

# PHASE 2 GEOTECHNICAL REPORT

## LOXTON HOUSING PROJECT, UBUNTU MUNICIPALITY, NORTHERN CAPE

28 August 2013

Rev 0

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**Prepared for:**

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Ref No: 2013\Municipality Ubuntu\Loxton\Phase2\Phase 2 Geotech Report 28.8.2013 Rev 0

## Quality Control

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<b>0</b>	<b>28.8.2013</b>	<b>I.Paton PrSciNat</b>	<b>D. McDonald Reg Eng Tech</b>

Outeniqua Geotechnical Services is an independent consulting firm with no financial interest in the project, other than remuneration for work performed in the compilation of this report.

## Table of Contents

<b>1. Introduction and terms of reference</b> .....	4
<b>2. The investigation</b> .....	4
<b>3. Soil classification of individual units</b> .....	4
<b>4. Recommendations</b> .....	4

**Figure 1 – Locality map**

**Figure 2 – Aerial photo of site**

**Figure 3 – Site layout plan**

**Appendix 1 – Site classifications**

**Appendix 2 – Soil profiles & DCP tests**

## **1. Introduction and terms of reference**

Outeniqua Geotechnical Services was appointed by Ubuntu Municipality to carry out a Phase 2 geotechnical site investigation of a new housing project in Loxton in the Northern Cape (see **Figures 1 & 2**) and provide a report for the purposes of enrollment of the new houses with the NHBRC and Department of Housing. The investigation is carried out with reference to the National Housing Department's GFSH-2 document. A Phase 1 geotechnical report for the site was done by this company in 2011 and the Phase 2 report should be read in conjunction with the Phase 1 report.

## **2. The investigation**

The phase 2 investigation typically involves an inspection of the site during the construction of the bulk engineering services in order to classify soil types on individual erven. This facilitates the design of suitable foundations for the houses to be built on these erven once the services are complete. The Phase 2 investigation was commissioned as the construction of services were in progress and some trenches were open for inspection and soil profiles were recorded in the trenches at several positions (see **Figure 3**). The soil types on the site consist of a mixture of fine to coarse grained granular alluvial soils (silt or gravel) with low plasticity. The soil consistency improves with increasing depth below natural ground level and there is no bedrock exposed in the trenches. Minor localised surficial fill material was noted in some places around the site. The fill consists of a mixture of different soil types and minor rubble. Observations of the natural *in situ* soil types exposed in the trenches generally concur with the findings of the Phase 1 geotechnical report. It appears that most of the uncontrolled fill has been cleared or levelled.

## **3. Soil classification of individual erven**

All soils are potentially compressible and/or collapsible with a total expected movement of 5-10mm (C1 category) and will require good compaction of trenches to reduce settlement. The potential expansiveness is low and a conservative classification of H is given in this regard. The revised soil classifications for each erf are provided in **Appendix 1** (refer to **Figure 3** for erf plan).

## **4. Recommendations**

The recommended foundation systems are lightly reinforced strip foundations or light RC rafts to cater for some variation in soil density and settlement. There is no need for further site detailed site investigations but it is recommended that the engineer inspect trenches before casting foundations. Any uncontrolled fill containing rubble and/or rubbish encountered in excavations for foundations must be removed under the footprint of structures. Compaction should be carried out to at least 93% of the Mod AASHTO density.



CLIENT:  
Ubuntu Municipality

PROJECT:  
Loxton Housing Project,  
Northern Cape

TITLE:  
Fig 1: Locality map

DRAWN BY:  
IP

DATE:  
22.8.2013

SCALE:





CLIENT:  
Ubuntu Municipality

PROJECT:  
Loxton Housing Project,  
Northern Cape

TITLE:  
Fig 2: Aerial photo of site

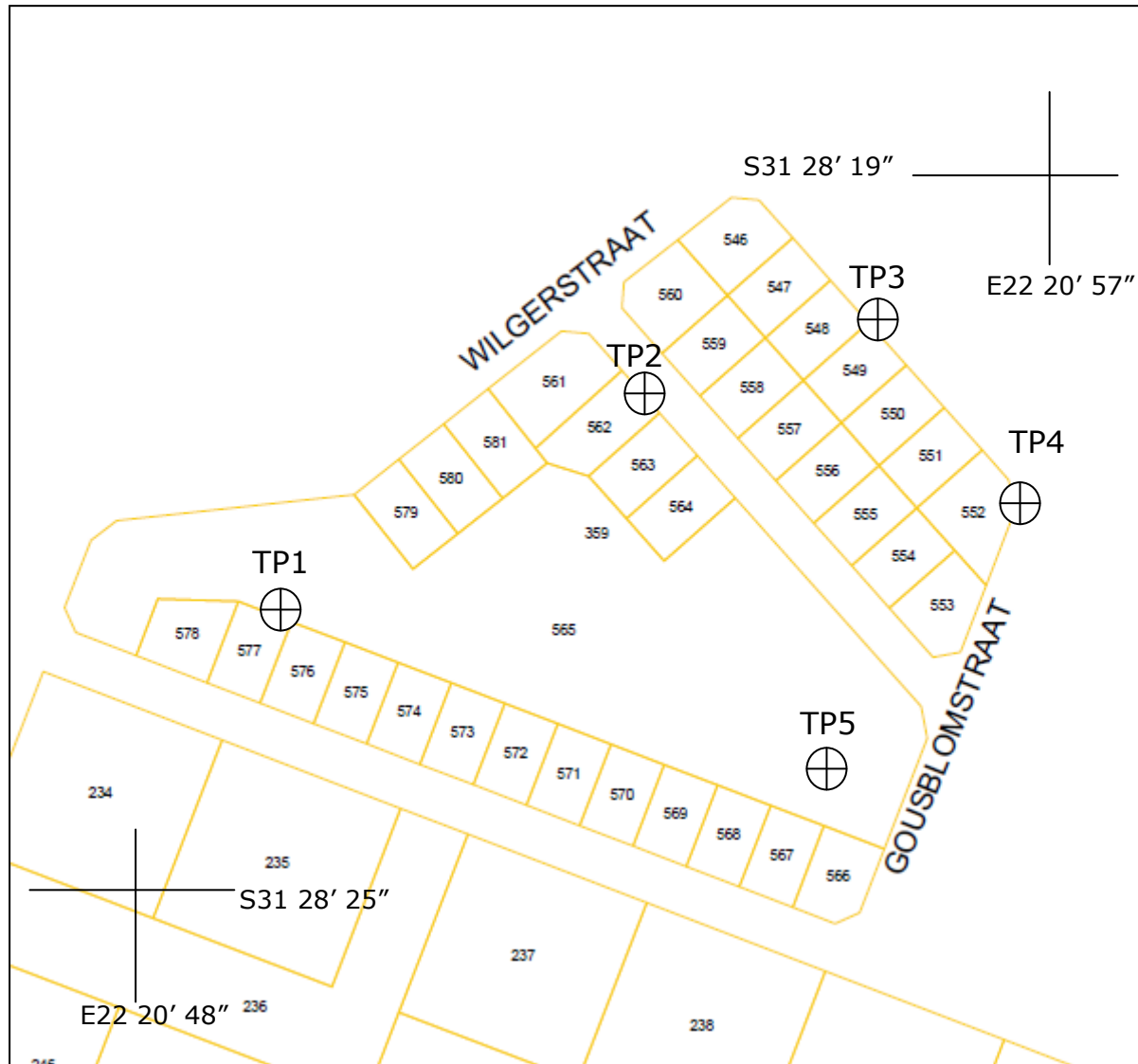
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DATE:  
22.8.2013

SCALE:



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CLIENT:  
Ubuntu Municipality

PROJECT:  
Loxton Housing Project,  
Northern Cape

TITLE:  
Fig 3: Site layout plan  
showing test positions

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IP

DATE:  
22.8.2013

SCALE:



## **Appendix 1**

### **Site classifications**



Phase 2 Geotechnical Investigation - Individual site soil classification  
 Loxton Housing Project, Ubuntu Municipality  
 August 2013

Erf No	Soil types*	Site Class**	Recommended Foundation System	Comments
546	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
547	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
548	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
549	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
550	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
551	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
552	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
553	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
554	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
555	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
556	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
557	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
558	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
559	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
560	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
561	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
562	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
563	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
564	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
565	n/a	n/a	n/a	Public open place
566	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
567	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
568	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
569	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
570	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
571	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
572	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
573	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
574	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
575	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
576	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
577	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
578	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
579	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
580	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO
581	CL/ML/SC/GC	C1/H	Light RC raft or RC strips	Compact founding medium to 93% Mod AASHTO

\*\* NHBRC SITE CLASSIFICATION (SEE ATTACHED CHART)

## NHBRC SITE SOIL CLASSIFICATION SYSTEM

TYPICAL FOUNDING MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Rock (excluding mud rocks which may exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R
Fine grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	<7,5	50%	H
		7,5 – 15	50%	H1
		15 – 30	50%	H2
		>30	50%	H3
Silty sands, sands, sandy and gravelly soils	COMPRESSIBLE AND POTENTIALLY COLLAPSABLE SOILS	<5	75%	C
		5 – 10	75%	C1
		>10	75%	C2
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	COMPRESSIBLE SOILS	<10	50%	S
		10 – 20	50%	S1
		>20	50%	S2
Contaminated soils, Controlled fill, Dolomitic areas, Landslip, Landfill, Marshy areas Mine waste fill, mining subsidence Reclaimed areas, Uncontrolled fill, Very soft silts/silty clays	VARIABLE	VARIABLE		P.

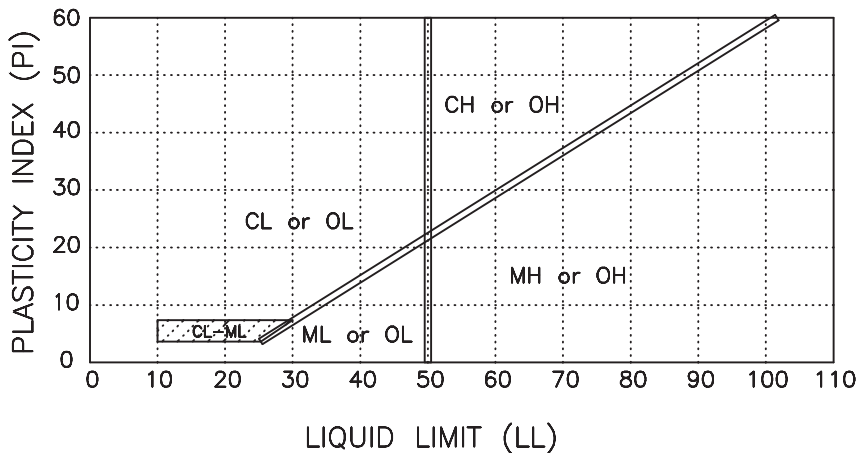
# UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the United Soil Classification System (USCS) on the boring logs presented in this report. Grain size analysis and Atterberg limits tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corps of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL NAMES		
<b>COARSE - GRAINED SOILS</b> (Less than 50% passes No. 200 sieve)	<b>GRAVELS</b> (50% or less of coarse fraction passes No. 4 sieve)	<b>CLEAN GRAVELS</b> (Less than 5% passes No. 200 sieve)		GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		<b>GRAVELS WITH FINES</b> (More than 12% passes No. 200 sieve)		GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
				GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.		
	<b>SANDS</b> (More than 50% of coarse fraction passes No. 4 sieve)	<b>CLEAN SANDS</b> (Less than 5% passes No. 200 sieve)		SW	Well graded sands, gravelly sands.
		<b>SANDS WITH FINES</b> (More than 12% passes No. 200 sieve)		SP	Poorly graded sands, gravelly sands.
				SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.		
<b>FINE - GRAINED SOILS</b> (50% or more passes No. 200 sieve)	<b>SILTS</b> (Limits Plot Below "A" Line & hatched Zone on Plasticity Chart)	<b>SILTS OF LOW PLASTICITY</b> (Liquid Limit Less Than 50)		ML	Inorganic silts, non-plastic or slightly plastic.
		<b>SILTS OF HIGH PLASTICITY</b> (Liquid Limit More Than 50)		MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	<b>CLAYS</b> (Limits Plot Above "A" Line & hatched Zone on Plasticity Chart)	<b>CLAYS OF LOW PLASTICITY</b> (Liquid Limit Less Than 50)		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		<b>CLAYS OF HIGH PLASTICITY</b> (Liquid Limit More Than 50)		CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

**NOTE:**  
 Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with Atterberg limits plotting in the hatched zone on the plasticity chart shall have dual symbol. In Arizona, local streams contain sand, gravel & cobble type material, which are locally known as SGC or riverrun material. The USCS is not used to divide and symbolize this material.

## PLASTICITY CHART



## DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt & clay)	Below No. 200 sieve
Clay	Smaller than 2 microns
Colloid	Smaller than 5 microns

## **Appendix 1**

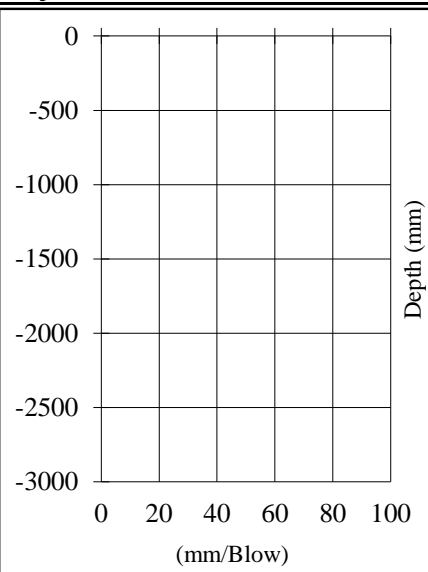
### **Soil profiles**

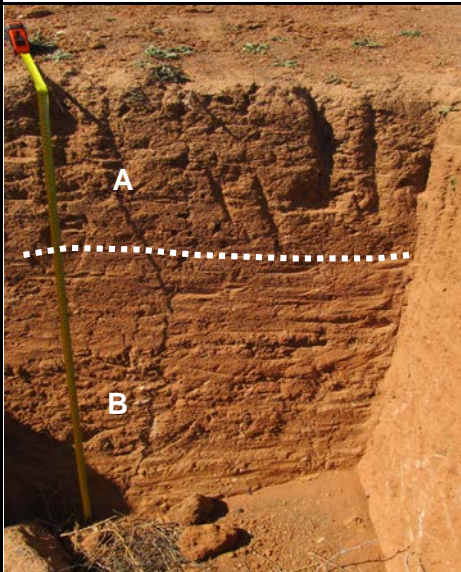
# Geotechnical Soil Profile

Client:	Ubuntu Municipality
Project:	Loxton Housing Project
Area:	Loxton, Northern Cape
Date:	02. 08. 13
Excavator:	Pre-excavated trenches

A	B	0		200		400		600		800		1000		1200		1400		1600		1800		2000
		(0 to 500)		(500 to 1400)																		

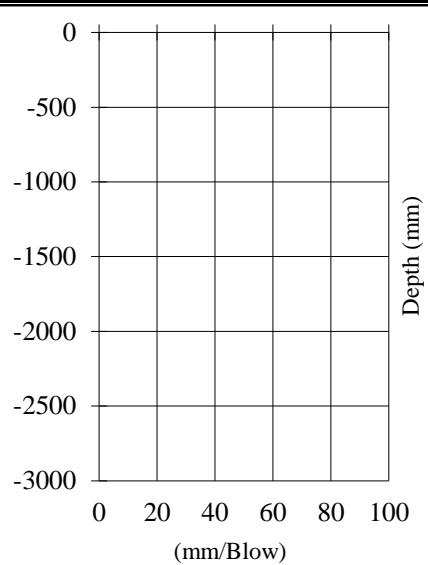
<b>TP 1</b>	Datum: NGL	Co-ords: 23 Y0062092 X3483607	Dynamic Cone Penetrometer (DCP)	Photo of Test Pit
	Key to symbols: ● Sample taken	📍 Groundwater		
<p>(0 to 500) Slightly moist, light red orange, medium dense to dense, intact, <b>SANDY GRAVELLY SILT</b>, transported.</p> <p>(500 to 1400) Slightly moist, light red orange, dense, intact, <b>GRAVELLY SANDY SILT</b>, transported.</p>				

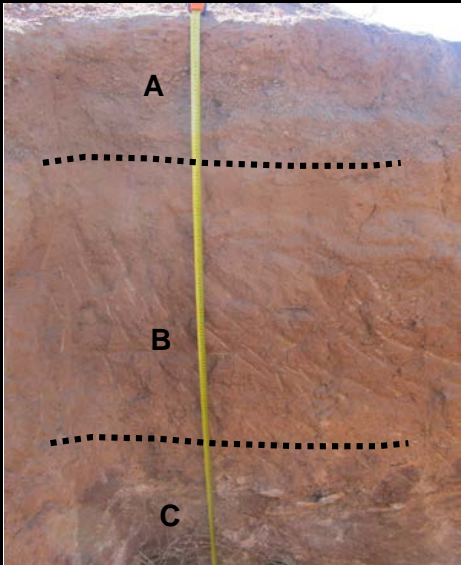




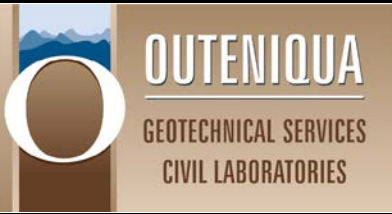
A	B	C	0		200		400		600		800		1000		1200		1400		1600		1800		2000
			(0 to 400)		(400 to 1350)		(1350 to 1800)																

<b>TP 2</b>	Datum: NGL	Co-ords: 23 Y0062029 X3483602	Dynamic Cone Penetrometer (DCP)	Photo of Test Pit
	Key to symbols: ● Sample taken	📍 Groundwater		
<p>(0 to 400) Slightly moist, light red orange, loose to medium dense, intact, <b>GRAVELLY SANDY SILT</b>, transported</p> <p>(400 to 1350) Slightly moist, light red orange, medium dense to dense, intact, <b>GRAVELLY SANDY SILT</b>, transported.</p> <p>(1350 to 1800) Slightly moist, light red orange to light yellow orange, dense, intact, <b>SANDY GRAVELLY SILT &amp; angular pebble &amp; cobble sized particles</b>, transported.</p>				





# Geotechnical Soil Profile

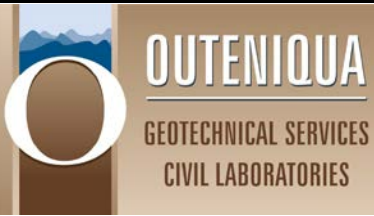


Client:	Ubuntu Municipality
Project:	Loxton Housing Project
Area:	Loxton, Northern Cape
Date:	02. 08. 13
Excavator:	Pre-excavated trenches

<b>TP 3</b>	Datum: NGL	Co-ords: 23 Y0061960 X3483564	Dynamic Cone Penetrometer (DCP)	Photo of Test Pit
	Key to symbols: ● Sample taken    📍 Groundwater			
	<p>(0 to 250) Slightly moist, light red orange to dark grey, loose, intact, <b>SANDY SILTY GRAVEL with bricks, cobbles &amp; pebbles</b>, imported (Fill).</p> <p>(250 to 400) Slightly moist, light red orange, loose, intact, <b>SANDY GRAVELLY SILT</b>, transported.</p> <p>(400 to 900) Slightly moist, light red orange, dense, intact, <b>GRAVELLY SANDY SILT</b>, transported.</p> <p>(900 to 1400) Slightly moist, light red orange, medium dense to dense, intact, <b>SILTY SANDY GRAVEL</b>, transported.</p> <p>(1400 to 1900) Slightly moist, light red orange, dense/stiff, intact, <b>SANDY CLAYEY SILT</b>, transported.</p>			

<b>TP 4</b>	Datum: NGL	Co-ords: 23 Y0061877 X3483575	Dynamic Cone Penetrometer (DCP)	Photo of Test Pit
	Key to symbols: ● Sample taken    📍 Groundwater			
	<p>(0 to 350) Slightly moist, light red orange, loose to medium dense, intact, <b>GRAVELLY SANDY SILT</b>, transported.</p> <p>(350 to 700) Slightly moist, light brown to light red orange, dense, intact, <b>SANDY SILTY GRAVEL</b>, transported/pedogenic (Calcrete gravel).</p>			

# Geotechnical Soil Profile



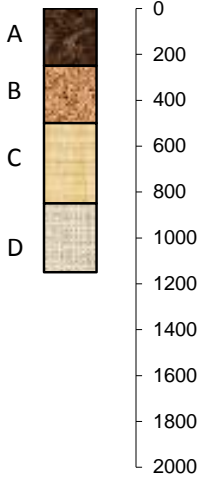
Client:	Ubuntu Municipality
Project:	Loxton Housing Project
Area:	Loxton, Northern Cape
Date:	02. 08. 13
Excavator:	23 Y0061910 X3483655

## TP 5

Datum:	NGL	Co-ords:	
Key to symbols:		● Sample taken	👉 Groundwater

### Dynamic Cone Penetrometer (DCP)

### Photo of Test Pit



(0 to 250)	Slightly moist, light red brown, loose to medium dense, intact, <b>SANDY GRAVELLY SILT</b> , transported.
(250 to 500)	Slightly moist, light red orange to light red brown, dense, intact, <b>SANDY CLAYEY SILT</b> , transported.
(500 to 850)	Slightly moist, light red brown, dense, intact, <b>SANDY SILTY GRAVEL</b> , transported.
(850 to 1150)	Slightly moist, light red brown to light red orange, dense to very dense, intact, <b>SANDY SILTY GRAVEL</b> , transported/pedogenic (Calcrete gravel).

