CHAPTER EIGHT: SOIL SUITABILITY ASSESSMENT

8.1 INTRODUCTION

This Chapter of the report presents the findings of the Reconnaissance Soil Survey conducted by the soil specialist, Dr Freddie Ellis (Pr. Sci. Nat. 400158). The study was commissioned as part of the Environmental Impact Assessment (EIA) Process in order to determine the suitability of the soils on the site for the commercial production of citrus and annual crops; and to refine the project layout by identifying areas most suitable for cultivation.

8.2 SPECIALIST TERMS OF REFERENCE

The terms of reference (ToR) for a Reconnaissance Soil Survey as requested by the applicant are stated below:

- Undertake soil analysis to establish the suitability of the soil for the proposed cultivation of annual crops (e.g. maize), as well as for the establishment of citrus orchards.
- Identify potential constraints imposed on the proposed farming activity by the soil/ landscape characteristics of the site.
- Provide suitable mapping for the development, taking into account the soil suitability of the area and the biophysical site constraints (e.g. slope analysis)
- Provide amelioration measures for soils that are not suitable for the cultivation of annual crops (e.g. maize) or for commercial citrus production in their current state.

8.3 APPROACH AND METHODOLOGY

The author of this Reconnaissance Soil Survey was provided with a soil report entitled: "*Assessment of soils for agricultural purposes/ cultivation of virgin land on the Farm Scheepersvlakte, in the Sundays River Valley Municipality (undated)",* which had been conducted ~5 years prior, by M.R. Maloma and N.E. Mbende of the Eastern Cape Department of Rural Development and Agrarian Reform. The abovementioned soil report was not accepted by the Department of Economic Development, Environmental Affairs and Tourism, as it neither met the requirements for specialist studies, in terms of the NEMA EIA Regulations, 2014 (as amended) nor the Specialist Terms of Reference as outlined in the Plan of Study for EIA and included above. Furthermore, the report stated that more than 200 soil pits were investigated but record of only 71 were given. Acceptable classifications of the previous soil profiles were incorporated and reclassified into the data set for this Reconnaissance Soil Survey. However, certain important criteria such as soil texture and soil horizon depths were not given in the previous soil report. See **Annexure 4** for further information about the reclassification of the soils, as well as a map showing where they were described.

During the current soil survey, a total of 44 soil profile pits were made on the Farm. Due to the reconnaissance nature of the survey, as well as the inaccessibility of certain areas, soil pits were not located beforehand (e.g. on a grid layout) but randomly in the field. The soil pits were mechanically excavated to a depth of ~1 200 mm or down to any restricting subsoil limitation. The latitude and longitude of the excavated soils profile pits were determined by GPS during the field soil survey (see **Annexure 1: Table 8.1)**.

During the field soil survey, important soil properties (e.g. texture, colour, mottling, structure, coarse fragments, hardpans, horizon depths, etc.) were described for each soil profile pit, following standard procedures as prescribed by the Institute for Soil, Climate and Water, Pretoria.

Based on recognizable, as well as inferred properties, the soils were classified according to the South African Soil Classification system (Soil Classification Working Group, 1991) into soil forms

and soil families. This system is based on the recognition of diagnostic soil horizons and materials. Soil forms are defined in terms of the type and vertical sequence of diagnostic horizons or materials. For communication, soil forms are given locality names, e.g. Addo or Augrabies. These names are abbreviated to two-letter symbols, e.g. Ad or Ag for the Addo and Augrabies soil forms, respectively. Soil forms are subdivided into soil families using properties that are not used in the definition of diagnostic horizons or materials. Reference to a soil family is by combining the soil form abbreviation and a four-digit symbol, e.g. Ag 1210, is family number 1210 of the Augrabies form.

The soil forms and families recognized during the field survey are listed alphabetically, according to the soil form abbreviation symbol, in **Annexure 1: Table 8.2**.

Depending on the purpose of a soil survey, soil families can be subdivided on an *ad hoc* basis into soil phases using properties such as soil and horizon depths, stoniness etc. Phase subdivision is achieved by detail coding of individual soil profiles (refer **Annexure 2:** Structure of Soil Code and Explanation of Symbols, for the symbols used during this soil survey). Codes of all the profiles described are listed alphanumerically, according to the soil type legend symbols in **Annexure 1: Table 8.3**.

The soils in the old quarry area, artificial wetland area and on slopes greater than 15% have not been rated as they are not considered suitable for planting.

8.4 SOIL TYPES AND SOIL MAP

The aim of a soil map is to reflect the natural distribution of soil types and spatial variation in soil properties on any given farm or area. Depending on the relationship between soil parent material, soil types and terrain, the spatial variation in soil properties and the influence of these variations on land use and soil suitability for specific agricultural activities, various approaches could be followed to develop a map legend according to which a soil map is compiled.

The approach followed for the reconnaissance soil survey conducted on Scheepers Vlakte Farm included the development of a map legend that will accommodate most of the variations in soil properties that might influence soil suitability, amelioration measures and potential land use. In **Annexure 1: Table 8.4**, the map legend based on soil types is explained. The properties and features of the different soil types/ map units are defined in terms of *inter alia*:

- Soil form,
- Diagnostic horizons,
- Relevant family criteria,
- Degree of wetness of the upper and lower subsoil horizons,
- Density of upper and lower subsoil horizons,
- Depth to limiting horizons/ materials,
- Coarse fragments in top- and/ or upper subsoil horizons, and
- Sand grade and clay content of the topsoil.

With reference to the accuracy of the soil map, the following aspects should be kept in mind:

- The most important factor that determines the accuracy of the soil map is the accuracy of the base map itself and in particular, the positioning of the soil pits with reference to land features such as roads, fences, lands and streams. In this case, an older background photograph and a five-meter contour was utilized in addition to the Google Earth image, to enhance the accuracy of the final soil map.
- The soil pits were randomly placed. On the ~850ha of the farm, 44 soil pits were investigated, meaning that the minimum size of a map unit is ~19ha. However, by making use of some

investigations from the previous soil report by Maloma and Mbende (see above), which included 71 additional profile pits, the minimum size is believed to be smaller than ~19ha. Despite all the observations, inclusions of other soils may, therefore, be expected to occur in some map units.
- In situations where the boundaries between map units coincide with fairly prominent changes in slope, the soil boundaries are expected to be relatively accurate. In cases where slope changes are gradual, the soil boundaries are only approximate divisions. However, despite the possible inclusions of other soils, not mentioned in a particular map unit, it is expected that it will have little influence on the ultimate aim of the survey, namely to determine the suitability of a specific area for the commercial production of citrus and annual crops (e.g. maize).
- The soils in the old quarry area, artificial wetland area and on slopes greater than 15% have not been rated as they are not considered suitable for planting.

A detailed soil map of the selected section of the farm was compiled using the soil types as listed in **Annexure 1: Table 8.4** (see **Annexure 3: Figure 8.1**). A Google Earth image of the survey area was used as background map. In addition to the soil type symbols and boundaries, the positions of the 44 soil pits are also indicated on the map together with a line scale.

Map units are identified by means of a symbol that consists of the abbreviation for the soil form followed by an Arabic number (e.g. Ag 1). The number suffix has no intrinsic meaning. It only serves as an identifier for different map units that consist of soils belonging to the same soil form but differ in one or more important soil properties. The map units are listed alphanumerically according to the soil form symbol in **Annexure 1: Table 8.4**. All the profiles and codes in the different map units are listed alphanumerically in **Annexure 1: Table 8.3** (also see **Annexure 3: Figure 8.1**).

Certain properties (e.g. horizon/ soil depth, coarse fragments, etc.) of the soils are specified in **Annexure 1: Table 8.4**. Additional properties can be abstracted from the:

- Definition of the soil form in terms of diagnostic horizons and materials,
- Properties of diagnostic horizons and materials,
- Differentiating family criteria, and
- Additional information specified in the soil code.

8.5 PHYSICAL SOIL LIMITATIONS

Due to their genetic composition, the lateral and vertical root growth pattern may vary significantly between different types of plants (e.g. citrus versus annual crops). The minimum useable soil depth required for good root development and water and nutrient uptake to ensure healthy and productive plants can, therefore, differ greatly between different plant types. In addition, the tolerance of different plants to soil wetness and soil borne diseases may also vary greatly.

In the following paragraphs, the most important soil properties that might affect infiltration, root development, and nutrient and water uptake will be discussed.

8.5.1 Low Clay Content of Top- and Upper Subsoils

The ability of soils to retain water and plant nutrients for use by plants is mainly determined by the clay and organic matter content. A clay content of less than 10% is generally associated with a low water storage capacity, which could be considered as a limiting factor for crop production. Low clay content is regarded as a limitation because sandy soils dry out fairly quickly and can become very warm during summer. It is, therefore, difficult to maintain the free water at an optimal level during warm, dry summer months and when plants are young with a small leaf canopy. Another limitation of sandy topsoils, with low organic matter content, which have been cleared of vegetation, is their susceptibility to water erosion.

It is, therefore, important that crops such as citrus should be irrigated to ensure minimum water stress during the warm summer months, and especially after harvest. Annual crops under irrigation, however, normally perform better than perennial crops on sandy soils.

8.5.2 Dense Subsoil Clay Layers

Dense clay layers occur as gleyed (wet), weakly to moderately structured G horizons (e.g. Kroonstad form) and relatively dry well-structured B horizons, (e.g. Estcourt or at Scheepers Vlakte Farm, Sepane form).

With clear to abrupt (sharp) increase in clay from the overlying horizon to the clay layer, free water generally accumulates in the overlying, lighter textured horizon during the rainy season or as a result of over-irrigation. Under conditions of water saturation, reduction and loss of iron leads to the development of a bleached E horizon in the overlying sandy material (e.g. Kroonstad form). Such horizons can set hard on drying and have a high soil density.

The effective depth of soils with structured subsoil clay layers is, therefore, limited by the clay layer itself and indirectly by the periodic wetness in the overlying layer with less clay.

8.5.3 Wetness

This refers to the presence of free water at varying depths in a soil profile.

A small percentage of the soils on Scheepers Vlakte Farm have diagnostic horizon(s) and/ or material that developed as a result of periodic free water in the profile. These horizons and/ or materials may include the following:

- E horizon (not identified on the Farm),
- Unconsolidated material showing signs of wetness.

During the field survey, the soil water condition in individual soil profiles were evaluated according to the wetness classification that was developed for soils in the winter rainfall region (refer **Annexure 2**). This wetness classification is based on the number of days during the year and depth of saturation with water. Profile morphology is used to determine the depth of water saturation and the maximum height of signs of hydromorphy is used as depth limit. Climate, locality, aspect, vegetation and water conditions during the survey, as well as profile morphology were used to evaluate the duration of water saturation. The expected number of days of saturation during the rainy season in "wet" years is used to determine duration. It is essential for free water to occur in the profile continuously for at least seven (7) days. However, the total number of days with free water need not be continuous. The wetness rating for the individual profiles are listed in **Annexure 1: Table 8.3**.

Wetness during active root respiration results in a low oxygen concentration with an increased carbon dioxide concentration. This causes reduction of iron oxides/ hydroxides and leaching of the reduced iron. As the iron content decreases, soil density increases, and very large soil strengths can develop when the soil dries out.

Other adverse effects of wetness are:

- Toxic concentrations iron (Fe2+), manganese (Mn2+), sulfides, nitrites, ethylene and volatile organic acids can develop. In certain plants a moderate degree of wetness will only have a negative influence on growth without dieback of the plants. Sensitive plants, however, can dieback.
- Various diseases can become epidemic under wet conditions. Phytophthora can wipe out

sensitive crops/ plants.
- As a result of limited volumes of non-wet soil that is available for root growth, plants have a restricted root system during the wet season. Crops with a high-water requirement may show drought stress during warm and/ or dry spells if water content becomes very low.

If the surveyed area is going to be planted with wetness sensitive plants, special attention should be given to drainage. It is recommended that a drainage expert is consulted to develop an integrated drainage/ stormwater management plan for the total area intended for agricultural development.

8.5.4 Coarse Fragments in Top- and/ or Subsoils

A small percentage of the soils on Scheepers Vlakte Farm contain coarse material that qualifies as gravel or stones.

The main limitation of coarse fragments is that an increase in the volume-content of coarse fragments decreases the fine soil (<2 mm) fraction and consequently the water holding capacity. The nutrient retention capacity is similarly influenced.

Dry, gravelly soils, therefore, require less water to reach field water capacity but require more regular and lighter irrigations than similarly textured, non-gravelly/ stony soils. In addition, fertilizer programs also require adjustment.

8.5.5 Weathered Rock

In rare cases hard, partly weathered Enon rock occurs in deeper subsoils.

Weathering rock is always denser and more impervious to air, water and plant roots than the overlying horizons. The shallower the rock, the less weathered and the harder it is, the greater is the negative influence on root penetration and development. As a result of its dense, impermeable nature, weathering rock commonly shows signs of wetness.

Weathering rock could be loosened with a tine implement to a fairly constant depth to increase effective soil depth and to ensure an even surface for lateral drainage of excess soil water. Because loosened rock has a rapid hydraulic conductivity and free water flows freely through the profile, it is essential that cutoff drains should be installed.

In **Table A** below, the classes and symbols that were used in **Annexure 1: Table 8.6** to qualify the physical limitations of the soils in the different map units are explained.

8.6 AMELIORATION OF PHYSICAL SOIL LIMITATIONS

Except for the negative effect of a low clay content and the presence of gravel and stones on the water holding capacity of the soils, all the other physical limitations can be improved or eliminated by means of deep soil preparation, drainage or ridging.

Table A below, indicates the classes used to specify the necessity of specific amelioration measures that were used in **Annexure 1: Table 8.6**.

Table A: Classes used to specify the necessity of specific amelioration measures.

Necessity for Amelioration Measure	Abbreviation
Measure unnecessary	(none)
Measure recommended but not essential	Recom
Measure essential	Essen

8.7 SOIL SUITABILITY WITH SPECIAL REFERENCE TO CITRUS AND ANNUAL CROPS

The most common limitations of the soils on Scheepers Vlakte Farm are free lime ($CaCO_3$) and dense subsoil hardpan carbonate or clay layers.

The suitability of the individual soil profiles for the commercial production of citrus and annual crops was evaluated in the field by the soil surveyor. The suitability rating ranges from 1 to 10, with 1 the lowest and 10 the highest or best suitability. These ratings are listed in **Annexure 1: Table 8.3** for each profile, and the average rating for each map unit in **Annexure 1: Table 8.6**. The average suitability rating for map units was calculated from the individual profile ratings. These ratings can be interpreted according to the guidelines in **Table B.1** (Citrus) and **Table B.2** (Annuals**)**.

Table B.1: Interpretation of suitability ratings and percentage of soil profiles in each rating class and recommendation for citrus production.

Rating	Suitability Class		Number of Profiles per Class	Percent of Class
	Rating	Recommendation		
≤3	Low	Not Recommended	11	25.1
>3 - ≤4	Medium low	Marginally Recommended	6	13.6
>4 - ≤5	Medium	Conditionally Recommended	14	31.8
>5 - ≤6	Medium high	Recommended	13	29.5
>6	High	Highly Recommended		

From **Table B.1,** it is evident that ~25% of the Farm area is *Not Recommended* for citrus production. Approximately 14% of soils are *Marginally Recommended* and ~32% is *Conditionally Recommended*, while ~30% is *Recommended*. No soils were rated as Highly Recommended for citrus production.

Table B.2: Interpretation of suitability ratings and percentage of soil profiles in each rating class and recommendation for annual crop production.

Rating	Suitability class		Number of Profiles per Class	Percent of Class
	Rating	Recommendation		
≤3	Low	Not Recommended	10	22.7
>3 - ≤4	Medium low	Marginally Recommended	4	9.1
>4 - ≤5	Medium	Conditionally Recommended	12	27.3
>5 - ≤6	Medium high	Recommended	17	38.6
>6	High	Highly Recommended	1	2.3

Table B.2, largely corresponds with the findings of **Table B.1,** with the difference that more profiles were rated in the *Recommended* and even the *Highly Recommended* classes for annual crops. It, therefore, reflects a marginally better suitability for annual crops than for citrus production. In **Table B.3,** the approximate area (in hectare) per soil type is given. Based on average suitability the recommendation for citrus and annual crops is also listed for each soil type.

Table B.3: Approximate area and average suitability per soil type and recommendation for citrus and annual crops.

Map Unit	Approx. area (ha)	Ave. Suitability Citrus	Recomm. Citrus	Ave. Suitability Annuals	Recomm. Annual Crops
Ad 1	14.3	4.5	Conditionally recommended	4.5	Conditionally recommended
Ad 2	11.9	3.75	Marginally recommended	4	Conditionally recommended
Ad 3	89.2	3.875	Marginally recommended	4	Conditionally recommended
Ad 4	38.9	4.875	Conditionally recommended	5.25	Recommended
Ag 1	276.2	5.25	Recommended	5.71	Recommended
Ag 2	26.4	5	Conditionally recommended	5.3	Conditionally recommended
Ag 3	21.8	4.5	Conditionally recommended	5	Conditionally recommended
Br 1	69.6	2.875	Not recommended	3	Not recommended
Br 2	39.7	2.75	Not recommended	2.75	Not recommended
Cg 1	18.6	2.5	Not recommended	3	Not recommended
Cg 2	3.0	2.5	Not recommended	3	Not recommended
Gm 1	8.6	5	Conditionally recommended	5.5	Recommended
Hu 1	6.6	6	Recommended	6	Recommended
Oa 1	1.5	5.5	Recommended	4.5	Conditionally recommended
Oa 2	2.4	4.5	Conditionally recommended	5.5	Recommended
Oa 3	4.0	6	Recommended	6.5	Highly recommended
Oa 4	10.1	5.75	Recommended	6	Recommended
Ou 1	13.8	4.875	Conditionally recommended	5	Conditionally recommended
Pr 1	8.3	2.75	Not recommended	3.5	Marginally recommended
Pr 2	72.7	3.75	Marginally recommended	4.5	Conditionally recommended
Se 1	24.1	2.75	Not recommended	3	Not recommended
Va 1	44.6	4.5	Conditionally recommended	4.75	Conditionally recommended
Quarry	2.6	NR	Not rated	NR	Not rated
Slopes >15	24.9	NR	Not rated	NR	Not rated
Artificial Wetland	5.5	NR	Not rated	NR	Not rated
Total Area	839.3				

From **Table B.3** above, it is evident that the dominant soils that are *Recommended* for deep-rooted perennial crops (e.g. citrus) include the Augrabies (Ag 1), Hutton (Hu 1 and 2) and Oakleaf (Oa 3 and 4) soil types, with an area of **~298ha**. *Conditionally Recommended* soils include Ad 1 and 4, Ag 2 and 3, Gm1, Oa2, Ou1 and Va1 with an area of **~171ha**. *Marginally Recommended* soils cover ~**174ha**, whilst *Not Recommended* soils represent **~163ha**. Therefore, a total area of **~643ha** is considered suitable for the commercial production of citrus.

The situation for annual crop production is slightly better than for citrus production. The *Highly Recommended* soils cover and area of **~4ha**, the *Recommended* soils **~343ha**, the *Conditionally Recommended* soils **~296ha**, and the Marginally Recommended soils **~8ha**. Approximately 155ha

of soils are *Not Recommended* for annual crop production**.** Therefore, a total area of **~651ha** is considered suitable for the commercial production of annual crops.

For sustainable development of deep-rooted perennial citrus under irrigation, special attention should be given to amelioration measures, such as:

- Mechanical loosening of dense subsoil clay layers.
- Mixing of A horizon with subsoil horizon where applicable but no mixing with free lime subsoils (soft or hardpan carbonate horizons).
- Cut off drainage when planting blocks are laid out, especially on slopes.
- Ridging of soils with shallow soil.
- Judicious irrigation practices.
- Creating and maintaining a proper organic surface mulch.

For further physical soil amelioration measures to be taken (indicated per map unit) consult **Annexure 1**, **Table 8.6**.

The soil map is extremely important for the layout of blocks, amelioration measures, and selection of crops to be planted. Expert advice from an experienced crop specialist who can interpret the soils information and can accommodate it in planning is, therefore, vital for the success of any future agricultural development on Scheepers Vlakte Farm.

8.8 REFERENCES

Lambrechts, JJN; Van Zyl, J; Ellis, F and Schloms, BHA. 1978. Grondkode en kaartsimbool vir detailkartering in die Winterreënstreek. Technical Communication No. 165, Dept. Agric. Tech. Services, Pretoria.

Soil Classification Working Group, 1991. Soil Classification: A Taxonomic System for South Africa. Mem. Natural Agric. Resources for S.A. No. 15.

8.9 ANNEXURE 1

Table 8.1: Coordinates of soil profiles.

Profile Number	Map Symbol	Latitude	Longitude
1	Pr 2	-33,460413	25,620395
2	Ad 2	-33,458008	25,620547
3	Va 1	-33,460401	25,617289
4	Va 1	-33,460446	25,614867
5	Se 1	-33,458199	25,613032
6	Se 1	-33,456755	25,61178
7	Ag 1	-33,453308	25,610687
8	Gm 1	-33,450772	25,613336
9	Va 1	-33,447374	25,608656
10	Pr 2	-33,444192	25,611616
11	Ad 3	-33,44257	25,609661
12	Ag 3	-33,439607	25,608418
13	Ag 1	-33,442877	25,616552
14	Ad 4	-33,44529	25,618567
15	Br 1	-33,449912	25,618421
16	Br 2	-33,450548	25,624284
17	Ag 1	-33,449911	25,62588
18	Ag 1	-33,448892	25,628482
19	Oa 2	-33,444132	25,625645
20	Ou 1	-33,442953	25,626281
21	Ag 1	-33,442422	25,630687
22	Cg 1	-33,442557	25,651295
23	Br 1	-33,444794	25,640984
24	Pr 2	-33,441565	25,638295
25	Br 1	-33,43903	25,63668
26	Oa 1	-33,43768	25,633216
27	Ad 1	-33,437337	25,635475
28	Oa 4	-33,437061	25,642133
29	Ag 1	-33,440554	25,642806
30	Ag 2	-33,44091	25,641438
31	Br 1	-33,440418	25,643501
32	Ou 1	-33,439525	25,646531
33	Ag 1	-33,438369	25,650983
34	Ad 4	-33,442974	25,649558
35	Cg 2	-33,443289	25,648198
36	Va 1	-33,443932	25,645049
37	Ag 1	-33,444126	25,644188
38	Oa 3	-33,448374	25,640373
39	Ag 2	-33,454433	25,631949
40	Ad 3	-33,453099	25,633041
41	Hu 1	-33,450235	25,635782
42	Pr 1	-33,448505	25,637452
43	Oa 4	-33,447282	25,63855
44	Cg 1	-33,446436	25,635184

Table 8.2: Soil forms and families listed alphabetically according to soil form abbreviation symbol.

ABBREVIATION	SOIL FORM AND VERTICAL SEQUENCE OF DIAGNOSTIC HORIZONS AND/ OR MATERIALS

Ad **ADDO FORM**

Orthic A
Neocarbonate B
Soft carbonate horizon

SOIL FAMILIES

1000¬A horizon not bleached
- 1100¬Non-red B horizon
  - 1110¬Non-luvic B1 horizon
    - 1111¬No signs of wetness in carbonate horizon
- 1200 Red B horizon
  - 1210 Non-luvic B1 horizon
    - 1211 No signs of wetness in carbonate horizon

Ag **AUGRABIES FORM**

Orthic A
Neocarbonate B
Unspecified material

SOIL FAMILIES

1000¬A horizon not bleached
- 1100¬Non-red B horizon
  - 1110 Non-luvic B1 horizon
  - 1120 Luvic B horizon
- 1200 Red B horizon
  - 1210¬Non-luvic B1 horizon
  - 1220 Luvic B1 horizon

Br **BRANDVLEI FORM**

Orthic A
Soft carbonate horizon

SOIL FAMILIES

1000 No signs of wetness in carbonate horizon

Cg **COEGA FORM**

Orthic A
Hardpan carbonate horizon

SOIL FAMILIES

1000 Non-calcareous A horizon
2000 Calcareous A horizon

Gm **GAMOEP FORM**

Orthic A
Neocutanic B
Hardpan carbonate horizon

SOIL FAMILIES

1000A horizon not bleached
- 1200 Red B horizon
  - 1210 Non-Luvic B1 horizon

Hu **HUTTON FORM**

Orthic A
Red apedal B
Unspecified material

Soil families

3000 Eutrophic B1 horizon
- 3100 Non-Luvic B1 horizon

Oa **OAKLEAF FORM**

Orthic A
Neocutanic B
Unspecified material

SOIL FAMILIES

1000 A horizon not bleached
- 1100 Non-red B horizon
  - 1110 Non-luvic B1 horizon
  - 1120 Luvic B1 horizon
- 1200 Red B horizon
  - 1210 Non-luvic B1 horizon
  - 1220 Luvic B1 horizon

Ou **OUDTSHOORN FORM**

Orthic A
Neocutanic B
Dorbank

SOIL FAMILIES

1000 A horizon not bleached
- 1200 Red B horizon
  - 1210 Non-luvic B1 horizon
  - 1220 Luvic B1 horizon

Pr **PRIESKA FORM**

Orthic A
Neocarbonate B
Hardpan carbonate horizon

SOIL FAMILIES

1000 A horizon not bleached
- 1100 Non-red B horizon
  - 1110 Non-luvic B1 horizon
- 1200 Red B horizon
  - 1210 Non-luvic B1 horizon

Se **SEPANE FORM**

Orthic A
Pedocutanic B
Unconsolidated material with signs of wetness

SOIL FAMILIES

1000 A horizon not bleached
- 1100 B horizon not red
  - 1200 Medium/coarse angular B horizon
    - 1220 Calcareous B and upper C horizons

Va **VALSRIVIER FORM**

Orthic A
Pedocutanic B
Unconsolidated material without signs of wetness

SOIL FAMILIES

1000 A horizon not bleached
- 1100 B horizon not red
  - 1110 Subangular/fine angular B horizon
    - 1112 Calcareous B or upper C horizon
  - 1120 Medium/coarse angular B horizon
    - 1122 Calcareous B or upper C horizon

Table 8.3: Soil types with a complete list of described soil profiles and codes – Scheepers Vlakte Farm, Addo.

Map symbol	Profile number	Depth codes	Form & Family	Subsoil limitations/properties				Topsoil			Wetness class	Changes	Transitional form	Suitability rating citrus	Suitability rating annuals
				Upper	Middle	Lower	Coarse fragments	Coarse fragments	Sand grade	Clay class					
Addo form soils: *Soils with an orthic A- on a neocarbonate B horizon on a soft carbonate horizon*															
Ad 1	27	2 8 8 6	Ad 11/211	nc(yere)	sk	hk	2g+1k		fi	4			Pr	4,5	4,5
Ad 2	2	1 3	Ad 1111	nc(dkye)	sk/hk1				fi	3/4			Pr	3,75	4
Ad 3	11	1 4	Ad 1211	nc(re)	sk				fi	4				3,75	4
Ad 3	40	2 5	Ad 11/221	nc(rebr)vp	sk				fi	4			Va	4	4
Ad 4	14	2 7	Ad 1211	nc(re)	sk				fi	4				5	5,5
Ad 4	34	2 6	Ad 1211	ne/nc(re)	sk				fi	3/4			Et	4,5	5
Augrabies form soils: *Soils with an orthic A- on a neocarbonate B horizon on unspecified material*															
Ag 1	7	2 5	Ag 1220	nc/vp(re)	nc				fi	4			Va	5	5,5
Ag 1	13	2 6	Ag 1210	nc/ne(re)	nc				fi	4				5	5,5
Ag 1	17	2	Ag 1210	nc(re)					fi	3/4				5,5	6
Ag 1	18	2 7	Ag 1220	nc(re)	nc/vr				fi	3				4,75	5,5
Ag 1	21	2 8	Ag 1210	nc(re)	nc/sk				fi	3/4				5	5,5
Ag 1	29	2 9	Ag 1210	nc(re)	nc/sk				fi	4/5				5,75	5,75
Ag 1	33	2 6	Ag 1220	ne(re)	nc(re)				fi	3/4			Gm	5,25	6
Ag 1	37	2	Ag 1210	nc(re)					fi	4				5,75	6
Ag 2	30	2 2	Ag 1210	nc(re)	2g+4k			1g+2k	fi	3				5,5	6
Ag 2	39	2	Ag 1220	nc(re)+2g+1k					fi	4				5	5
Ag 3	12	2 5	Ag 1120	nc/vp	nc(re)				fi	3/4			Va	4,5	5
Brandvlei form: *Soils with an Orthic A- on a Soft carbonate horizon*															
Br 1	15	2	Br 1000	sk				1f+2g+2k	fi	3				2,75	3
Br 1	23	2	Br 1000	sk/hk				2g+1k	fi	3/4				3	3
Br 1	25	3	Br 1000	sk/hk1					fi	3/4			Cg	3	3
Br 1	31	2	Br 1000	sk				2g+3k	fi	3/4				2,75	3
Br 2	16	2 6	Br 1000	sk	sk/nc+2g+2k			2g + 1k	fi	3				2,75	2,75
Coega form soils: *Soils with an orthic A- on a hardpan carbonate horizon*															
Cg 1	22	3	Cg 1000	hk2/3					fi	3/4				2,5	3
Cg 1	44	2	Cg 1000	hk2/3					fi	2/3				2,5	3
Cg 2	35	2	Cg 2000	hk2					fi	3				2,5	3

Gamoep form soils: Soils with an orthic A- on a red apedal B horizon on a hardpan carbonate horizon															
Gm 1	8	2 6	Gm 1210	ne(re)	hk2/R				fi	4/5			Py	5	5,5
Hutton form soils: Soils with an orthic A on on a Red apedal B horizon on unspecified material															
Hu 1	41	2 2	Hu 3100	re	2f+3g+3k			2f+2g+1k	fi/ne	3			Ag	6	6
Oakleaf form soils: *Soils with an orthic A- on a neocutanic B horizon on unconsolidated material without signs of wetness*															
Oa 1	26	2 2	Oa 1110	ne(ye/gr)			3f+3g+1k	3f+3g+1k	me/fi	2/3				5,5	4,5
Oa 2	19	2 5	Oa 1120	ne(re)/gs	ne/vr				fi	3/4				4,5	5,5
Oa 3	38	2 0	Oa 1210	ne(re)	nc(re)				fi	4			Ag	6	6,5
Oa 4	28	3 7	Oa 1220	ne/re	yp				fi	4			Hu	5,75	6
Oa 4	43	3 7	Oa 1220	ne/re	yp				fi	4			Hu	5,75	6
Oudtshoorn form soils: *Soils with an orthic A- on a neocutanic B horizon on dorbank*															
Ou 1	20	2 4 5	Ou 1220	ne/vr	db1	db3			fi	3/4				4	5
Ou 1	32	2 6	Ou 1220	ne(re)	db2				fi	3/4				4,75	5
Prieska form soils: *Soils with an orthic A on a neocarbonate B horizon on a hardpan carbonate horizon*															
Pr 1	42	2 4	Pr 1110	nc(ye)	hk3				fi	3			Cg	2,75	3,5
Pr 2	1	1 3	Pr 1210	nc(re)	hk2/3				fi	4/5				3,75	4,5
Pr 2	10	1 3	Pr 1210	nc(re)	hk2				fi	4				3,5	4,5
Pr 2	24	2 4	Pr 1210	nc(re)	hk1/2				fi	4			Ad	4	4,5
Sepane form soils: Soils with an orthic A- on a pedocutanic B horizon on unconsolidated material with signs of wetness															
Se 1	5	2 6	Se 1220	g vp	vp/gc				fi	5	3			2,75	3
Se 1	6	2 6	Se 1220	vp(gr)	vp/gc			1g+2k	fi	5	3			2,75	3
Valsrivier form soils: *Soils with an orthic A horizon on a pedocutanic B horizon on unconsolidated material without signs of wetness*															
Va 1	3	2 6 8	Va 1 1/212	vp(dkre)	nc	sk+2g+1k			fi	4/5				4,25	4,75
Va 1	4	2 5	Va 1 1/212	vp(dkbr)	nc(re)				fi	4/5			Ag	4,5	4,75
Va 1	9	2 6	Va 1212	vr	nc/vr				fi	4/5			Ag	4,5	4,75
Va 1	36	2 6	Va 1212	vr/nc(re)	nc(re)				fi	3/4			Ag	4,75	4,75

Table 8.4: Brief description of soil types on Scheepers Vlakte Farm, Addo.

Explanation of superscripts

1) Effective depth before mechanical amelioration of physical limitations
2) Effective depth after mechanical amelioration of physical limitations

SOIL TYPES

Addo form soils: *Soils with an orthic A- on a neocarbonate B horizon on a soft carbonate horizon.*

Soil type symbol:	**Ad 1**	**Ad 2**
Soil family	Ad 11/211	Ad 1111
Family criteria:		
Bleaching of A horizon	Non-bleached	Non-bleached
Colour of B horizon	Non-red (yellowish)	Non-red (dark-yellow)
Clay increase from A to B	Non-luvic	Non-luvic
Signs of wetness in carbonate horizon	Absent	Absent
Additional features:		
Free lime in topsoil	Non-calcareous	Non-calcareous
Clay content topsoil	15 - 20 %	15 - 20 %
Depth to soft carbonate horizon	80 - 90 cm	30 cm
Depth to and nature of material below soft carbonate horizon	Soft carbonate, becoming hard carbonate 100cm+	Soft carbonate, becoming slightly hard carbonate 60 cm+
Coarse fragments in B horizon	About 30 % gravel + stones	Non-gravely
Effective depth (cm):	70 - 90[1]; 75+[2]	40 cm[1] 75+[2]

Soil type symbol:	**Ad 3**	**Ad 4**
Soil family	Ad 1/221	Ad 1211
Family criteria:		
Bleaching of A horizon	Mainly Non-bleached	Mainly Non-bleached
Colour of B horizon	Red - redbrown	Red - redbrown
Clay increase from A to B	Non-luvic to luvic	Non-luvic
Signs of wetness in carbonate horizon	Absent	Absent
Additional features:		
Free lime in topsoil	Non-calcareous	Non-calcareous
Clay content topsoil	16 – 20 %	13 – 20 %
Depth to soft carbonate horizon	30 - 50 cm	70 - 80 cm
Depth to and nature of material below soft carbonate horizon	Not reached	Not reached
Coarse fragments in B horizon	Non-gravelly	Non-gravelly
Effective depth (cm):	50[1]; 75+[2]	0[1]; 75+[2]

Augrabies form soils: *Soils with an orthic A- on a neocarbonate B horizon on unspecified material without signs of wetness.*

Soil type symbol:	**Ag 1**	**Ag 2**
Soil family	Ag 1210	Ag 1210
Family criteria:		
Bleaching of A horizon	Non-bleached	Non-bleached
Colour of B horizon	Red	Red
Clay increase from A to B	Non-luvic	Non-luvic
Additional features:		
Free lime in topsoil	Non-calcareous	Non-calcareous
Clay content topsoil	13 - 20 %	16 – 25 %
Coarse fragments in B horizon	Non-gravelly	Non-gravelly
Depth to and type of unspecified material	Neocarbonate to soft carbonate from 80 cm+	Not reached
Effective depth (cm):	≈60[1)]; 75+[2)]	80[1)]; 75+[2)]

Soil type symbol:	**Ag 3**
Soil family	Ag 1120
Family criteria:	
Bleaching of A horizon	Non-bleached
Colour of B horizon	Mainly Non-red
Clay increase from A to B	Luvic
Additional features:	
Free lime in topsoil	Non-calcareous
Clay content topsoil	16 - 22 %
Coarse fragments in B horizon	Non-gravelly
Depth to and type of unspecified material	Not reached but hardsetting lower B
Effective depth (cm):	≈90[1)]; 120+[2)]

Brandvlei form soils: *Soils with an orthic A- on a soft carbonate horizon.*

Soil type symbol:	**Br 1**	**Br 2**
Soil family	Br 1000	Br 1000
Family criteria:		
Signs of wetness in carbonate horizon	Absent	Absent
Additional features:		
Clay content topsoil	10 – 15 %	10 - 15
Depth to soft carbonate horizon	20 – 30 cm	20 – 30 cm
Depth to and nature of material below soft carbonate horizon	≈60 cm; Occasionally slightly hard carbonate horizon	≈60 cm soft carbonate to neocarbonate material
Coarse fragments in A horizon	Non-gravelly	About 40 % gravel + stones
Effective depth (cm):	20 - 30[1)]; 55+[2)]	20 - 30[1)]; 55+[2)]

Coega form soils: *Soils with an orthic A- on a hardpan carbonate horizon.*

Soil type symbol:	**Cg 1**	**Cg 1**
Soil family	Cg 1000	Cg 2000
Family criteria:		
Free lime in A horizon	Absent	Present
Additional features:		
Clay content topsoil	8 - 15 %	10 - 15 %
Depth to hardpan carbonate horizon	≈20 cm	≈20 cm
Coarse fragments in A horizon	Non-Gravelly	Non-Gravelly
Effective depth (cm):	≈20[1)]; 55+[2]	≈20[1)]; 55+[2]

Gamoep form soils: *Soils with an orthic A- on a neocutanice B horizon on a hardpan carbonate horizon.*

Soil type symbol:	**Gm 1**
Soil family	Gm 1210
Family criteria:	
Bleaching of A horizon	Non-bleached
Colour of B horizon	Red
Clay increase from A to B	Non-luvic
Additional features:	
Free lime in topsoil	Non-calcareous
Clay content topsoil	18 - 25 %
Coarse fragments in B horizon	None
Depth to hardpan carbonate horizon	60 cm
Effective depth (cm):	≈60[1)]; 75+[2)]

Hutton form soils: *Soils with an Orthic A- on a Red apedal B horizon on unspecified material.*

Soil type symbol:	**Hu 1**
Soil family:	Hu 3100
Family criteria:	
Degree of leaching of upper B (B 1) horizon	Poorly leached (eutrophic)
Clay increase from A to B 1 horizon	Non-Luvic
Additional features:	
Clay content topsoil	10 – 15 %
Coarse fragments in topsoil	About 50 % fine, medium and coarse gravel
Coarse fragments in subsoil	About 80 % fine, medium and coarse gravel
Depth and type of unspecified material	Not reached
Effective depth: (cm)	≈75[1)]; 75+[2)]

Oakleaf form soils: *Soils with an orthic A- on a neocutanic B horizon on unspecified material without signs of wetness.*

Soil type symbol:	**Oa 1**	**Oa 2**
Soil family	Oa 1110	Oa 1120
Family criteria:		
Bleaching of A horizon	Non-bleached	Non-bleached
Colour of B horizon	Non-Red (grey-yellow)	Yellowish red
Clay increase from A to B	Non-luvic	Non-luvic
Additional features:		
Clay content topsoil	10 - 15%	12 – 15%
Coarse fragments in A horizon	About 50 % fine, medium and coarse gravel	None
Coarse fragments in B horizon	About 80 % fine, medium and coarse gravel	None
Depth to and type of unspecified material	Not reached (Area with high-lying terrace gravels)	Neocutanic to pedocutanic (hardsetting in subsoil)
Effective depth (cm):	≈130[1)]; 75+[2)]	≈50[1)]; 75+[2)]
Soil type symbol:	**Oa 3**	**Oa 4**
Soil family	Oa 1210	Oa 1220
Family criteria:		
Bleaching of A horizon	Non-bleached	Non-bleached
Colour of B horizon	Red	Red
Clay increase from A to B	Non-luvic	Luvic
Additional features:		
Clay content topsoil	18 - 25%	18 – 25%

Coarse fragments in A horizon	None	None
Coarse fragments in B horizon	None	None
Depth to and type of unspecified material	Neocuranic gradually changing to neocarbonate from 120 cm	Neocutanic (hardsetting in subsoil)
Effective depth (cm):	≈120[1]; 75+[2]	≈100[1]; 75+[2]

Oudtshoorn form soils: *Soils with an orthic A- on a neocutanic B horizon on dorbank.*

Soil type symbol:	**Ou 1**
Soil family	Ou 1220
Family criteria:	
Bleaching of A horizon	Non-bleached
Colour of B horizon	Red
Clay increase from A to B	Luvic
Additional features:	
Clay content topsoil	13 - 18 %
Depth to dorbank (db1/nc/sk)	≈50 cm
Coarse fragments in B horizon	Non-gravelly
Effective depth (cm):	≈80[1]; 75+[2]

Sepane form soils: *Soils with an orthic A- on a pedocutanic B horizon on unconsolidated material with signs of wetness.*

Soil type symbol:	**Se 1**
Soil family:	Se 1220
Family criteria:	
Bleaching of A horizon	Non-bleached
Structure of B horizon	Medium/coarse angular blocky
Presence of free lime in B or upper C horizon	Calcareous
Additional features:	
Clay content topsoil	≈20 %
Depth to B horizon	≈20 cm
Coarse fragments in topsoil	Non-gravelly
Depth to and nature of unconsolidated material	≈70 cm; dense wet blocky clay
Effective depth (cm):	≈20[1]; ≈60[2] depending on effectiveness of loosening

Prieska form soils: *Soils with an orthic A- on a neocarbonate B horizon on a hardpan carbonate horizon.*

Soil type symbol:	**Pr 1**	**Pr 2**
Soil family	Pr 1110	Pr 1210
Family criteria:		
Bleaching of A horizon	Non-bleached	Non-bleached
Colour of B horizon	Yellowish	Red
Clay increase from A to B	Non-luvic	Non-luvic
Additional features:		
Free lime in topsoil	Non-calcareous	Non-calcareous
Clay content topsoil	10 - 15 %	15 – 20 %
Depth to hardpan carbonate horizon	≈40 cm	40 cm
Coarse fragments in B horizon	Generally non-gravelly	Non-Gravelly
Effective depth (cm):	≈40[1]; 75+[2]	≈40[1]; 75+[2]

Valsrivier form soils: *Soils with an orthic A- on a pedocutanic B horizon on unconsolidated material without signs of wetness.*

Soil type symbol:	**Va 1**
Soil family:	Va 11/212
Family criteria:	
Bleaching of A horizon	Non-bleached
Colour of B horizon	Non-red to red
Structure of B horizon	Subangular blocky
Presence of free lime in B or upper C horizon	Calcareous
Additional features:	
Clay content topsoil	≈20 %
Depth to B horizon	≈20 cm
Coarse fragments in topsoil	Non-gravelly
Depth to and nature of unconsolidated material	≈50 cm; Reddish neocarbonate material
Effective depth (cm):	≈20[1)]; 75+[2)] depending on effectiveness of loosening

Soil type symbol:	**Va 4**
Soil family:	Va 1212
Family criteria:	
Bleaching of A horizon	Non-bleached
Colour of B horizon	Red
Structure of B horizon	Subangular blocky
Presence of free lime in B or upper C horizon	Calcareous
Additional features:	
Clay content topsoil	≈20 %
Depth to B horizon	≈20 cm
Coarse fragments in topsoil	Non-gravelly
Depth to and nature of unconsolidated material	≈80 cm; Yellowish pedocutanic to neocarbonate material
Effective depth (cm):	≈20[1)]; 65+[2)] depending on effectiveness of loosening

Table 8.5: Limitations of soil types.

i) The following classes and abbreviations are used to qualify the physical soil limitations of the map units

Limitation class	Abbreviation
None	(no symbol)
Low	Low
Moderate	Mod
Severe	Sev
Variable	Var

i) Coarse fragments refer to material larger than 2.0 mm in top- and upper subsoil.
ii) The depth to subsoil limitations is specified in centimetres (cm) following the limitation class.

Soil type symbol	High clay in topsoil	Coarse fragments	Wetness	Alkalinity due to free lime		Dense subsoil clay layer	Stratified alluvium	Subsoil hardpan
				Upper subsoil	Lower subsoil			
Addo form soils: *Soils with an orthic A- on a neocarbonate B horizon on a soft carbonate horizon*								
Ad 1		Low		Mod	Sev			
Ad 2				Mod-Sev	Sev			Low
Ad 3				Mod-Sev	Sev			
Ad 4				Mod	Mod			
Augrabies form soils: *Soils with an orthic A- on a neocarbonate B horizon on unspecified material*								
Ag 1				Low	Low			
Ag 2		Low		Low	Low			
Ag 3				Low	Low			
Brandvlei form soils: *Soils with an orthic A- on a soft carbonate horizon*								
Br 1				Mod 20-30	Sev ≈30	Low 80		
Br 2		Low		Mod 20-30	Sev ≈30			
Coega form soils: *Soils with an orthic A- on a hardpan carbonate horizon*								
Cg 1					Mod 30			Sev ≈30
Cg 2				Mod ≈20				Sev ≈30
Gamoep form soils: Soils with an orthic A- on a red apedal B horizon on a hardpan carbonate horizon								
Gm 1					Low 60			Mod
Hutton form soils: *Soils with an orthic A on on a Red apedal B horizon on unspecified material*								
Hu 1		Mod						
Oakleaf form soils: *Soils with an orthic A- on a neocutanic B horizon on unconsolidated material without signs of wetness*								
Oa 1		High						
Oa 2								
Oa 3								
Oa 4						Low 80		
Oudtshoorn form soils: *Soils with an orthic A- on a neocutanic B horizon on dorbank*								
Ou 1					Low 50			Low 50
Prieska form soils: *Soils with an orthic A on a neocarbonate B horizon on a hardpan carbonate horizon*								
Pr 1				Low ≈10				Sev ≈40
Pr 2				Mod ≈10	Mod ≈40			Mod ≈40
Sepane form soils: *Soils with an orthic A horizon on a pedocutanic B horizon on unconsolidated material with signs of wetness*								
Se 1	Low		Mod 20		Mod ≈20	Mod ≈20		
Valsrivier form soils: *Soils with an orthic A horizon on a pedocutanic B horizon on unconsolidated material without signs of wetness*								
Va 1	Low				Var ≈20	Low≈10		

Table 8.6: Recommended physical soil amelioration measures for deep rooted crops; e.g. citrus.

Notes:

i) The following classes are used to qualify the necessity for a particular amelioration measure

Necessity	Symbol
Not necessary	(No symbol)
Recommended	Recom
Essential	Essen

ii) The following depth classes are used with the recommendations for shift ploughing or ripping

Depth class	Symbol
Shallow	SH
Moderately deep	MD
Deep	DE
Very deep	VD

Soil type	Ridging	Deep soil tillage		Cut-off drainage
		Shift plough (depth)	Ripping (depth)	
Addo form soils: *Soils with an orthic A- on a neocarbonate B horizon on a soft carbonate horizon*				
Ad 1	Recom		Essen DE	
Ad 2	Recom		Essen DE	
Ad 3	Recom		Essen DE	
Ad 4	Recom	Recom MD	Essen DE	
Augrabies form soils: *Soils with an orthic A- on a neocarbonate B horizon on unspecified material*				
Ag 1		Recom MD	Recom DE	
Ag 2		Recom MD	Recom DE	
Ag 3		Recom MD	Recom DE	
Ag 4		Recom MD	Recom DE	
Brandvlei form soils: *Soils with an Orthic A- on a Soft carbonate horizon*				
Br 1	Essen		EssenMD	
Coega form soils: *Soils with an orthic A- on a hardpan carbonate horizon*				
Cg 1	Essen		Essen DE	
Cg 2				
Gamoep form soils: Soils with an orthic A- on a red apedal B horizon on a hardpan carbonate horizon				
Gm 1	Recom		Essen DE	
Hutton form soils: *Soils with an Orthic A- on a Red apedal B horizon on unspecified material*				
Hu 1		Recom MD	RecomDE	
Oakleaf form soils: *Soils with an orthic A- on a neocutanic B horizon on unconsolidated material without signs of wetness*				
Oa 1			RecomDE	
Oa 2				
Oa 3				
Oa 4				
Oudtshoorn form soils: *Soils with an orthic A- on a neocutanic B horizon on dorbank*				
Ou 1		Recom MD	EssenDE	
Prieska form soils: *Soils with an orthic A on a neocarbonate B horizon on a hardpan carbonate horizon*				
Pr 1	Essen		EssenMD	
Pr 2	Essen		EssenDE	
Sepane form soils: *Soils with an orthic A horizon on a pedocutanic B horizon on unconsolidated material with signs* of wetness				
Se 1	Recom		Recom DE	Recom
Valsrivier form soils: *Soils with an orthic A horizon on a pedocutanic B horizon on unconsolidated material without signs* of wetness				
Va 1	Recom	Recom MD	Recom DE	

8.10 ANNEXURE 2

Structure of soil code and explanation of symbols

1 Structure of soil code

The code consists of two series of letter-number symbols, separated by a horizontal line, arranged in the following order:

Position to horizontal line	For description refer to section
Above the line	
Depth of horizons and/or materials	2.1
Soil form	2.2
Soil family	2.3
Subsoil limitations or properties	2.4
Below the line	
Texture of topsoil horizon	3.1
Additional qualifiers	3.2

In a Microsoft Word or Excel table the letter-number symbols can be written in a single line with the “above the line” letter-number symbols followed by the “below the line” letter-number symbols.
In uncultivated soils the term topsoil horizon refers to the natural A horizon, while for cultivated soils it refers to the upper 150 - 300 mm of the soil profile affected by tillage.

2 Classes and symbols for properties above the line

2.1 Horizon and/ or effective depths

The depths of all the diagnostic as well as non-diagnostic horizons and/or materials encountered in a profile are coded with a number symbol in front of the soil form symbol. Depth classes and symbols used are:

Depth class (mm)			Symbol	Depth class (mm)			Symbol
0	.-	150	1	750	-	950	7
150	-	250	2	950	-	1 150	8
250	-	350	3	1 150	-	1 350	9
350	-	450	4	1 350	-	1 550	0
450	-	550	5	>1 550			no symbol
550	-	750	6				

Depth symbols for diagnostic horizons or materials specified in a particular soil form are arranged from shallow (topsoil transition) to deep (deepest subsoil transition) before the form symbol (e.g. 3 5 Es 1100, where 3 refers to the A/E transition and 5 to the E/B transition). Depth symbols for subsoil limitations or properties (arranged from shallow to deep) appear between the depth symbols for diagnostic horizon transitions and the form symbol (e.g. 3 5 3 Es 1100; the second 3 indicates the depth of a subsoil limitation or property.)

2.2 Soil Form

Soil forms and abbreviations used in the soil code are explained by the Soil Classification Working Group (1991). For example Tu is the abbreviation for a Tukulu form soil.

2.3 Soil family

Soil families are identified by a locality name or coded by means of a four-digit symbol (Soil Classification Working Group, 1991). For example 1110 is the four-digit symbol for the Hefnaar soil family of the Augrabies soil form. In the code the four-digit symbol is used directly after the soil form abbreviation symbol; e.g. Ag 1110.

2.4 Subsoil limitations and properties

The depth of soil utilized by plant roots is determined by a variety of soil materials and factors. For example, in the Valsrivier soil form the maximum effective root depth is determined by the pedocutanic B. In those forms where the limiting horizon is part of the defined sequence of horizons that is diagnostic of the soil form, the symbol for the limiting material or horizon do not have to be coded. It is, however, recommended that symbols for all diagnostic horizons are included in the code. If the limiting horizon or material is not included in the sequence of diagnostic horizons, the symbol for the specific horizon or material must be specified after the family number in the code. The depth symbol for such horizons is written between the depth symbol for diagnostic horizons and the soil form symbol. The more important materials that may affect root penetration

and water infiltration to a greater or lesser extent are one or more of the following:

- **Moderate to strongly structured, unconsolidated material without signs of wetness**
  - **vp** - Blocky clay: a non-gleyed soil material with a non-uniform non-red colour and a moderate or stronger structure when moist. It largely meets the requirements of a pedocutanic B horizon
  - **vr** - Blocky clay: a non-gleyed soil material with a uniform red colour and a moderate or stronger structure when moist. It largely meets the requirements of a red structured B horizon
- **Weaker than moderately structured, unconsolidated material without signs of wetness**
  - **nc** - Calcareous unconsolidated material with signs of soil development, e.g. aggregation, clay illuviation and/or disappearance of original stratification. It largely meets the requirements of a neocarbonate B horizon. Red as well as non-red variants occur.
  - **re** - Red, non-calcareous soil material with a structure weaker than moderate blocky or prismatic. It largely meets the requirements of a red apedal B horizon.
  - **sk** - Calcareous material which largely meets the requirements of a soft carbonate horizon.
  - **ye** - Brown or yellow-brown, non-calcareous soil material with a structure weaker than moderate blocky or prismatic. It largely meets the requirements of a yellow-brown apedal B horizon.
  - **Note:** The colour of certain of these horizons/materials (e.g. **nc**) might be important for land use interpretation and soil suitability evaluation. In such cases the dominant colour should be coded by using the following colour abbreviation symbols: **dkgr** = dark grey; **gr =** grey; **grye** = grayish yellow; **re =** red; **ye =** yellow and **yere** = yellowish red. For example, the combined symbol **nc/yere** (horizon/material symbol linked to the colour symbol with forward slash) refers to a yellowish red neocarbonate horizon/material.
- **Textural stratification in diagnostic and non-diagnostic unconsolidated material**
  Depending on the mode of transport (water or wind) and deposition, some unconsolidated materials are texturally stratified. However, with time soil development may result in the disappearance of the stratification. However, in certain young soils stratification can still be detected. Since textural stratification is an important characteristic in land use, it has to be indicated in the code in the following way:

Description	Symbol
Textural stratification non-prominent or absent	
Predominantly loamy or porous silt	U6

3 Classes and symbols for properties below the line

3.1 Texture of topsoil and directly underlying E or apedal B1 horizon

The texture is coded in terms of the:

- sand grade for soils with less than 20% clay and
- clay content (percentage).

Classes and abbreviations for sand grade clay content are the following:

Sand grade	Symbol
fine	fi
Clay content	**Symbol**
15 – 20	4
20 – 35	5

Examples:
- A topsoil developed from parent material with 18 % clay and fine sand grade is coded by the symbol **fi 4**.
- In cases where the clay content is on or near the boundary between two classes, e.g. 23 %, it should be coded as **fi 4/5**.

3.2 Additional qualifiers

- **Tge** Other (general) topsoil related features
  Tge-nca - Non-calcareous A horizon: Having a non-calcareous topsoil horizon (associated with soils where the subsoil is calcareous by definition e.g. neocarbonate, soft carbonate or within certain families, e.g. pedocutanic B)
  Tge-cal - Calcareous A horizon: Having a calcareous upper or whole part of the topsoil that is calcareous lying on a subsoil that is non-calcareous. Calcareous nature due to natural factors such as dust blown in. It is optional to use this symbol also for a soil having a calcareous topsoil in soils where the subsoil is also calcareous by definition e.g. neocarbonate, soft carbonate or within families, e.g. pedocutanic B

4 Examples of a fully coded description

Although the sequential position of the symbols for certain components used in the soil code is fixed, the sequence of non-diagnostic subsoil limitations and their respective depth symbols can be coded in more than one way. The detail that soil surveyors want to include in the code may also differ. For this reason a few examples will discussed as guidelines for individuals that is not familiar with the code.

Example:

Dystrophic, luvic Hutton form soil with an A/B transition at 300 mm, extremely hard ferricrete (hard plinthite) at 850 mm and stoneline at 500 mm. The topsoil contains 15 % coarse gravel and 35 % stones, 15 – 20 % clay, and has a coarse sand grade. The clay content of the B is constant with depth. The code for this soil may be written in one of the following ways:

Field code 1 3 7 5 Hu1200 re hp2 sl
2g+4k co4

Field code 2 3 5 7 Hu1200 sl hp2
2g+4k co4

Word/Excel format 1 3 7 5 Hu1200 re hp2 sl
followed in same line by a double forward slash and then
2g+4k co4

Word/Excel format 2 3 7 5 Hu1200 hp2 sl
followed in same line by a double forward slash and then
2g+4k co4

Note: Field code 1 and Word/Excel format 1 is the preferred way of coding.
It is recommended that when the code is captured in a Word or Excel format table, the separate items of the code should each constitute a separate column. The following can be used as an example of a Word format table:

Profile number	Depth codes	Soil form and family	Subsoil limitations/ properties				Topsoil			Wetness class	Changed properties or condition
			Upper subsoil	Middle subsoil	Lower subsoil	Coarse fragments	Coarse fragments	Sand grade	Clay class		
1	2 4 6 2	Tu 2110	ne/ye	gs+4g	vp	3f+2g	2f	co	3	3	md 7
2	3 6 8 3	Es 1100	pr	sw		6f	4f	fi	2/3	6	dr

The subsoil limitations/properties are sequentially linked to the depth codes from right to left. For example:

Profile 1

Depth codes	2	4	6	2
	↓	↓	↓	↓
Subsoil limitations/properties	ne/ye	gs+4g	vp	3f + 2g
Upper and lower depth of subsoil limitation/property	20 - 40 cm	40 - 60 cm	60 cm and deeper	20 – 40 cm

Profile 2

Depth codes	3	6	8	3
	↓	↓	↓	↓
Subsoil limitations/properties		pr	sw	6f
Upper and lower depth of subsoil limitation/property	30 - 60 cm	60 - 85 cm	85 cm and deeper	30 – 60 cm

The first 3 in the depth code refer to the boundary between the orthic A and the E horizon.

8.11 ANNEXURE 3

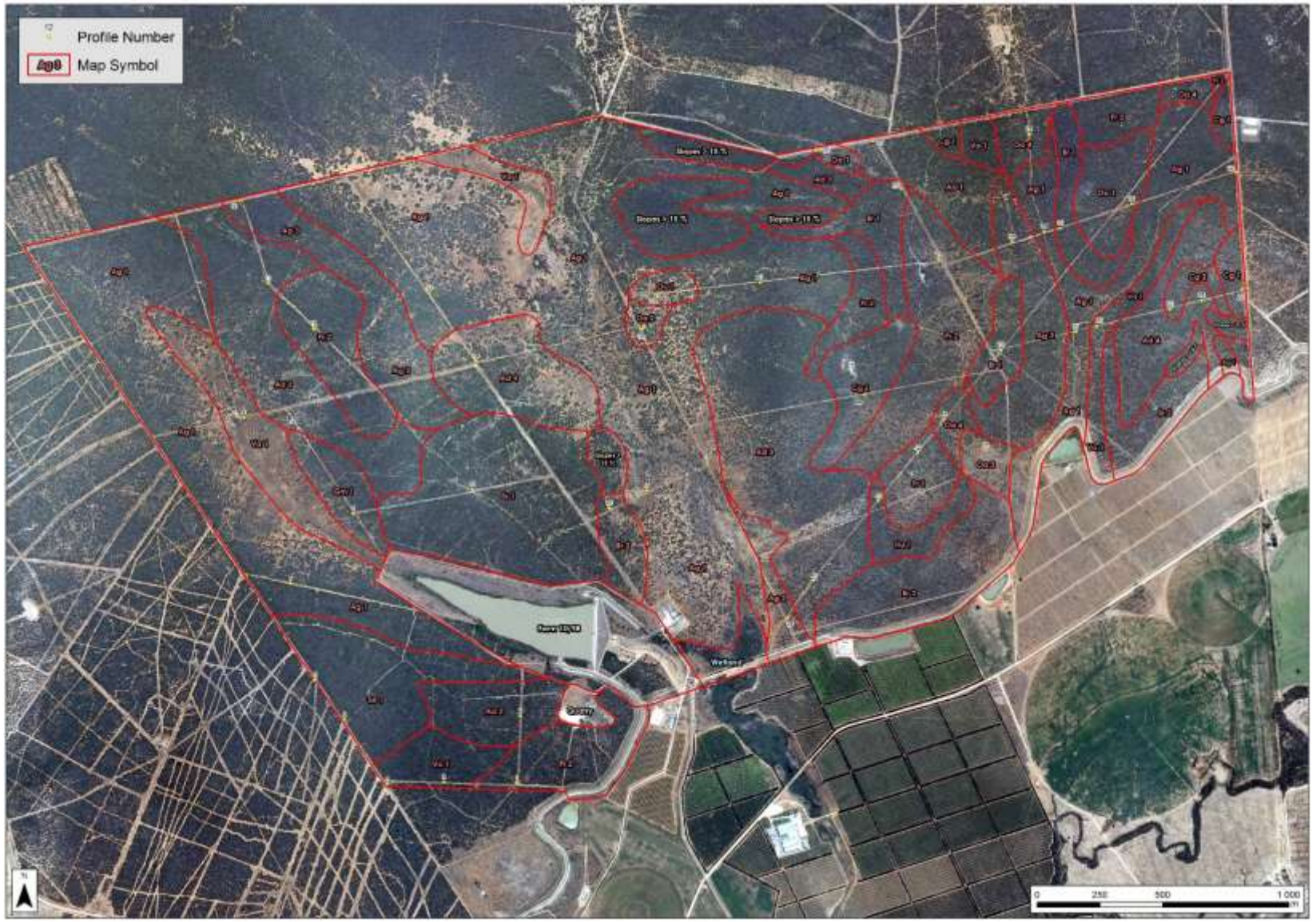

Figure 8.1: Soil map of Scheepers Vlakte Farm.

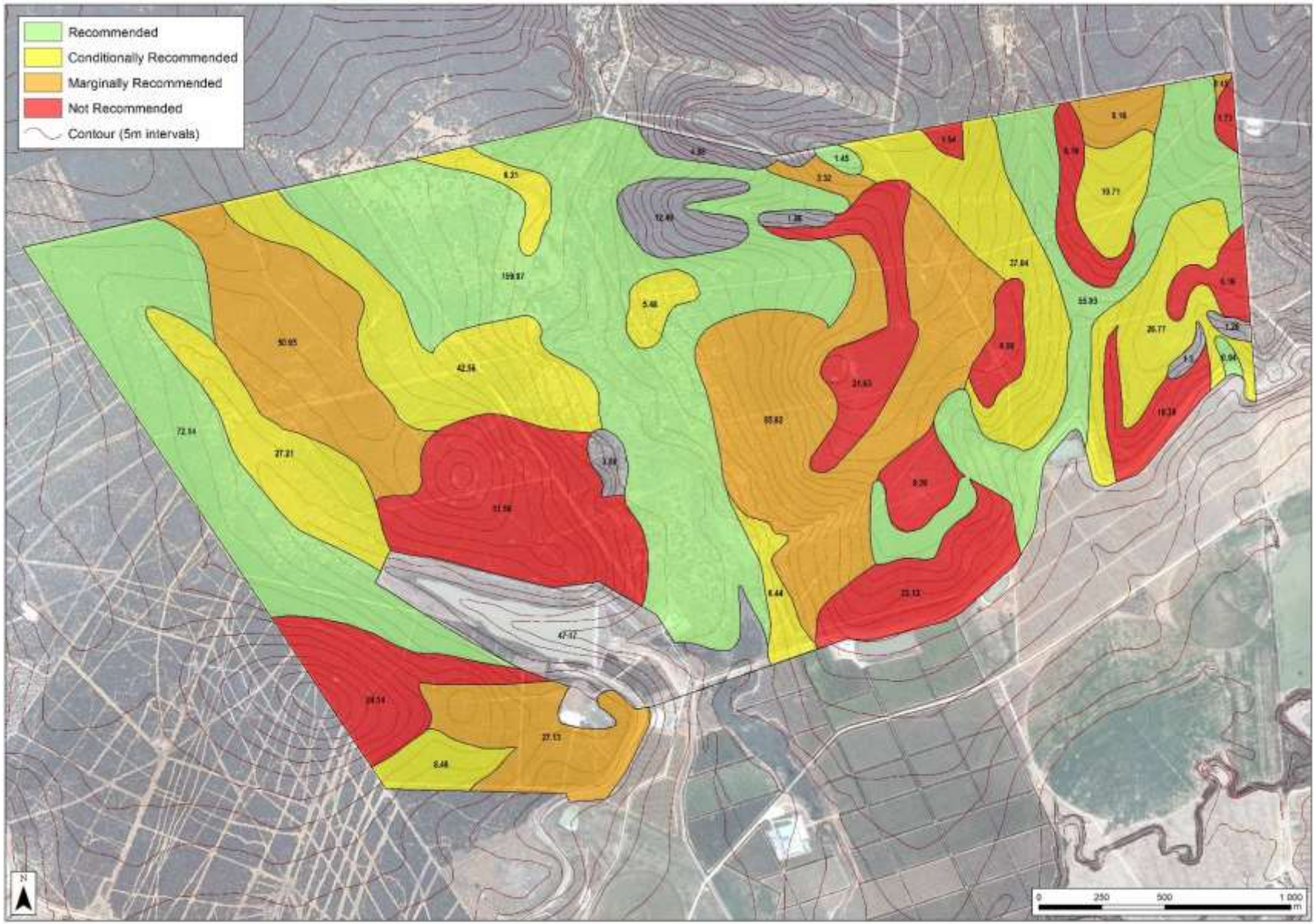

Figure 8.2: Soil suitability for citrus (ha given inside each unit).

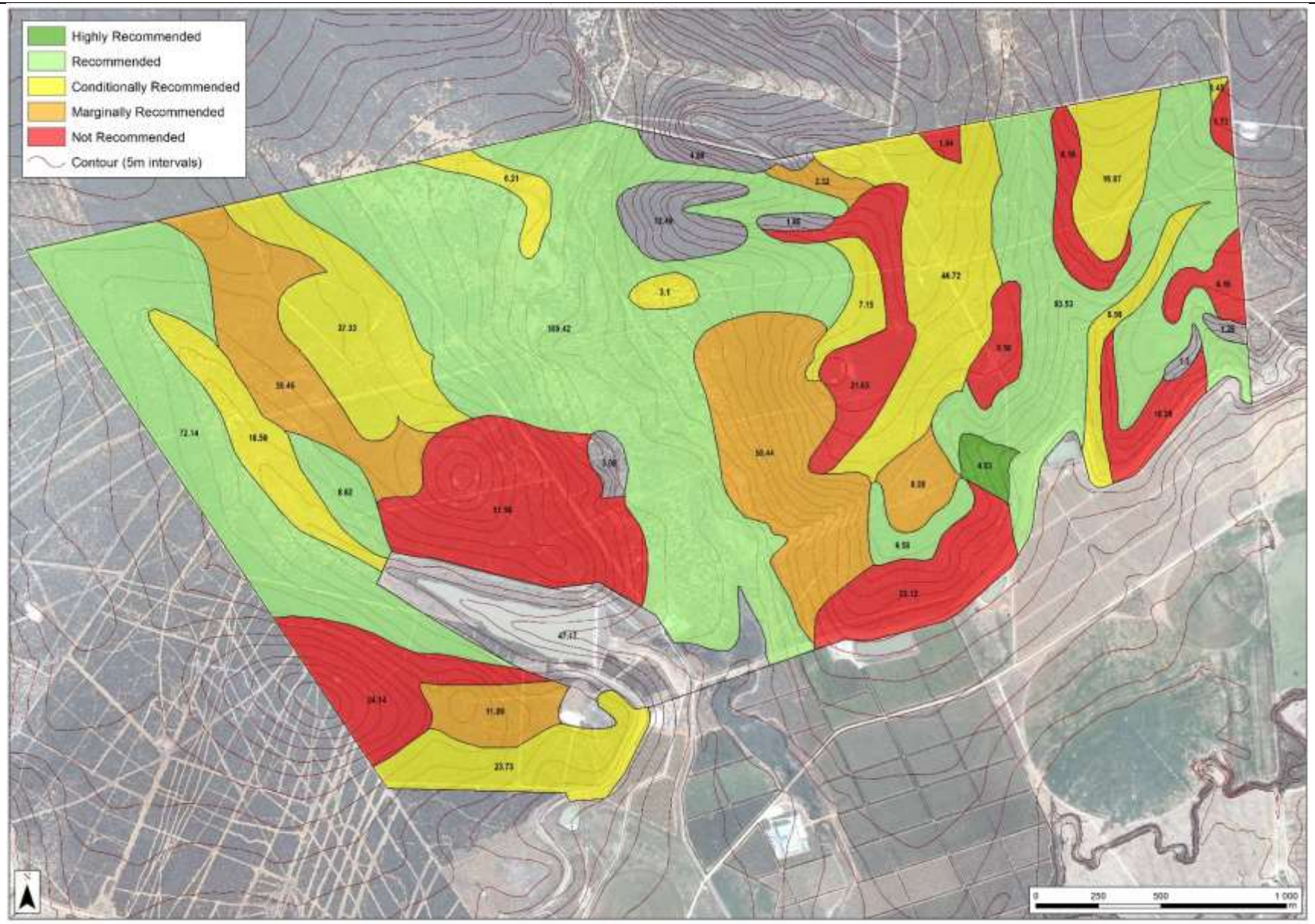

Figure 8.3: Soil suitability for annual crops (ha given inside each unit).

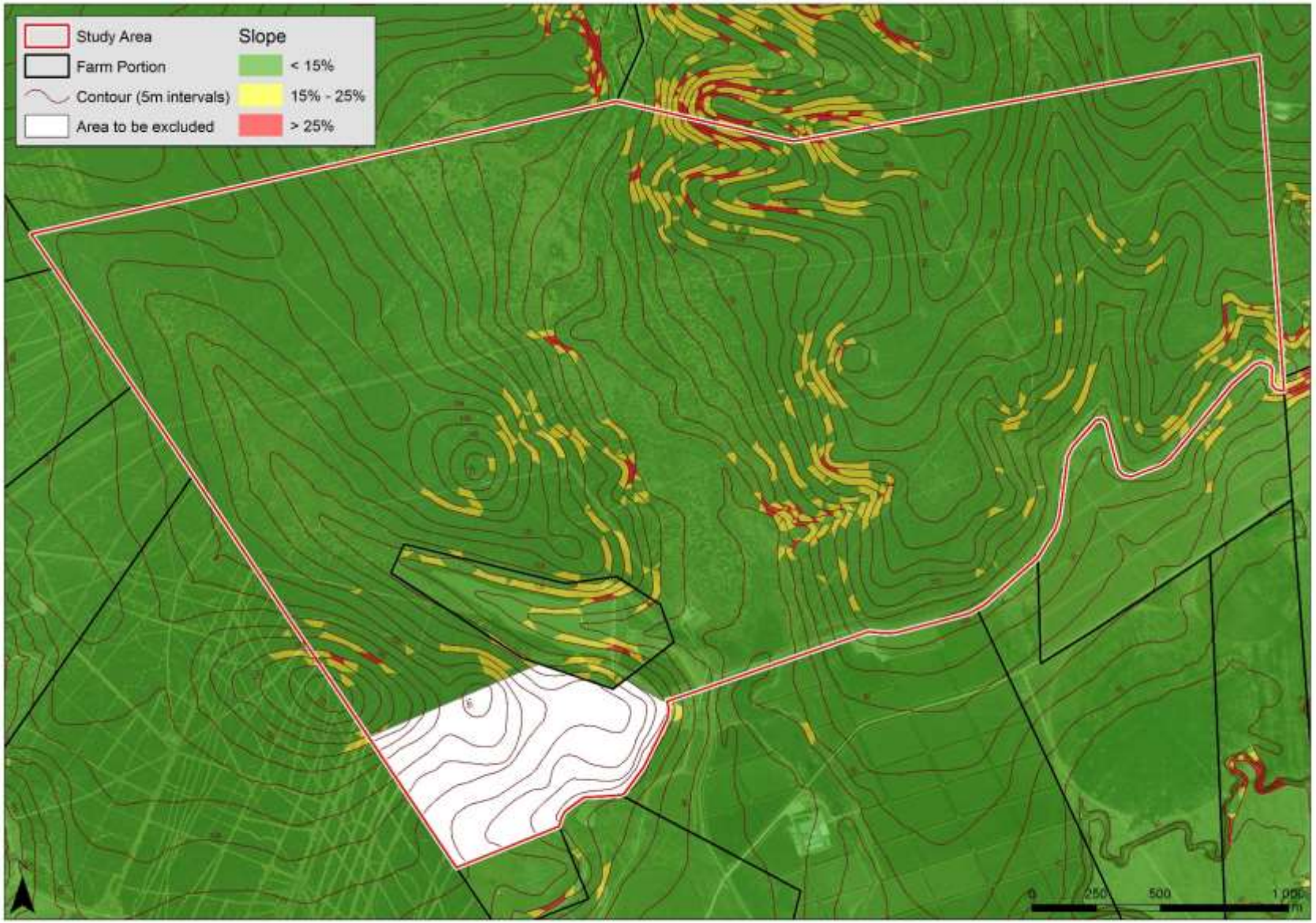

Figure 8.4: Slope analyses of Scheepers Vlakte Farm (area shown as to be excluded is now included in survey area).

8.12 ANNEXURE 4

Figure 8.5: Profiles of previous soil report, plotted after reclassification as given in Table 8.7, Annexure 4.

Table 8.7: Reclassified previous soil profiles.

Adjusted map symbol	Previous soil classification	Previous profile number
Ad 2	Ad 1111	P53
Ag 1	Ag 1110	P1
Ag 1	Ag 1110	P12
Ag 1	Ag 1110	P13
Ag 1	Ag 1110	P14
Ag 1	Ag 1110	P15
Ag 1	Ag 1110	P16
Ag 1	Ag 1110	P17
Ag 1	Ag 1110	P18
Ag 1	Ag 1110	P23
Ag 1	Ag 1110	P24
Ag 1	Ag 1110	P25
Ag 1	Ag 1110	P27
Ag 1	Ag 1110	P4
Ag 1	Ag 1110	P59
Ag 1	Ag 1110	P60
Ag 1	Ag 1110	P61
Ag 1	Ag 1110	P62
Ag 1	Ag 1110	P63
Ag 1	Ag 1210	P10
Ag 1	Ag 1210	P11
Ag 1	Ag 1210	P19
Ag 1	Ag 1210	P39
Ag 1	Ag 1210	P49
Ag 1	Ag 1210	P6
Ag 1	Ag 1210	P65
Ag 1	Ag 1210	P67
Ag 1	Ag 1210	P68
Ag 1	Ag 1210	P69
Ag 1	Ag 1210	P7
Ag 1	Ag 1210	P8
Ag 1	Ag 1210	P9
Br 1	Br 1000	P21
Br 1	Br 1000	P22
Br 1	Br 1000	P28
Br 1	Br 1000	P30
Br 1	Br 1000	P32
Br 1	Br 1000	P35
Br 1	Br 1000	P38
Br 1	Br 1000	P43
Br 1	Br 1000	P44
Br 1	Br 1000	P45
Br 1	Br 1000	P46
Br 1	Br 1000	P55
Br 1	Br 1000	P56
Br 1	Br 1000	P58
Br 1	Br 1000	P70
Cg 1	Cg 1000	P20
Cg 1	Cg 1000	P31
Cg 1	Cg 1000	P33
Cg 1	Cg 1000	P47
Cg 1	Cg 1000	P48
Cg 1	Cg 1000	P51
Cg 1	Cg 1000	P52
Cg 1	Cg 1000	P57
Oa 1	Cv 3100	P26
Oa 1	Cv 3100	P64

Ag 1	Cv 3100	P71
Oa 1	Gf 2100	P54
Ag 1	Hu 3100	P66
Ag 1	Hu 3200	P34
Ag 1	Hu 3200	P36
Ag 1	Hu 3200	P37
Ag 1	Hu 3200	P40
Ag 1	Hu 3200	P41
Ag 1	Hu 3200	P50
Se 1	Se 1120	P2
Va 1	Va 1112	P42