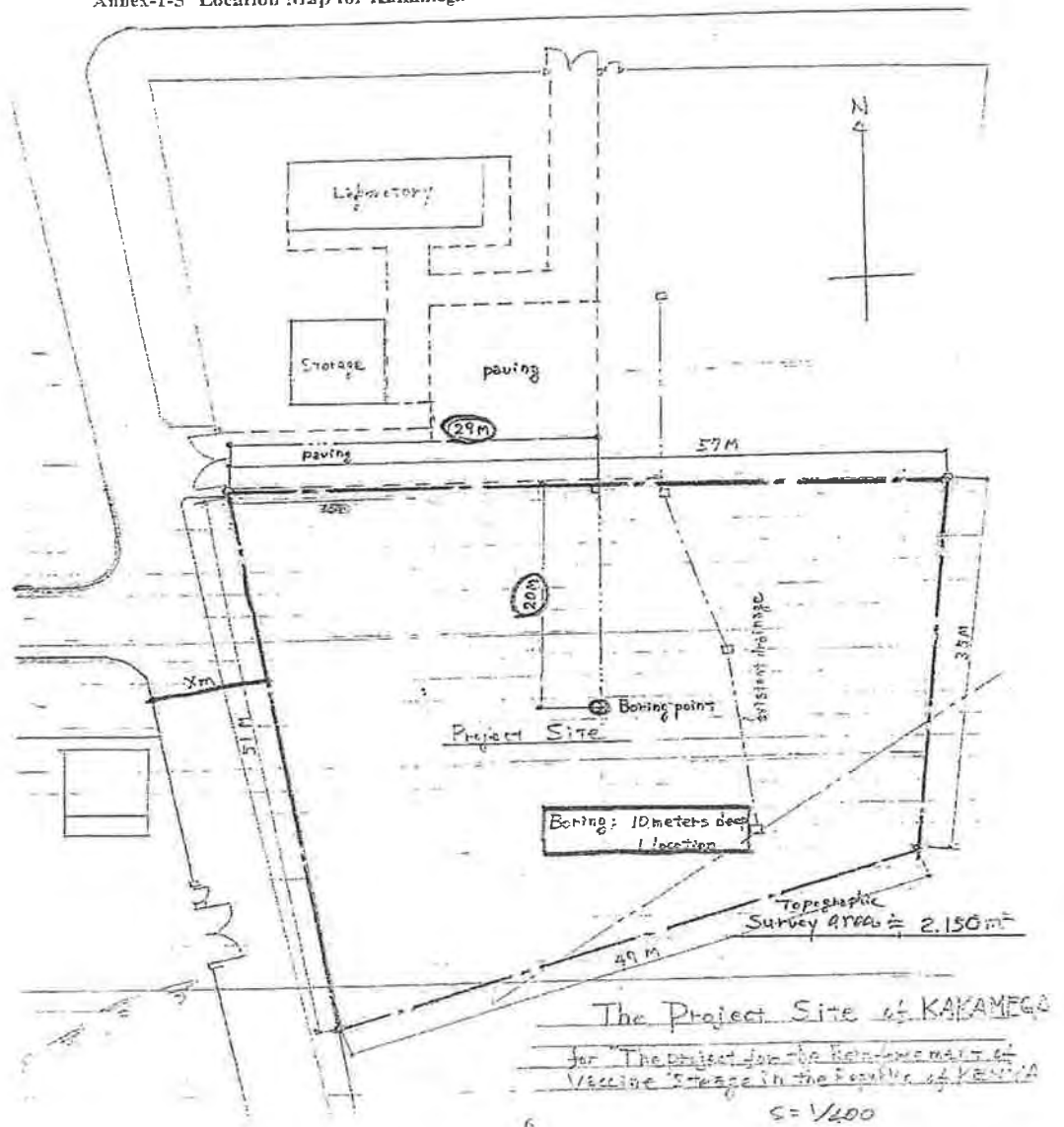


Figure 1: Project Site in Kakamega

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

### 7.1 Observations

The site investigations have shown that clay soils dominate the site. Kakamega Hospital is supplied with power by Kenya Power and Lighting Company which will be used in the new facility. The town has a reliable water supply from the local statutory authorities.

### 7.2 Soil Bearing Capacities

The following allowable bearing capacities can be used by the Structural Engineer: -

ITEM	DEPTH (m)	'N' Values from S.P.T (m)	Allowable Soil Bearing Pressure(kN/m <sup>2</sup> )
1	1.95	13	70
2	2.95	6	70
3	3.95	16	150
4	4.95	14	140
5	5.95	18	70
6	6.95	7	70
7	7.95	17	155
8	8.95	10	105
9	9.95	22	235
10	10.95	22	235

BRITTECH LIMITED P.O. BOX 15130-00509 Langata, Nairobi, Kenya TEL: 80087169049 FAX: 800293 E-mail: <a href="mailto:suitech@wvfkemri.com">suitech@wvfkemri.com</a>		Project No. SH/1008		Operator Lab team		SUMMARY OF SOIL TEST RESULTS		APPENDIX SHEET No. 81677A																												
Project Vaccine Storage Facilities in Kenya		Checked FKW		Date 8/1/2010																																
Client Yokogawa Architects & Engineers, Inc.																																				
ATTENBERG PARAMETERS																																				
Sample No.	Sample Depth (m)	Natural Moisture Content (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Passing 425 µm (%)	Plasticity Modulus (%)	75 µm (%)	150 µm (%)	212 µm (%)	300 µm (%)	425 µm (%)	600 µm (%)	1.18 mm (%)	2 mm (%)	6.35 mm (%)	9.5 mm (%)	12.7 mm (%)	19 mm (%)	25 mm (%)	37.5 mm (%)	50 mm (%)	63 mm (%)	75 mm (%)	OMC (%)	IMDD (%)	IS G (%)	Soaking Period Days	CBR Value (%)	Swell (%)	REMARKS					
SA-1	3-6m	35	31	29	13	93	2697	88	89	90	91	93	95	96	97	100									30	1.4	2.8	4	6	0.9	Red CLAY					
SA-2	6-10m	42	32	28	12	97	2716	92	94	95	96	97	98	99	100										26	1.5	2.7	4	6	0.9	Red CLAY					
D3	1.50																																			
D4	1.95																																			
D7	2.50																																			
D8	2.85																																			
D11	3.50																																			
D12	3.95																																			
D15	4.50																																			
Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	Sample Number	Sample Depth (m)	Natural Moisture Content (%)	
D31	8.50	31.0	D31	8.50	31.9	D16	4.85	31.9	D31	8.50	31.0	D16	4.85	31.9	D31	8.50	31.0	D16	4.85	31.9	D31	8.50	31.0	D16	4.85	31.9	D31	8.50	31.0	D16	4.85	31.9	D31	8.50	31.0	
D32	8.95	24.2	D19	5.50	11.4	D19	5.50	11.4	D32	8.95	24.2	D19	5.50	11.4	D32	8.95	24.2	D19	5.50	11.4	D32	8.95	24.2	D19	5.50	11.4	D32	8.95	24.2	D19	5.50	11.4	D32	8.95	24.2	
D35	9.50	40.4	D20	5.85	28.6	D20	5.85	28.6	D35	9.50	40.4	D20	5.85	28.6	D35	9.50	40.4	D20	5.85	28.6	D35	9.50	40.4	D20	5.85	28.6	D35	9.50	40.4	D20	5.85	28.6	D35	9.50	40.4	
D36	9.95	39.4	D23	6.50	29.0	D23	6.50	29.0	D36	9.95	39.4	D23	6.50	29.0	D36	9.95	39.4	D23	6.50	29.0	D36	9.95	39.4	D23	6.50	29.0	D36	9.95	39.4	D23	6.50	29.0	D36	9.95	39.4	
D39	10.50	42.5	D24	6.85	31.1	D24	6.85	31.1	D39	10.50	42.5	D24	6.85	31.1	D39	10.50	42.5	D24	6.85	31.1	D39	10.50	42.5	D24	6.85	31.1	D39	10.50	42.5	D24	6.85	31.1	D39	10.50	42.5	
D40	10.95	33.6	D27	7.50	28.7	D27	7.50	28.7	D40	10.95	33.6	D27	7.50	28.7	D40	10.95	33.6	D27	7.50	28.7	D40	10.95	33.6	D27	7.50	28.7	D40	10.95	33.6	D27	7.50	28.7	D40	10.95	33.6	
			D28	7.85	29.4	D28	7.85	29.4				D28	7.85	29.4				D28	7.85	29.4				D28	7.85	29.4				D28	7.85	29.4				

Site Location: Kakamega

# DRILLING & PROSPECTING INTERNATIONAL LTD



## PRELIMINARY SITE BOREHOLE LOG

LOCATION VACCINE STORAGE LAKAMEGA

SHEET No. 1

CARRIED OUT FOR:

BRITECH

PLANT:

BOREHOLE NO: 1

DIAMETER: 150mm

D 90 R

DATES: 18/03/2010

DRAWN BY:

J. NDAVI

DEPTH	DESCRIPTION	LEGEND	SAMPLE			REMARKS
			TYPE	No	DEPTH	
0						
0.50				B1	1.00	Bag sample
1m	REDDISH CLAY			U2	1.45	u/100 - 11 Blows
				D3	1.50	U-shoe
				D4	1.95	S.P.T 4/3/3/4/3 H=13
2m	"			B5	2.00	Bag sample
				U6	2.45	u/100 - 34 Blows
				D7	2.50	U-shoe
				D8	2.95	S.P.T 2/2/2/1/1 H=6
3m	"			B9	3.00	Bag sample
				U10	3.45	u/100 - 21 Blows
				D11	3.50	U-shoe
				D12	3.95	S.P.T 5/4/4/3/5 H=16
4m	"			B13	4.00	Bag sample
				U14	4.45	u/100 - 22 Blows
				D15	4.50	U-shoe
				D16	4.95	S.P.T 4/3/3/3/5 H=14
5m	"			B17	5.00	Bag sample
				U18	5.45	u/100 - 32 Blows
				D19	5.50	U-shoe
				D20	5.95	S.P.T 4/5/5/3/5 H=18
6m	"			B21	6.00	Bag sample
				U22	6.45	u/100 - 23 Blows
				D23	6.50	U-shoe
				D24	6.95	S.P.T 2/1/2/2/2 H=7
7m	"			B25	7.00	Bag sample
				U26	7.45	u/100 - 34 Blows
				D27	7.50	U-shoe
				D28	7.95	S.P.T 5/4/4/5/4 H=17
8m	"			B29	8.00	Bag sample
				U30	8.45	u/100 - 26 Blows
				D31	8.50	U-shoe
				D32	8.95	S.P.T 2/3/2/2/3 H=10
9m	RED CLAY			B33	9.00	Bag sample
				U34	9.45	u/100 - 30 Blows
				D35	9.50	U-shoe
				D36	9.95	S.P.T 6/5/6/6/5 H=22
10m	YELLOWISH CLAY			B37		

- | U Piston/U 100 undisturbed sample
- ↑ B Disturbed Bulk Bag Sample
- € D Disturbed Jar sample
- | S Standard Penetration Test
- x V Vane Test
- W Water sample

M. C. SCARPELLINI

PRELIMINARY SITE BOREHOLE LOG

LOCATION VACCINE STORAGE KAKAMEGA

SHEET No. 2

CARRIED OUT FOR: BRITECH

PLANT:

BOREHOLE NO: L

DIAMETER: 150mm

D 90 R

DATES: 18/3/2010

DRAWN BY: J. NDAVI

DESCRIPTION	DEPTH	LEGEND	SAMPLE			REMARKS
			TYPE	No	DEPTH	
YELLOWISH CLAY			U	38	10.45	U/100 - 40 Blows
"			D	39	10.50	U-Shoe
"			D	40	10.95	S.P.T 6/4/6/6/6/ H=22

M.C. SCARPELLINI

- | U Piston/U 100 undisturbed sample
- ↑ B Disturbed Bulk Bag Sample
- ε D Disturbed Jar sample

- | S Standard Penetration Test
- X V Vane Test
- W Water sample



### 3.0 SITE LOCATION AND GEOLOGICAL OVERVIEW

#### 3.1 Site Location

The Proposed Site for the construction of Vaccine Storage Facilities is within the premises of Meru General Hospital, in Meru Town. Meru Town is well known for the big surrounding farms of miraa (khat) and Meru its proximity to National Park.

Meru Town is the headquarters of Meru Central District in the Eastern Province of Kenya. It is located on the northeast slopes of Mt. Kenya and five miles north of the equator. It is 1600 metres above sea level.

Annex-1-2 Location Map for Meru

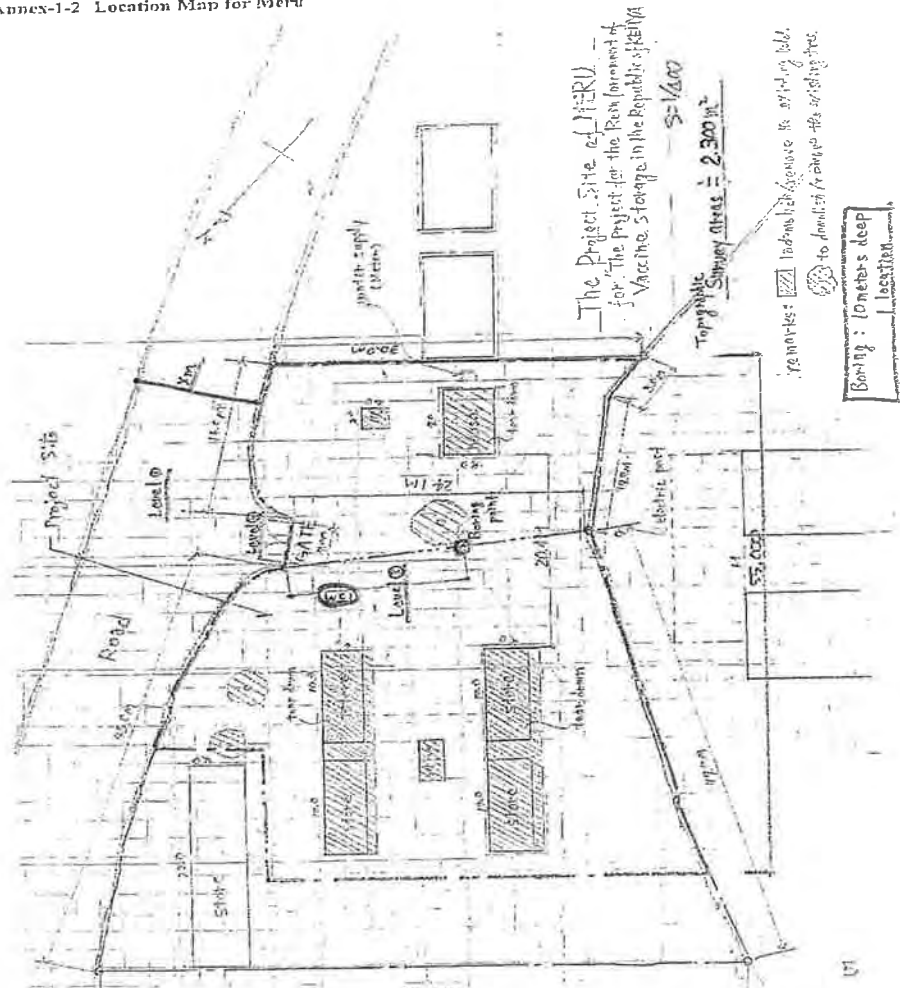


Figure 1: Proposed Site in Meru

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

### 7.1 Observations

The site is dominated by fine grained clays. Meru General Hospital receives electricity from the Kenya Power and Lighting Company and has a reliable water supply from the Municipal Council.

### 7.2 Soil Bearing Capacities

The following allowable bearing capacities can be used by the Structural Engineer: -

ITEM	DEPTH (m)	'N' Values from S.P.T	Allowable Soil Bearing Pressure(kN/m <sup>2</sup> )
1	1.95	11	100
2	2.95	14	110
3	3.95	17	155
4	4.95	18	190
5	5.95	21	155
6	6.95	17	155
7	7.95	21	190
8	8.95	20	140
9	9.95	14	140
10	10.95	24	250



PRELIMINARY SITE BOREHOLE LOG

LOCATION VACCINE STORAGE XFERU

SHEET No. 1

CARRIED OUT FOR: BRITECH

PLANT:

BOREHOLE NO: 1

DIAMETER: 150MM

D 90K

DATES: 22/3/2010

DRAWN BY:

J. N. DAVI

DEPTH	DESCRIPTION	LEGEND	SAMPLE			REMARKS
			TYPE	No	DEPTH	
0.00				B 1	1.00	Bag sample
1M	REDISH CLAY		U 2		1.45	U/100 -
			D 3		1.50	U-Shoe
			D 4		1.95	S.P.T 3/2/3/3/3 H=11
2M	REDISH CLAY		B 5		2.00	Bag sample
			U 6		2.45	U/100 - 18 Blows
			D 7		2.50	U-Shoe
			D 8		2.95	S.P.T 4/4/4/3/3 H=14
3M	REDISH CLAY		B 9		3.00	Bag sample
			U 10		3.45	U/100 - 20 Blows
			D 11		3.50	U-Shoe
			D 12		3.95	S.P.T 5/4/5/3/3 H=17
4M	REDISH CLAY		B 13		4.00	Bag sample
			U 14		4.45	U/100 - 21 Blows
			D 15		4.50	U-Shoe
			D 16		4.95	S.P.T 4/6/5/4/3 H=18
5M	REDISH CLAY		B 17		5.00	Bag sample
			U 18		5.45	U/100 - 18 Blows
			D 19		5.50	U-Shoe
			D 20		5.95	S.P.T 6/6/6/5/4 H=21
6M	REDISH CLAY		B 21		6.00	Bag sample
			U 22		6.45	U/100 - 19 Blows
			D 23		6.50	U-Shoe
			D 24		6.95	S.P.T 5/5/4/5/3 H=17
7M	REDISH CLAY		B 25		7.00	Bag sample
			U 26		7.45	U/100 - 21 Blows
			D 27		7.50	U-Shoe
			D 28		7.95	S.P.T 7/6/5/6/4 H=21
8M	REDISH CLAY	8.00	B 29		8.00	Bag sample
			U 30		8.45	U/100 - 24 Blows
			D 31		8.50	U-Shoe
			D 32		8.95	S.P.T 5/6/6/5/3 H=20
9M	GREYISH CLAY		B 33		9.00	Bag sample
			U 34		9.45	U/100 - 25 Blows
			D 35		9.50	U-Shoe
			D 36		9.95	S.P.T 3/4/2/3/5 H=14
10M	GREYISH CLAY	10.00	B 37		10.00	Bag sample

U Piston/U 100 undisturbed sample  
 † B Disturbed Bulk Bag Sample  
 € D Disturbed Jar sample

S Standard Penetration Test  
 x V Vane Test  
 E W Water sample

PRELIMINARY SITE BOREHOLE LOG

LOCATION VACCINE STORAGE MERU

SHEET No. 2

CARRIED OUT FOR: BLITECH

PLANT:

BOREHOLE NO: L

DIAMETER: 150mm

D 90 R

DATES:  
22/3/2010

DRAWN BY:

J. NDAVI

10M

DESCRIPTION	DEPTH	LEGEND	SAMPLE			REMARKS
			TYPE	No	DEPTH	
GREYISH CLAY			█	U 38	10.45	U/100 - 24 Blows
			↑	O 39	10.50	U-shoe
			↑	O 40	10.95	S.P.T 3/3/5/5 H=16
						END OF B/HOLE NO: L AT 10.00M

M.C. SCARPELLINI

- | U Piston/U 100 undisturbed sample
- ↑ B Disturbed Bulk Bag Sample
- ⊖ D Disturbed Jar sample
- | S Standard Penetration Test
- x V Vane Test
- W Water sample

### 3.0 SITE LOCATION AND GEOLOGICAL OVERVIEW

#### 2.1 Site Location

The Proposed Site for the construction of Vaccine Storage Facilities is within the Public Health Offices compound which is 1.5km from the Garissa General Hospital. The Ministry offices are inside Garissa Town while the General Hospital is on the outskirts, along the Garissa – Wajir Road, 1.5km from the town centre.

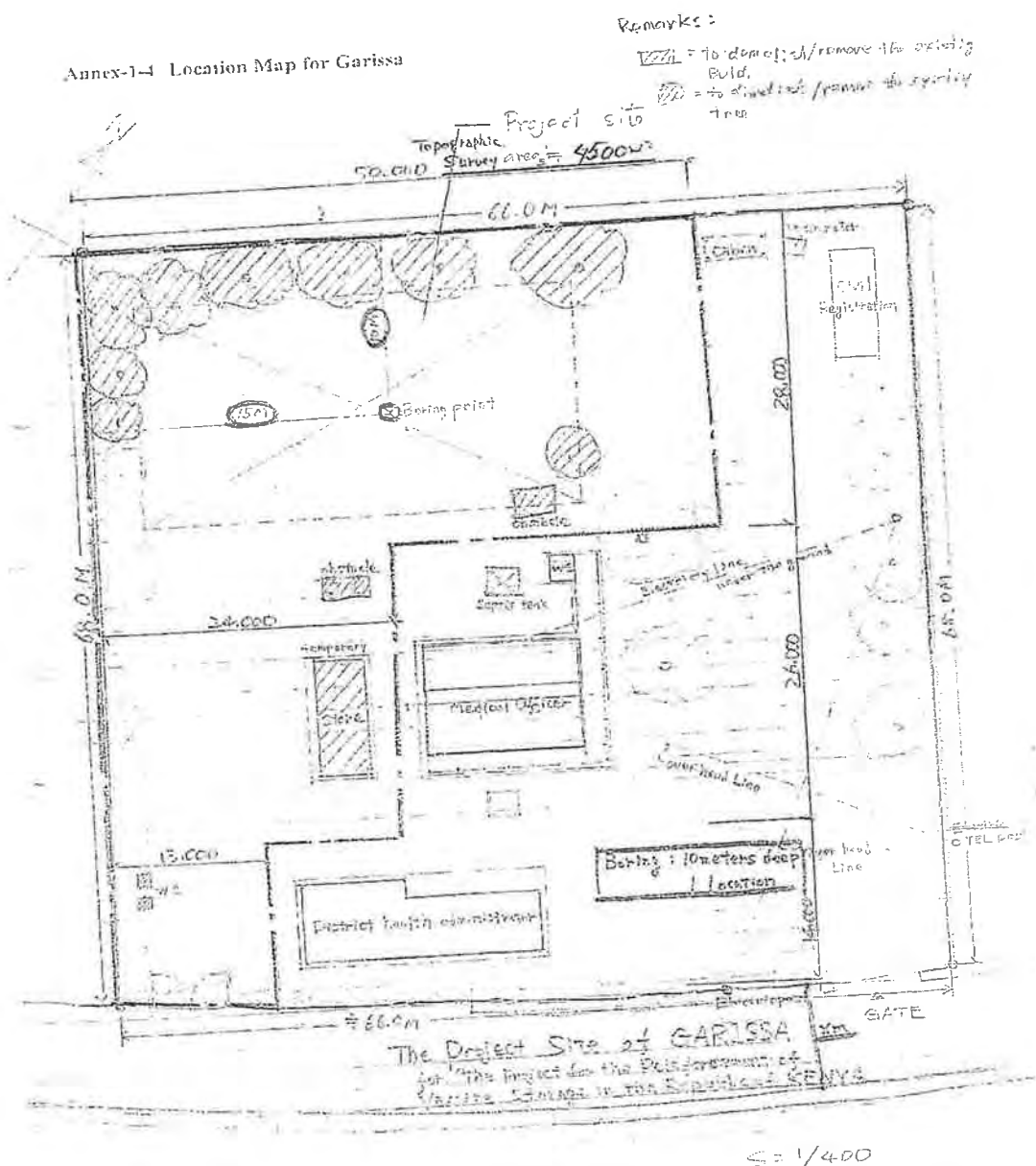


Figure 1: Proposed Site in Garissa

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

### 7.1 Observations

The site is dominated by silty and sandy clays with cobbles at 7 and 8 metres below ground level. Garissa Town is supplied with electricity from the Kenya Power and Lighting Company and has a reliable water supply from the Municipal Council, pumped from the adjacent Tana River.

### 7.2 Soil Bearing Capacities

The following allowable bearing capacities can be used by the Structural Engineer:

ITEM	DEPTH	'N' Values from S.P.T	Allowable Soil Bearing Pressure(kN/m <sup>2</sup> )
1	1.45	19	215
2	2.45	16	180
3	3.45	18	205
4	4.45	20	213
5	5.45	23	263
6	6.45	19	215
7	7.45	21	250
8	8.45	20	213
9	9.45	26	315
10	10.45	35	450

*Table 2.* SPT Tests in the Borehole

It is important for the foundations engineer to put in to consideration the ground water flow. Although due to the sandy nature of the soils it is unlikely to have a softening or swelling /heaving problem, considerable upthrust is expected.

BRITECH LIMITED P.O BOX 15130-00509 Langata, Nairobi, Kenya TEL: 890951/890449 FAX: 890293 E-mail: <a href="mailto:britech@britechkenya.com">britech@britechkenya.com</a>		Project No. SH/1008		Operator Lab team		SUMMARY OF SOIL TEST RESULTS		APPENDIX SHEET No. 83385A																															
Project Vaccine Storage Facilities In Kenya		Checked FKW		Date 2/6/2010		Operator Lab team		APPENDIX SHEET No. 83385A																															
Client Yokosawa Architects & Engineers, Inc.		Project Vaccine Storage Facilities In Kenya		Checked FKW		Date 2/6/2010		APPENDIX SHEET No. 83385A																															
LOCATION																																							
Sample No.	Sample Depth (m)	Natural Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index	Linear Shrinkage (%)	Passing 425 µm (%)	Plasticity Modulus	Passing 75 µm (%)	150 µm (%)	212 µm (%)	300 µm (%)	425 µm (%)	600 µm (%)	1.18 mm (%)	2 mm (%)	5 mm (%)	6.35 mm (%)	9.5 mm (%)	12.7 mm (%)	19 mm (%)	25 mm (%)	37.5 mm (%)	50 mm (%)	63 mm (%)	75 mm (%)	OMC (%)	MDD (kg/m <sup>3</sup> )	IS G	Soaking Period (Days)	CBR Value (%)	Swell (%)	REMARKS						
ATTERBERG PARAMETERS										GRADING										COMPACTION										CALIFORNIA BEARING RATIO									
GA-1	2-6m	11.7	17	42	25	11	61	2697	88	89	90	91	93	95	96	97	100										14	1.79	2.68	4	6	0.9	SANDY CLAY						
GA-2	7-10m	30.0	20	53	33	15	75	2475	45	55	60	69	75	83	89	94	100										17	1.71	2.72	4	7	0.9	SANDY CLAY						
Sample Number		Sample Depth (m)		Natural Moisture Content (%)		Sample Number		Sample Depth (m)		Natural Moisture Content (%)		Sample Number		Sample Depth (m)		Natural Moisture Content (%)		Sample Number		Sample Depth (m)		Natural Moisture Content (%)		Sample Number		Sample Depth (m)		Natural Moisture Content (%)		Sample Number		Sample Depth (m)		Natural Moisture Content (%)					
D2	1.45				12.6		D16	8.45																															
D4	2.45				13.5		D18	9.45																															
D6	3.45				15.7		D20	10.45																															
D8	4.45				13.8																																		
D10	5.45				11.4																																		
D12	6.45				24.5																																		
D14	7.45				12.1																																		

Site Location: Garissa



# DRILLING & PROSPECTING INTERNATIONAL LTD



## PRELIMINARY SITE BOREHOLE LOG

LOCATION VACCINE STORAGE - GARISSA

SHEET No. 1

CARRIED OUT FOR: BRITECH

PLANT: D90 E

BOREHOLE NO: 1

DIAMETER: 150MM

DATES: 26/02/10

DRAWN BY:

J. NDAVI

DEPTH (M)	DESCRIPTION	DEPTH (M)	LEGEND	SAMPLE			REMARKS
				TYPE	No	DEPTH (M)	
0.00	CLAY	0.00			B1	0.00	BAG SAMPLE
1.00	"				D2	1.00	
						1.45	S.P.T 5/6/3/5/5 N=19
2.00	"				B2	2.00	BAG SAMPLE
					D4	2.45	S.P.T 5/3/3/5/5 N=16
3.00	"				B5	3.00	BAG SAMPLE
					D6	3.45	S.P.T 6/4/4/5/5 N=18
4.00	"				B7	4.00	BAG SAMPLE
		4.00			D8	4.45	S.P.T 6/4/6/5/5 N=20
5.00	SANDY CLAY				B9	5.00	BAG SAMPLE
	"				D10	5.45	S.P.T 6/6/6/5/6 N=22
6.00	"				B11	6.00	BAG SAMPLE
	"				D12	6.45	S.P.T 6/6/4/4/5 N=19
7.00	SANDY CLAY WITH COBBLES	6.80			B13	7.00	BAG SAMPLE
	"				D14	7.45	S.P.T 7/6/5/5/5 N=21
8.00	"				B15	8.00	BAG SAMPLE
	"				D16	8.45	S.P.T 5/5/6/4/5 N=20
9.00	"				B17	9.00	BAG SAMPLE
	REDDISH CLAY	9.00			D18	9.45	S.P.T 6/6/4/8/8 N=26
10.00	"				B19	10.00	BAG SAMPLE

U Piston/U 100 undisturbed sample  
 E Disturbed Bulk Bag Sample

S Standard Penetration Test  
 V Vane Test

# DRILLING & PROSPECTING INTERNATIONAL LTD



## PRELIMINARY SITE BOREHOLE LOG

SHEET No. 1 (CONTINUED)

LOCATION VACCINE STORAGE - GARISSA

PLANT: D 902

CARRIED OUT FOR: BRITECH

DIAMETER: 150MM

BOREHOLE NO: 1

DATES: 26/03/10

DRAWN BY:

J. NDAVI

10M

DESCRIPTION	DEPTH	LEGEND	SAMPLE			REMARKS
			TYPE	No	DEPTH	
REDDISH CLAY					10.00	
"				D20	10.45	S.P.T 16/9/8/9/9 N=25
						END OF B/HOLE 1 AT 10.00M
						NOTE: WATER STRUCK AT 10.00M

U Piston/U 100 undisturbed sample  
E Disturbed Bulk Bag Sample

S Standard Penetration Test  
x V Vane Test