SOIL SURVEY AND AGRICULTURAL ASSESSMENT OF PORTION 373 OF OUTENIQUA GAME FARM

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1. SUMMARY

A soil survey was conducted on the farm portion 373 of Outeniqua Game Farm to assess land for cultivation and irrigation of various crops. Figure 1 shows the location of the project area.

Use was made of road cuttings and soil pits to identify soil types. 57 soil observations were done on the western portion of the farm while 34 were described in a previous survey of the eastern portion of the farm representing 24.7 ha. A total of 158.8 ha was surveyed and assessed for agricultural potential. Pits or soil observations were not made on the steeper slopes due to difficult access, rock outcrops and/or dense vegetation.

The soil data was used to delineate like soil bodies.

The soil map (Figure 2) provides a spatial location of these soil bodies. The report incorporates data on the different soils and provides soil suitability ratings for irrigation of Avocado pears, citrus, maize and both irrigated and dryland pastures. Soil potential maps are presented in Figure 3. Photographs of some of the dominant soils described during the survey are presented in Appendix I and Appendix II contains the soil profile descriptions.

The soils range from shallow gravelly podzols and lithosols Silcrete remnants on ridge crests to deep red sandy clays weathered from granite on upper to lower mid slopes. These generally range from effective soil depths of 30 cm to 90 cm. All the soils were identified as well-drained besides some small pockets of hydromorphic soils.

The soils were assessed for irrigated fruit crops and pastures as well as dryland pastures. Potentials were rated from high to moderately low for 143.9 ha. of arable land.

2. METHODS

Use was made of road cuttings and soil pits to describe the soil profiles. The location of each soil observation was fixed with a GPS. The soils were described and classified using the South African soil classification (Soil Classification Working Group, 2018). These soil pit locations were then overlayed on the satellite imagery, and the soil information used to delineate soil boundaries. Features such as clay percentage, soil depth and soil classification are important to determine soil potential.

Photo interpretation aids in delineating the soil unit boundaries. Soils vary considerably over short distances in relation to soil depth, texture and classification. Hence any delineated soil unit may have some variation but for practical reasons they are grouped into management units, e.g. The **Be 1** unit (Be=Bethesda soil form) will consist dominantly of the **Bethesda** soil form but will also include other forms with similar effective depths and textures – which relate to the practical management of these soil units.

The soil information from the soil survey that was conducted in the eastern portion of the study area was incorporated into this report.

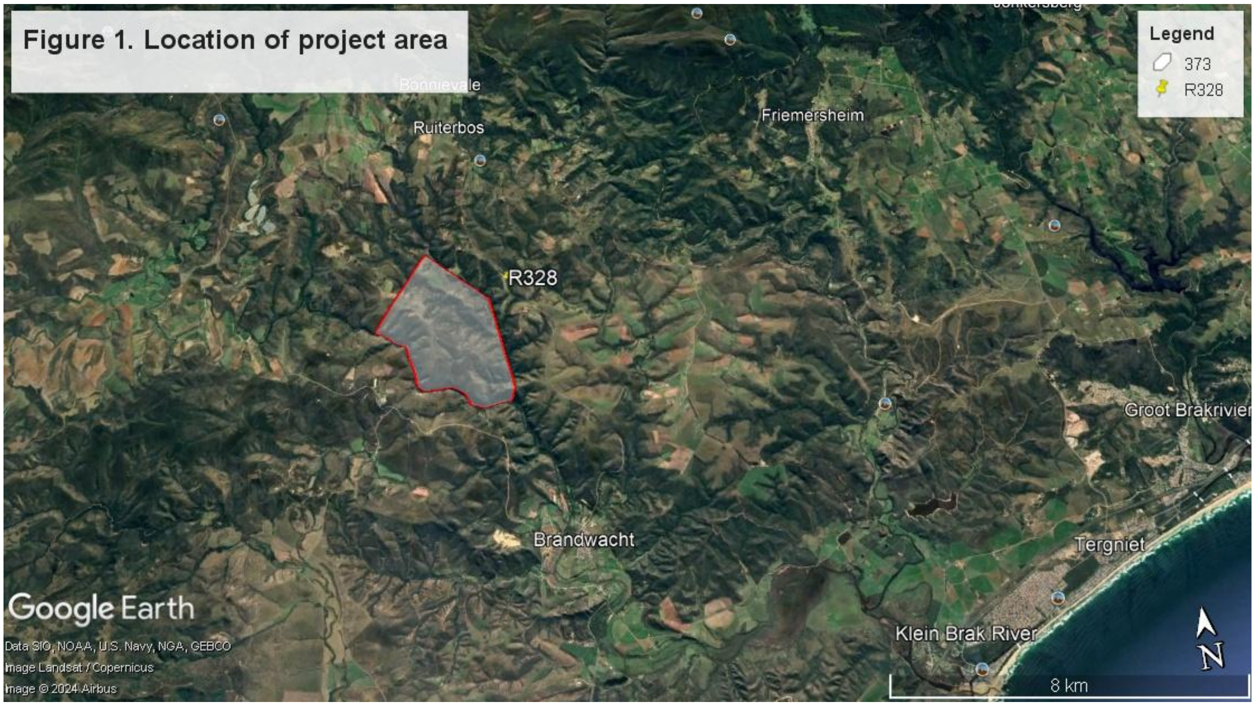

Figure 1. Location of project area

3. TERRAIN

The area comprises a steeply rolling incised landscape with gently sloping upper and top slopes, classified as a steeply dissected coastal plateau (Schafer, 1992). Altitudes range from approximately 100 to 276 m.a.s.l.

4. CLIMATE

The climate is classified as warm temperate with an all-season rainfall. Data from a nearby weather station at Ruitersbos shows a long-term average rainfall of 759 mm. (Weather Bureau data). The graph below illustrates the monthly rainfall distribution for the area.

However, the project area receives approximately between 550 and 650 mm according to published rainfall isohyet maps (Dept. of water affairs, 1965)

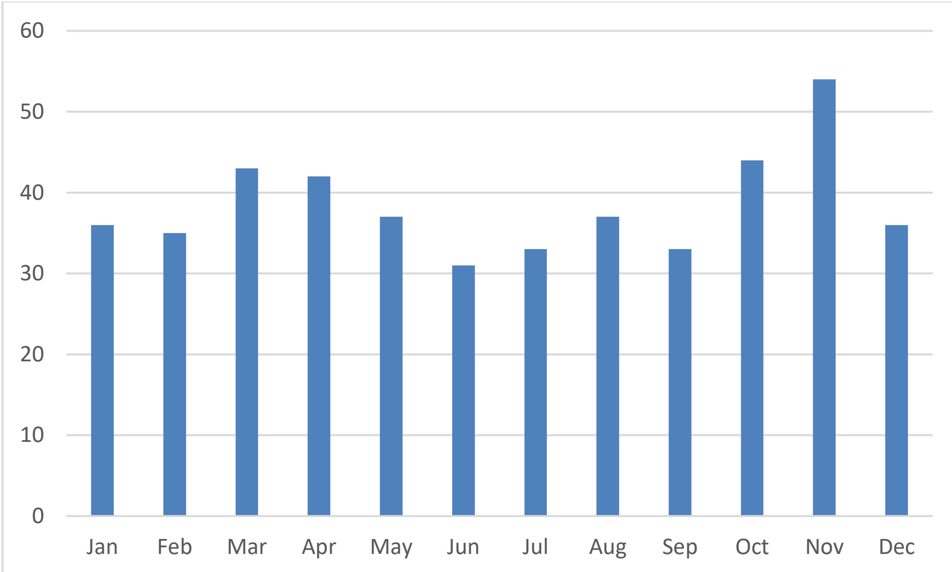

Figure 2. Mean monthly average rainfall for Ruitersbos (mm).

5. GEOLOGY and SOILS

The geology map indicates that the area is dominated by Granite gneiss of the Cape Granite suite while some ridge crests are capped with silcrete remnants (Geological Survey, 1991). The silcretes occur as fractured remnants of a massive duripan cemented essentially by silica but also iron. These have resisted downward erosion due to their extremely hard nature. The soil associated with the silcretes is shallow, stony and has high gravel contents. This material is underlain by a well weathered fine sand - referred to as the pallid zone and may reach several metres thick (Brink, 1985).

Sandstone was also identified in the area where moderately deep, medium to light textured, well drained soils were identified (Be 1 soil unit).

The soils vary considerably over short distances, particularly on steep side slopes, with scattered rock and boulder outcrops. Soils on the more gently sloping upper and top slopes are less variable but all contain large quantities of gravels and in parts – mainly ridge crests – silcrete rock.

5.1 Soils derived from the Silcretes

Convex top and upper slopes

These soils are generally podzolized *(Houwhoek* or *Groenkop* soil forms) with very high gravel contents. Plate 1 illustrates a *Houwhoek* soil form from within the Hh 1 soil unit. Podzols essentially form in light textured soils. Of fundamental importance to the genesis of these soils is the formation of fulvic acid which is capable of breaking down clay minerals into compound elements. Iron and aluminium are then leached out of the upper horizons of the soil profile into the lower B horizons (Brink, 1985). A hard-pan or ortstein B horizon layer generally occurs below 60 cm. This is largely impervious and limits vertical water movement.

Vilafontes soil form (Vf 1 soil unit; plate 3) was also identified where a moderately developed E horizon or leached soil layer overlies a darker coloured, gravelly layer often with higher clay (25-35% clay).

5.2 Soils derived from the Granites

Upper to lower mid slopes

These granites comprise very coarse-grained particles, are well-drained sandy clay loams and have weathered to mainly dark reddish-brown soils or dark brown quartz rich sandy clays.

Tubatse, Vilafontes and *Glenrosa* are common soil forms that have formed in the granite material. Textures range from sandy loam to sandy clay loam in the topsoils and generally sandy clay loam (25 to 35%) in the subsoils. The *Tubatse* soils are red apedal and friable and contain some loose stone or rock in the lower subsoil while the *Vilafontes* have an E horizon that has developed over the gravel rich subsoil. These soils are quite variable due mainly to the variable nature of the terrain: steep to very steep, both convex and concave slopes and frequent rock outcrops. They are however of moderate to high potential despite the very steep slope gradients for the most part. The boundaries of this unit were photo interpreted as the very steep slopes and dense vegetation made it difficult to excavate any soil pits.

Concave lower slopes and drainage lines

Organic rich, apedal, loamy sands and sandy loams overlie a clay rich lower subsoil at below 100 to 130 cm depth (Tu 1 unit). These soils are well drained, acid but have a high agricultural potential. An added advantage for crop production, particularly fruit tree crops, is that these sites are well protected from wind.

A small area of hydromorphic soils viz. *Kroonstad* was described on a level lower slope (unit Kd 1), These soils have a moderate potential for dryland pastures.

5.3 Soils developed from sandstone

Upper and upper mid slopes

These soils are moderately deep to deep sandy loam to sandy clay loams (Be 1 soil unit). They are apedal, friable and well drained with little stone or rock in the upper subsoil horizons.

Topsoil clay percentages range between 16 and 18% and subsoil between 24 and 35 %. Effective soil depths are between 70 and 100 cm. and they are underlain by hard or fractured rock.

These soils which support a Protea/Erica vegetation are likely to be more acid than other soils.

5.4 Soil Map

The soil map shows the distribution of the soil types, and the legend (Table 1) provides soil data pertaining to these units. Table 2 gives soil potential, hazards and suggested soil preparation methods.

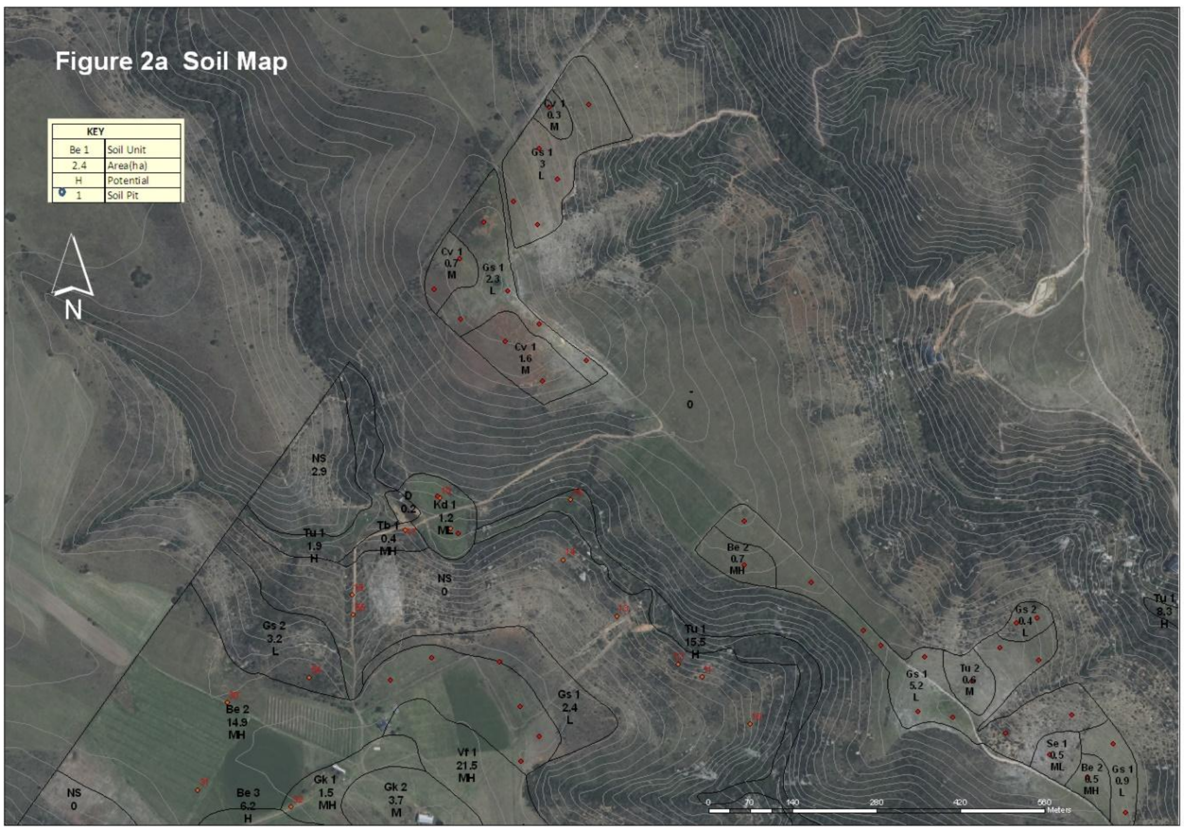

Figure 2a. Soil map of portion of project area

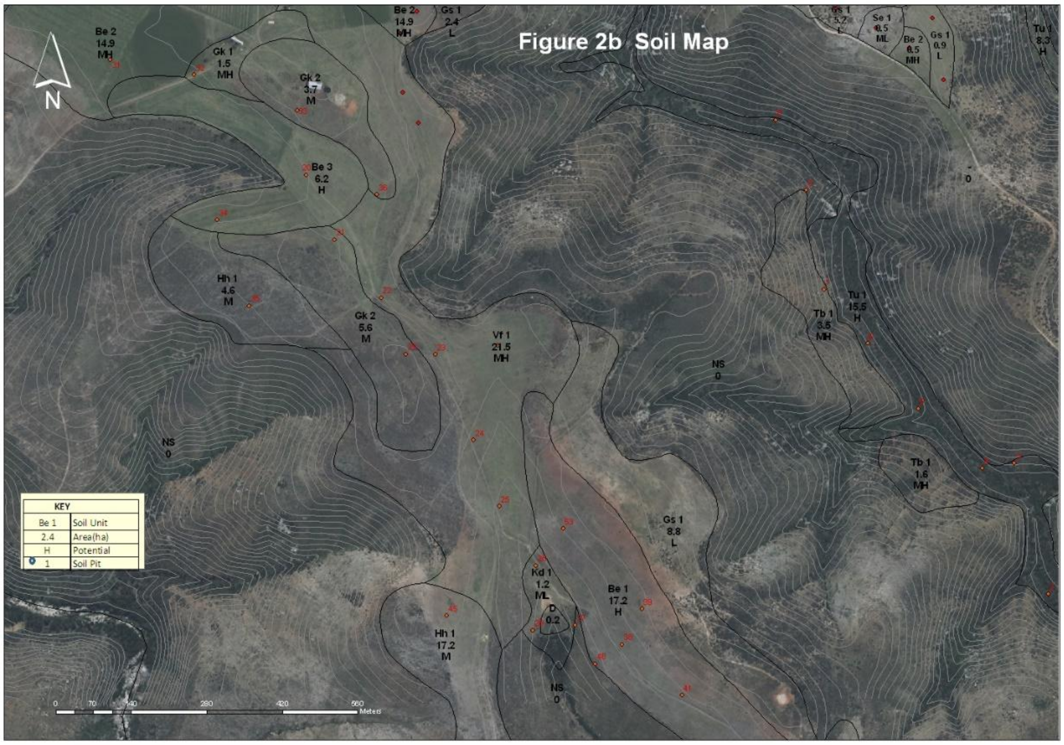

Figure 2b. Soil map of portion of the project area

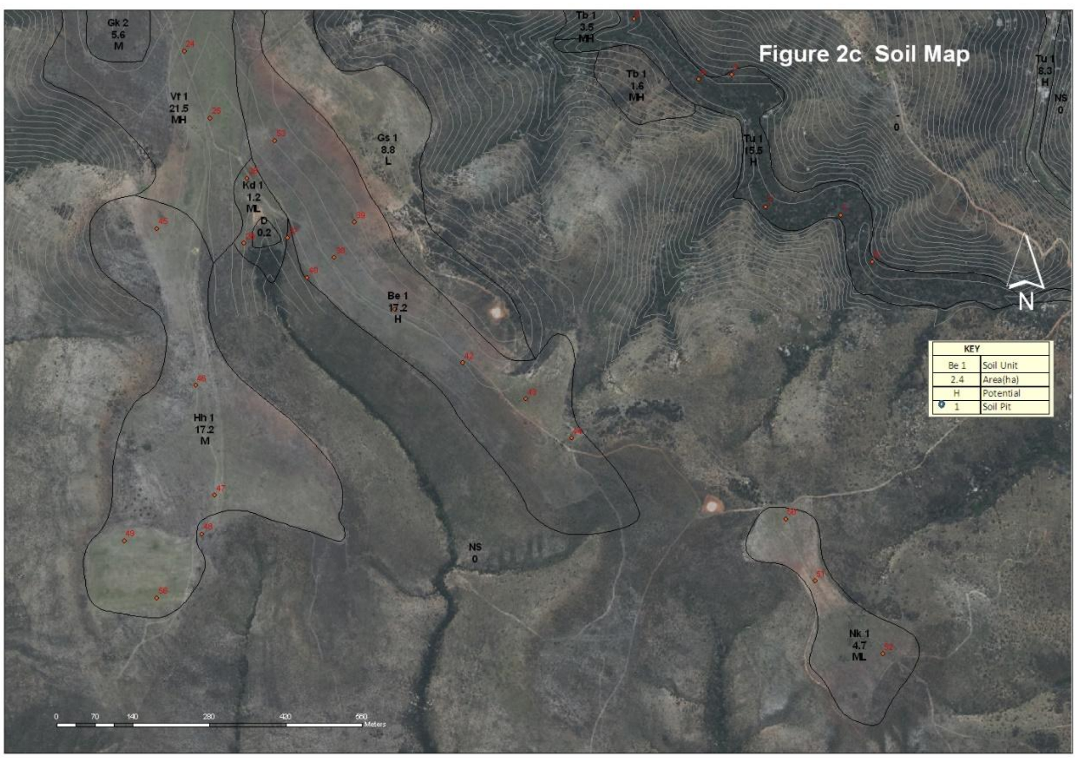

Figure 2c. Soil Map of portion of project area

Table 1. LEGEND TO SOIL MAP

SOIL UNIT	DOMINANT FORMS & FAMILY	OTHER FORMS	ERD cm*	LIMITATIONS	CLAY % A	CLAY % B	STRUCT A	STRUCT B
Be 1	Bethesda 1111	Nkonkoni 1121	60-90	Stone;saprolite	16-20	20-36	a	a
Tu 1	Tukulu 1110 Oakleaf 1111	Tubatse 1211	120	Variable soils; drainage areas	15-18	18-35	a	a
Tb 1	Tubatse 1211, 1111	Oakleaf 1210 Magudu 1200	70-120	Steep slopes; variable soils	15-20	20-36	a	a
Vf 1	Vilafontes 1110	Bethesda 1112	50-60	Restricted depth; low WHC	16-20	16-25	a	a
Be 2	Bethesda 1112; 1111	Houwhoek 1122	50-60	Gravel & stone;	12-15	15-25	a	a
Be 3	Bethesda 1120		90	Gravel; dense lower subsoil	16-20	20-45	a	a-m
Cv 1	Clovelly 1112		50-70	Gravel; restricted depth	15-20	15-30	a	a
Gk 1	Groenkop 1120		50	Gravel; sub-optimal WHC	12-16	15-20	a	a
Gk 2	Groenkop 1110	Dresden 1000	30-40	Gravel; restricted depth; low WHC	12-15	16	a	m
Nk 1	Nkonkoni 1121	Houwhoek 1122	50	Gravel; restricted depth; low WHC	12	12-15	a	a-m
Tu 2	Tukulu 1110		35-45	Restricted depth	25-30	30-35	a	a
Hh 1	Houwhoek 1122; 1110	Glenrosa 1120	45-55	Gravel; restricted depth; low WHC	12	15-25	a	m
Gs 1	Glenrosa 1120 Houwhoek 1122	Vilafontes 1110 Groenkop 1120	30-45	Stone and rock; restricted depth; low WHC	12-15	15-25	a	a-m
Gs 2	Glenrosa 1120 Houwhoek 1122	Groenkop 1120	30-40	Stone and rock; restricted depth, low WHC	12-15	15-30	a	a
Se 1	Sepane 1110		25-35	Dense structured clay subsoil; soil wetness	30-35	40-45	wfb	mmp
Kd 1	Kroonstad 1110	Vilafontes 1110	30-45	Poor drainage	20	60	a	wmb

SOIL FORM & FAMILY: refer to 'SOIL CLASSIFICATION 2018'.

ERD = *effective rooting depth*; WHC = *water holding capacity*

STRUCT = *soil structure*: a = apedal; m=massive; or w=weak, m=moderate, s=strong; *size*; f=fine, m=medium, c=coarse
type: b=blocky, c=crumb; p=prismatic

The effective rooting depth given in Table 1 relates to depth limiting horizons such as dense sub-soil layers, parent rock/saprolite or stone content.

5.5 Soil potential

Soil potential is determined by physical characteristics of the soils such as depth to limiting layers, texture and structure, which all affect soil water holding capacity and drainage. Soil potential was assessed for irrigated orchards, pastures and dryland pastures. Soil chemistry is not taken into account for this assessment and soil nutrient balancing will be based on chemical analytical results.

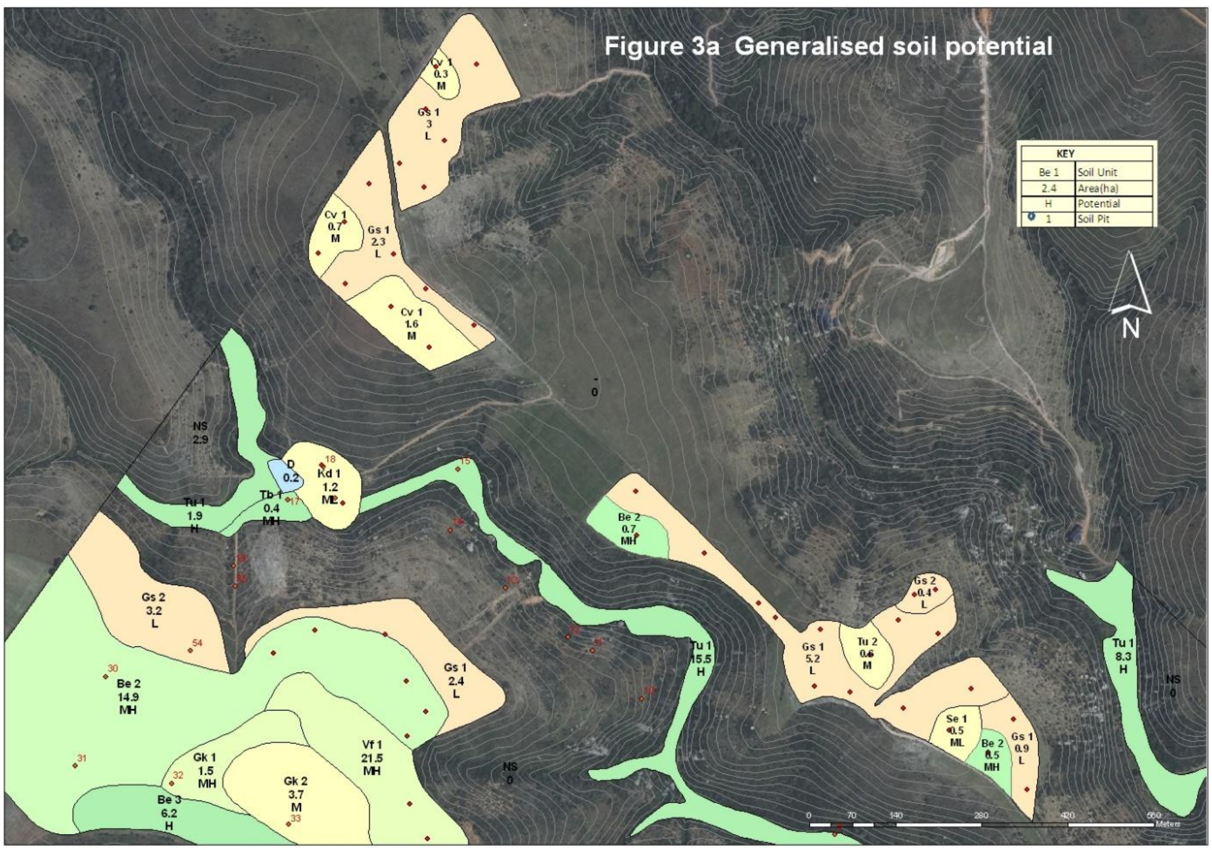

Figure 3a. Generalised soil potential for portion of the project area

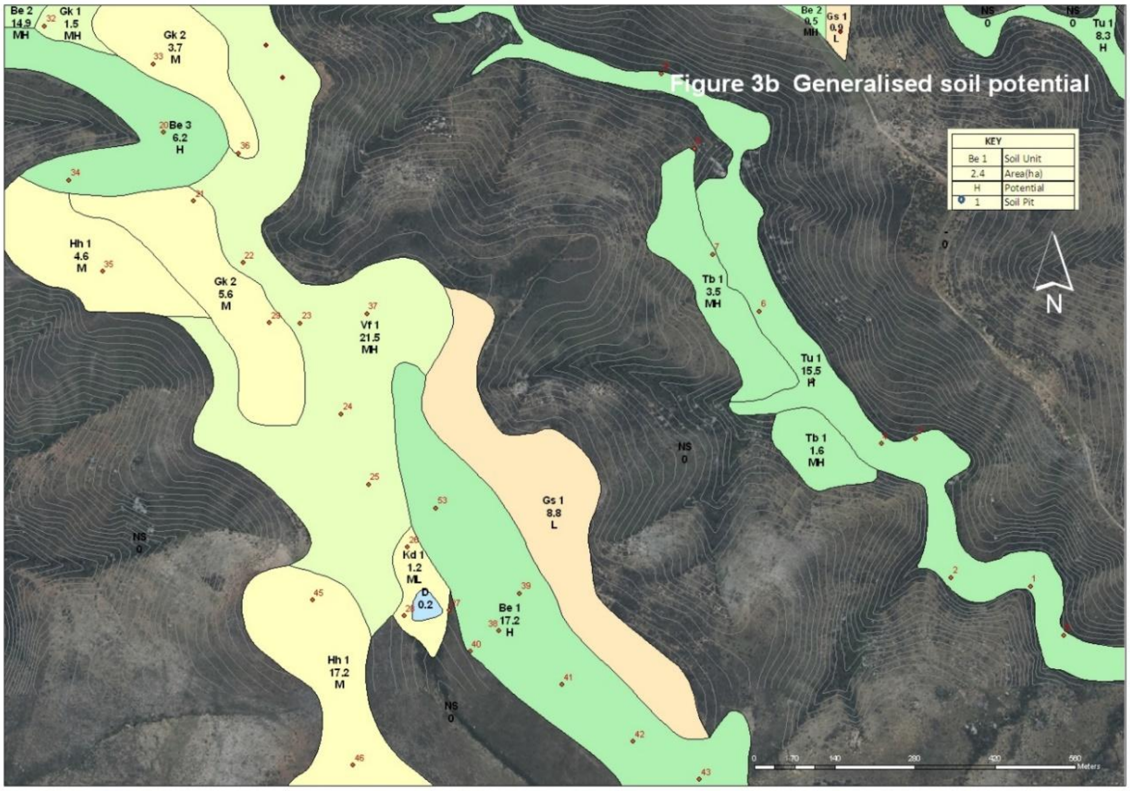

Figure 3b. Generalised soil potential for portion of the project area

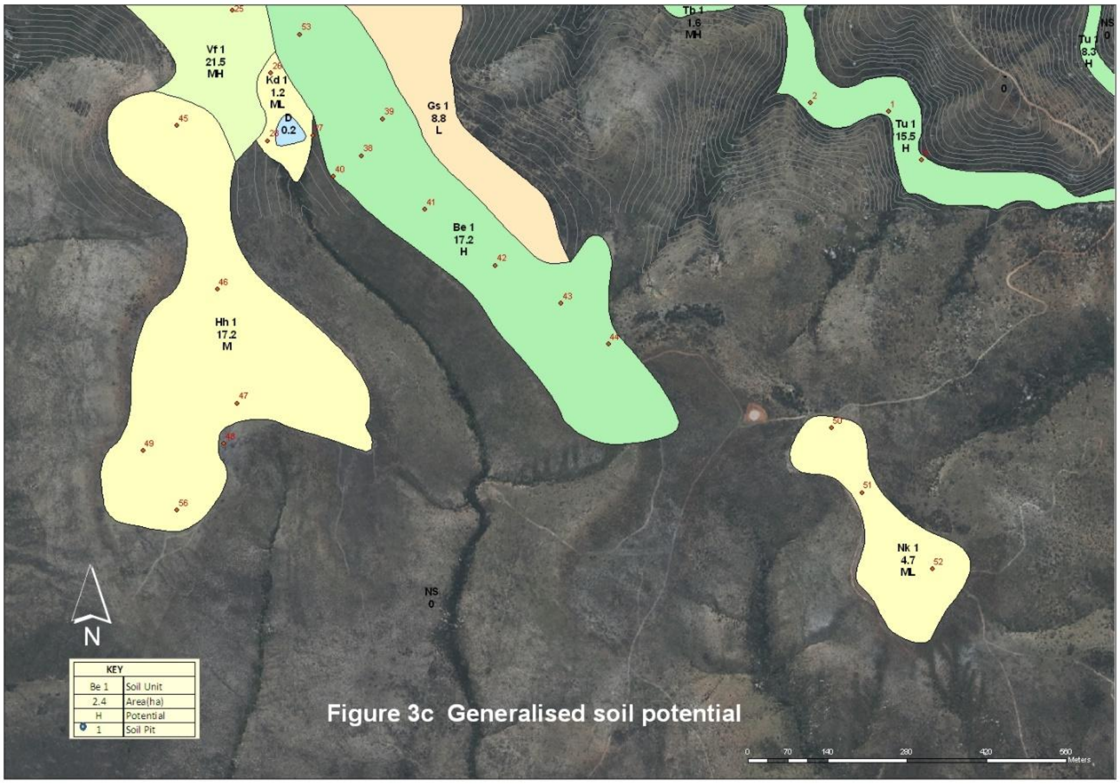

Figure 3c. Generalised soil potential for portion of the project area

Table 2 provides potentials for improved dryland pastures. The soils have been rated from high to moderate. The soil units have also been rated using the international **land capability classification** (LCC). The classes indicate the most intensive tillage that can be practiced safely with permanent maintenance of the soil (McRae and Burnham, 1981). There are 8 classes where classes I-IV are suitable for agriculture. The soil units were rated between I and VII.

Table 2. SUITABILITY FOR IMPROVED DRYLAND PASTURES AND OTHER CROPS

SOIL UNIT	LCC	SUITABILITY RATING						Area in ha.
		Dry land	Irrigated					
		Pastures	Pastures	Avocado	Citrus	Maize	Olives	
Be 1	I	MH	H	H	H	H	H	17.2
Tu 1	I	H	H	H	H	H	H	23.8
Tb 1	III	MH	H	M-H	M	-	MH	5.5
Vf 1	II	MH	H	-	M	M	M	21.5
Be 2	II	M	H	M	M	H	MH	16.1
Be 3	II	M	H	MH	H	H	H	6.2
Cv 1	II	MH	M	-	-	M	-	2.6
Gk 1	III	M	MH	-	-	MH	-	1.5

Gk 2	III	M	M	-	-	M	-	9.3
Nk 1	IV	M	M	-	-	-	-	4.7
Tu 2	III	M	M	-	-	-	-	0.6
Hh 1	III	ML	M	-	-	-	-	21.8
Gs 1	IV	**L**	ML	-	-	-	-	22.6
Gs 2	VI	**L**	L	-	-	-	-	3.7
Se 1	V	M	M	-	-	-	-	0.5
Kd 1	V	M	MH	-	-	-	-	1.2

TOTAL AREA – 158.8

LCC = Land Capability Classification **NS**=Not Suitable

Table 3. Summary of general crop potential areas (ha)

Potential class	Area in hectares
H	56.6
MH	44.6
M	34.3
ML	5.9
L	17.4

5.6 Soil amelioration

Soils were not sampled for chemical analyses and fertilizer recommendations do not form part of this report. Most of the soils will be acid and require liming especially on upper slopes and ridge crests, where podzols were identified and protea fynbos vegetation is common or where no lime was added previously.

Deep ripping to depths of at least 60cm and ridging to a height of 40 cm is recommended on most sites for the establishment of Citrus, Avocado Pears or Olives. Ridges should follow the contours to prevent soil erosion and aid in trapping water.

5.7 Crop suitability

The major limitation for fruit tree crops is the low water holding capacity of the soils in general, due to the high gravel and stone contents and restricted depth despite moderate-high clay contents in some of the subsoils (commonly 20-35%).

The only crops that have been recommended for dryland cropping are pastures. This would include lucerne and various suitable perennial grasses.

Areas were delineated on very steep lower slopes to a deeply incised valley (Tb 1 unit). This delineation was based on photo interpretation (reddish coloured soil surface) as no soil pits were dug. Observations were done further up the valley on these steep slopes and this confirmed that although the soils vary over short distances they are often deep, friable and have an optimal to sub-optimal water holding capacity.

It is advisable to excavate some pits within this area to ascertain if in fact the land is suitable. Ridges should be constructed to a height of at least 40 cm and should run parallel to the contours. This is to prevent erosion as well as trap water flow.

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APPENDIX I.   PLATES OF REPRESENTATIVE SOIL PROFILES

<table>
<tr>
<td>Plate 1. Houwhoek form - Hh
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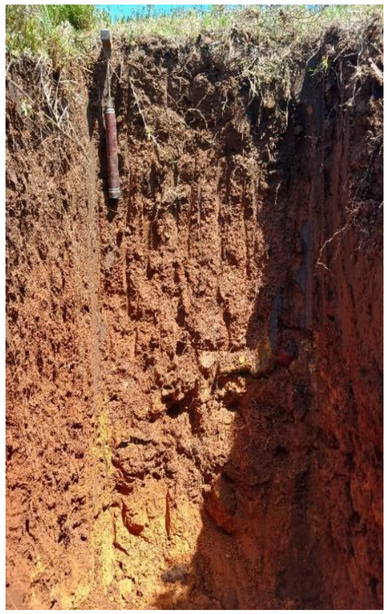
<td>Plate 2. Nkonkoni form - Nk
</td>
<td>Plate 3. Vilafontes form - Vf
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<td>Plate 4. Bethesda form - Be
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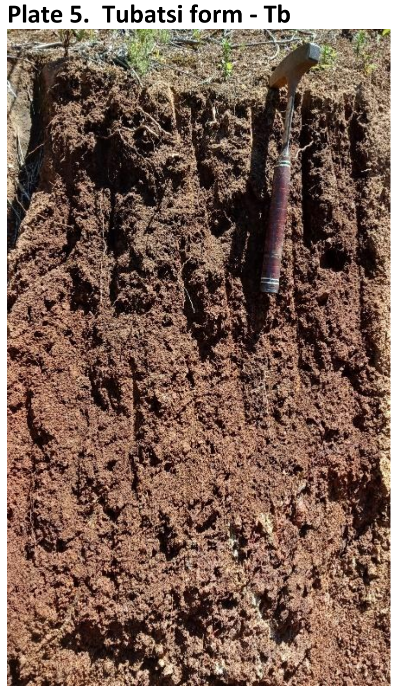
<td>Plate 5. Tubatsi form - Tb
</td>
<td>Plate 6. Glenrosa form - Gs
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APPENDIX II. SOIL PROFILE DATA

OBS	FORM	FAMILY	TSD	ESD	ASD	LTN	W	LITH	HOR	DPTH	COL	Clay	SG	CON	STR	STO	PERM
1	Oa	1111	150	120	150		0	Gr	A	30	VDGB	15	c	1	a	0	r
									B	120	VDB	18	c	1	a	3g	r
									C	150	CYB	50	c	3	m	2g	r
2	Gs	1120	70	70	1110	so	0	Gr	A	30	DB	16	c	1	a	2s	r
									B	70	DB	16	c	2	a	5sg	r
									Ch								
3	Tb	1211	90	60	90	so	0	Gr	A	30	VDB	16	f	1	a	0	r
									B	60	DRB	35	f	1	a	0	r
									C	90	DRB	20	f	2	m	6sr	r
4	Hu	1120	120	120	120		0	Gr	A	30	VDB	16	f	1	a	0	r
									B	120	DRB	35	f	2	a	0	r
5	Hu	1120	120	120	120		0	Gr	A	30	VDB	16	f	1	a	0	r
									B	120	DRB	36	f	1	a	0	r
6	Md	1200	120	90	120	so	0	Gr	A	40	VDB	16	f	1	wfb	0	r
									B	90	DRB	35	f	2	sfb	0	r
									C	120	DRB						
7	Md	1200	120	120	120	so	0	Gr	A	30	VDB	20	f	2	wfb	0	r
									B	120	DRB	30	f	2	sfb	0	r
									Ch	150							
8	Be	1220	120	90	120	so	0	Gr	A	40	VDB	20	f	1	a	0	r
									B	120	DRB	30	f	2	a	0	r
									C	150							
9	Ms	1120	45	45	60	R	0	Gr	A	45	L	18	f	1	a	1s	r
									R								
10	Oa	1111	120	100	100	st	0	Gr	A	30	VDB	16	f	1	a	5g	r
									B	120	DGB	18	f	1	a	5g	r
11	Nk	1122	60	50	90	st;so	0	Gr	A	30	DB	16	m	2	a	4g	r
									B	60	DRB	26	m	2	a	5g	r
									Ch								r
12	Be	1111	120	75	100	st;so	0	Gr	A	25	VDB	18	c	1	a	6g	r
									B	90	VDB	24	c	3	a	6g	r
									C	120	VDB					8sg	r
13	Gs	1120	50	50	80	st;so	0	Gr	A	35	DB	25	c	1	a	2g	r
									B	50	DRB	36	c	2	a	5sg	r
									C								r
14	Vf	1110	100	50	80	g;st	0	Gr	A	20	DGB	16	c	1	a	2s	r
									SL	30	DGB	16	c	1	a	7s	r
									B1	60	B	15	c	1	a	7g	r
									B2	120	MYB	45	c	1	a	0	r
15	Vf	1110	120	80	100	d;st	0	Gr	A	30	VDB	16	f	1	a	0	r
									E	60	PB	16	m	2	a	3g	r
									B	120	DGB	45	m	3	a	4g	r
16	Tu	1110	150	150	150		0	A	A	40	VDGB	16	c	1	a	0	r
									B	100	VDGB	22	c	2	a	0	r
									C	150	CYB	30	c	2	a	0	r
17	Kd	1110	60	30	40	gc	2	Gr	A	20	DGB	20	f	2	a	0	m
									E	25	PB	30	f	2	a	0	s

									B	60	MGY	60	f	4	wcb	0	s
18	Nk	1121	150	120	120	so	0	Gr	A	30	DB	35	f	1	wcc	0	r
									B	120	DB	45	f	2	a	0	r
									C	150	CRB	55	f	3	m	0	r
19	Vf	1110	120	50	90	d	1	Gr	A	30	VDB	18	f	1	a	0	r
									E	50	PB	16	f	1	a	0	r
									B	120	CGR	50	f	4	mcb	0	s
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									C	100	DGB	36	m	3	a	6s	r
21	Be	1111	90	50	100	gv	0	Si	A	30	VDGB	18	f	2	a	4g	r
									B	90	VDGB	24	f	3	m	6g	r
									C		Y	12	f	2	m		m
22	Vf	1110	90	45	90	gv	0	Si	A	20	DGB	15	f	1	a	4g	r
									E	55	GB	15	f	2	a	6sg	r
									B	100	CDGB	16	f	3	m	5g	mr
23	Vf	1110	100	45	80	gv	0	Si	A	25	DGB	18	f	1	a	4g	r
									E	50	DGB	20	f	2	a	5gs	r
									B	90	VDGB	50	f	3	a	6g	r
24	Vf	1110	100	50	90	gv;st	0	Si	A	30	DGB	20	f	1	a	5sg	r
									E	50	GB	20	m	2	a	6sg	r
									B	90	DGB	80	m	2	a	6sg	r
25	Be	1111	80	50	80	st;gv	1	Si	A	25	VDGB	25	f	1	a	5sg	r
									B	75	VDGB	36	m	2	a	5sg	r
									C								
26	Be	1111	90	60	90	st;gv	0	Si	A	30	VDGB	15	f	2	a	3g	r
									B	90	VDGB	20	f	2	a	6sg	r
									R	110							
27	Vf	1110	100	30	60	d	1	Si	A	25	VDG	18	f	1	a	0	r
									B	100	CGY	60	f	3	wcb	0	s
28	Be	1111	90	60	60	so	0	Si	A	30	VDG	25	f	1	a	3sg	r
									B	60	CVDG	35	f	2	a	4sg	r
									C	90							
29	Ka	1110	90	40	60	w	2	Si	A	40	L	36	f	1	a	6sg	mr
									G	90	P	45	f	3	wcb	1s	s
30	Gs	1120	50	40	60	st;r	0	Si	A	30	VDGB	15	f	2	a	3g	r
									B	50	VDGB	18	f	3	a	6g	r
									R								
31	Be	1112	90	90	90		0	Si	A	30	B	12	f	1	a	0	r
									B	90	B	12	f	1	a	3sg	r
									R								
32	Be	1112	100	60	90	st	0	Si	A	30	VDGB	12	f	1	a	0	r
									B	60	VDGB	18	f	2	a	6sg	r
33	Gk	1110	60	50	75	g	1	Si	A	30	GB	12	f	1	a	2g	r
									B	55	VDGB	15	f	3	a	6sg	r
									C	120	PY	5	f	1	m	0	r
34	Gk	1120	60	30	60	g	0	Si	A	30	DG	12	f	1	a	0	r
									B	60	DGB	15	f	3	a	6g	r
									R								
35	Ca	1112	70	50	70	st	0	Si	A	30	GB	12	f	1	a	1g	r

									B	70	YB	15	f	1	a	5sg	r
									R								
36	Hh	1122	150	90	100	st	1	Si	A	20	VDG	14	f	1	a	1g	r
									E	60	PG	6	f	1	a	4g	r
									B	100	L	16	f	5	m	6g	m
37	Dr	1000	30	30	60	hp	0	Si	A	30	DGB	15	f	1	a	0	r
									B	65	DGB	16	f	5	m	9s	r
38	Tu	1120	90	60	90	d	1	Si	A	30	DGB	22	f	1	a	0	r
									B1	60	DGB	30	f	2	a	4g	r
									B2	90	MYB	50	f	3	wmb	3g	s
39	Oa	1120	120	90	120	g;st	0	Si	A	25	VDG	16	f	1	a	4g	r
									B	120	B	24	f	1	a	5g	r
40	Be	1112	70	70	90	R	0	Si	A	20	VDGB	16	f	1	a	3g	r
									B	70	DYB	20	f	1	a	6g	r
									R								
41	Be	1222	60	45	65	R	0	Ss	A	20	VDGB	20	f	1	a	2sr	r
									B	60	RB	60	f	1	a	4sr	r
									R								
42	Vf	1110	80	60	80	s	0	Ss	A	20	VDG	20	f	1	a	3gs	r
									E	40	PGB	40	f	1	a	6gs	r
									B	90	YB	90	f	1	a	6gs	r
43	Ct	1110	120	80	110	s;g	0	Ss	A	30	DG	30	f	1	a	3gs	r
									E	70	PB	70	f	1	a	5g	r
									B	120	YB	120	f	1	a	5gs	r
44	Nk	1120	150	150	150		0	Ss	A	30	VDGB	30	f	1	a	0	r
									B	90	DRB	90	f	1	a	0	r
									C	150	PY	150	f	1	a	0	r
45	Cv	1111	120	80	100	so	0	Ss	A	20	VDGB	20	f	1	a	0	r
									B	100	YB	60	f	1	a	3sg	r
									C	120	PY	120	f	1	a	0	r
46	Be	1222	60	45	60	R	0	Ss	A	20	VDGB	20	f	1	a	0	r
									B	60	RB	60	f	1	a	5sg	r
									R								
47	Is	1120	60	40	60	g;R	0	Ss	A	20	VDGB	20	f	1	a	1g	r
									E	60	PG	60	f	1	a	6g	r
									R								
48	Be	1222	50	40	50	g;hp	0	Ss	A	20	VDGB	20	f	1	a	2g	r
									B	50	RB	50	f	1	a	5g	r
									R								
49	RR					R	0	Si									
50	Vb	1112	40	40	65	R	0	Ss	A	20	VDGB	20	f	1	a	1s	r
									B	40	DRB	40	f	1	a	2sb	r
									R								
51	Hh	1112	40	40	60	d	1	Si	A	20	VDGB	14	f	1	a	0	r
									E	35	PB	16	f	1	a	4g	r
									B1	40	YRB	30	f	1	a	5g	r
									B2	75	VDGB	30	f	1	a	6g	r
52	RR																
53	Nk	1112	150	60	90	so	0	Si	A	20	DGB	12	f	1	a	0	r
									B	60	RB	12	f	1	a	3s	r

									C	150	PY	6	f	1	a	0	r
54	Gk	1120	30	30	50	R	0	Si	A	15	VDGB	12	f	1	a	4gs	r
									B	30	DB	12	f	1	a	4gs	r
									R								
55	Oa	1120	90	60	110	R		Si	A	20	VDGB	16	f	1	a	2sg	r
									B	90	CYB	36	f	1	a	4sg	r
									R								
56	Gs	1120	60	30	60	r;R		Si	A	20	VDGB	16	f	1	a	7sr	r
									B	50	DGB	23	f	1	a	7sr	r
									R								
57	Vf	1110	120	60	90	d;g		Gr	A	25	DGB	16	f	1	a	2g	r
									E	40	DGB	15	f	1	a	2g	r
									B	120	DYB	32	f	1	a	6sg	mr

KEY TO CODES

OBS	Soil observation No.	
FORM	Soil form	
FAMILY	Family	
TSD	Total soil depth - cm	
ESD	Effective soil depth - cm	
ASD	Ameliorated soil depth - cm	
LTN	Depth limitation	s=stone; g=gravel; R=hard rock; so=saprolite; w=wetness
W	Wetness class	0=no wetness; 1=seasonal wetness 2=frequent wetness
LITH	Lithology (Geology)	Ss=Sandstone; Si = Silcrete; Gr-Granite; A=Alluvium
HOR	Horizon (soil layer)	
DPTH	Depth in cm	
COL	Munsell colour	G=grey, V=very, B=brown, D=dark, P=pale, Y=yellow, C=cutanic
Clay	clay %	
SG	sand grain	f=fine; m=medium; c=coarse
CON	consistency	1 = soft/friable; 2= slightly firm; 3= firm 4=hard
STR	Structure	a=apedal: w=weak;m=moderate; s=strong; SIZE: f=fine; m=medium; c=coarse TYPE: c=crumb, b=blocky
STO	% stone	5=50%; s=stone; r=rock; g=gravel
PERM	Permeabilty	r=rapid; m=moderate; s= slow