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AGRICULTURAL SUITABILITY ASSESSMENT FOR ORCHARD ESTABLISHMENT ON PORTION 4 OF FARM 172 KELLERSHOOGTE NEAR OUDTSHOORN

Report by
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1 INTRODUCTION AND AIM

The aim of this assessment was to assess the suitability of a site on Portion 4 of Farm 172 Kellershoogte for the establishment of almond orchards. The locality of the site is shown in Figure 1. An area of 8 hectares of orchard was established in 2021 (see Figure 2), with the intention of planting more. This triggered a 24G process in terms of NEMA due to the cultivation of virgin soil. As agreed with the Department of Forestry Fisheries and the Environment (DFFE), the 24G process currently being applied for, covers the entire intended planting area of approximately 55 hectares (see Figure 2), to prevent the farmer from having to make two separate applications for essentially the same thing.

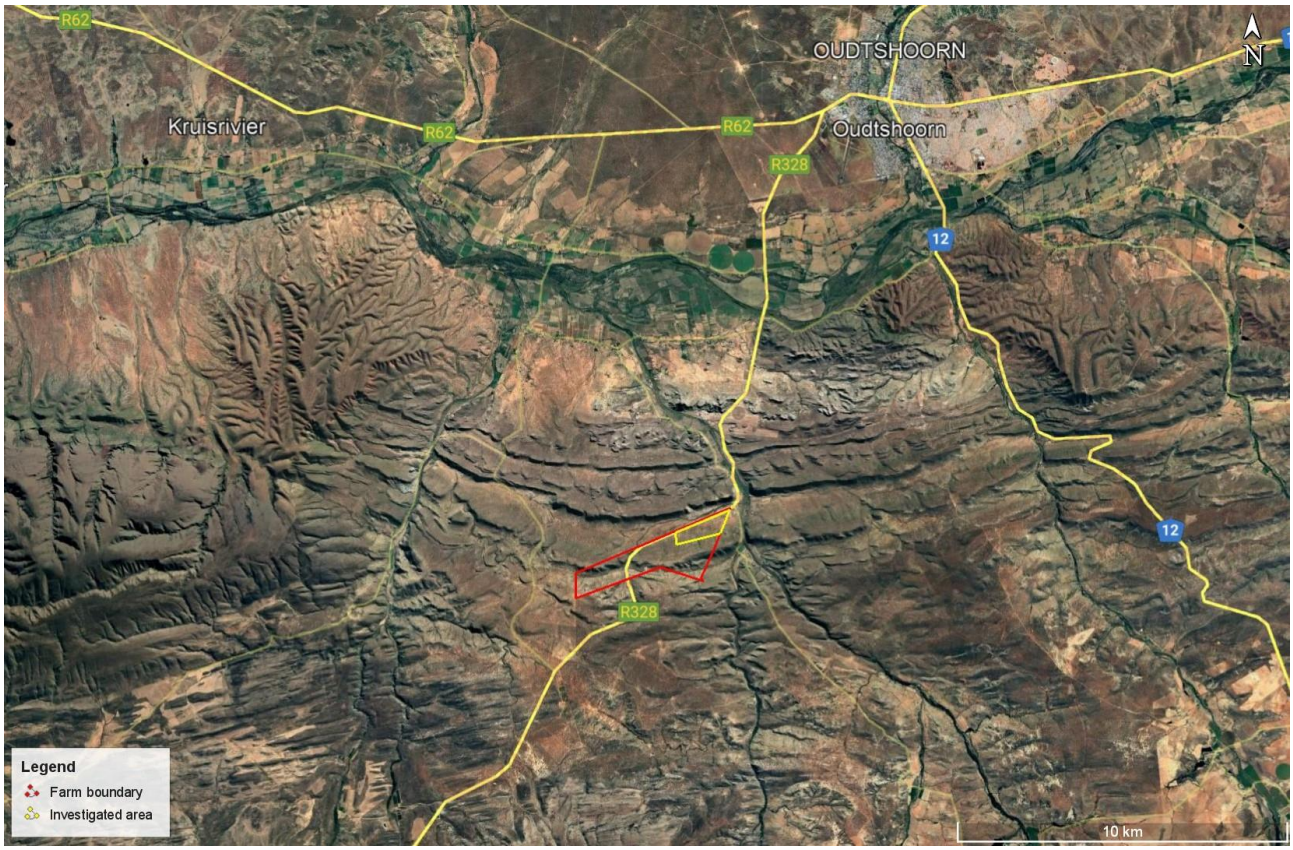

Figure 1. *Locality map of the proposed farm and investigated area south of Oudtshoorn.*

It should be noted that this assessment is not an agricultural impact assessment in the usual sense of such an assessment. The main impact of concern in agricultural impact assessments is the loss of agricultural production land. In this case, agricultural production land and production potential are being created by the activity that has triggered the assessment. The aim of this assessment is therefore to confirm whether the site is viable or not for the crop that is proposed, and that the soil resources on the site will not be damaged by the proposed activity.

It should further be noted that the screening tool agricultural sensitivity of the site, which focuses

on the value of agricultural land with respect to its potential loss, and the associated site sensitivity verification, is not relevant in the case of orchard establishment.

2 METHODOLOGY

The assessment was based on an on-site investigation of the soils and agricultural conditions and was also informed by existing soil and agricultural potential data for the site. Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries (DAFF). Rainfall and evaporation data was sourced from the SA Atlas of Climatology and Agrohydrology (2009, R.E. Schulze) available on Cape Farm Mapper.

The soil investigation was not based on a formal grid of test points but on hand augered cores in strategic places, on indications of the surface conditions, topography, and the investigation of some existing excavations. Soils were classified according to the South African soil classification system (Soil Classification Working Group, 1991). This level of soil assessment is considered entirely adequate for an understanding of on-site soil potential for the purposes of this assessment, largely because of the relative uniformity of soil conditions across much of the site.

Information on the quantity and quality of available irrigation water was sourced from Steenekamp (2020).

3 ASSUMPTIONS, UNCERTAINTIES OR GAPS IN KNOWLEDGE OR DATA

There are no specific assumptions, uncertainties or gaps in knowledge or data that affect the findings of this study.

4 RESULTS

A satellite image map of the investigated area is given in Figure 2, and site photographs are given in Figures 3 to 5.

The site lies on the north facing foot-slope of a low mountainous ridge. The slope gradient across the majority of the site is an average of approximately 6%, but it steepens on the upper southern side behind the site.

The geology is siltstone, shale and argillaceous sandstone of the Bokkeveld Group. Almost all the soils in the land type are shallow on underlying weathered rock and this is the same across the site where shallow soils predominantly of the Glenrosa soil form were identified. The clay content of the topsoil was estimated at 15%.

When the weathered rock of the B and C horizons of Glenrosa soils like these is sufficiently broken by ripping during soil preparation, the resultant medium, even though it is very rocky, is highly suitable as a rooting medium for orchard trees.

Figure 2. *Satellite image map showing the recommended planting area.*

The climate of the general area is known to be suitable for a range of orchard crops and there is nothing about the site itself that would create an unfavourable micro-climate. The north facing slope would not be prone to frost. The low rainfall of the area is irrelevant because the trees will be irrigated.

The salinity of both the soil and of the irrigation water is cause for concern. The salinity of the soil is likely to be high. It was not sampled and analysed but there are clear indications in the field of salinity. Furthermore the breaking of shale at soil preparation tends to result in a release of salt into the root zone soil with a resultant increase in soil salinity.

Water quality parameters for the available boreholes as given by Steenekamp (2020) are shown in Table 1. Table 2 provides the classification of irrigation water in the South African Water Quality Guidelines (WRC, 2020). Both of the boreholes fall into Class 4 for all four of the parameters in Table 2. Class 4 is the lowest quality water and is considered unsuitable for irrigation.

Table 1. Water quality parameters for Kellershoogte boreholes as given by Steenekamp (2020).

Parameter	KBH02	KBH03	KBH04
EC (mS/m)	303	289	324
SAR	6.9	6.8	
Cl	650	650	
Na	425	404	
Ca	140	143	
Mg	88	75	

The available borehole water is too saline, if it were the only source of water, to sustain almond production in the long term. However, low salinity *leibeurt* water is available from the Kandelaars River and the intention is to use this when it is available in order to irrigate the orchards with good quality water whenever possible. This is to prevent salt build up in the soil. During the recent drought years there has been no water flow in the Kandelaars River but in 2022 the river has flowed again. Application of low salinity water to the saline soil will cause dispersion of clay which will impede water infiltration. With drip irrigation, water infiltration is less of an issue, but it is still recommend that mulch be applied to the tree rows to facilitate water infiltration, which will be important for the infiltration of rain.

It should be noted that the young orchard has performed well, despite having been irrigated predominantly with borehole water that has high salinity.

In terms of water quantity, the final recommended sustainable yields of the sum of the three available boreholes was determined by Steenekamp (2020) to be 422,750m^3/year. This is sufficient water for the irrigation of the 55 hectares to be planted, especially since additional water will be applied from the river.

Table 2. Various limits for specific problems with irrigation water (WRC, 2020).

Water quality constituent	**Fitness for use for irrigation**			
	Good	**Fair**	**Marginal**	**Unacceptable**
	(Class 1)	**(Class 2)**	**(Class 3)**	**(Class 4)**
	Salinity and sodicity			
Electrical conductivity (mS/m)	0-40	40-90	90-270	270-540
Sodium absorption ratio (SAR)	0-1.5	1.5-3.0	3.0-5.0	5.0-10
	Potentially toxic ions			

Chloride (mg/kg)	0-105	105-140	140-350	>350
Sodium (mg/kg)	0-69	69-115	115-161	161-207

Figure 3. *View of the young, established orchard, showing the rockiness of the soils. The young orchard has performed well, despite having been irrigated predominantly with borehole water that has high salinity.*

Figure 4. *View from north, looking down-slope across the site to the orchard at the bottom.*

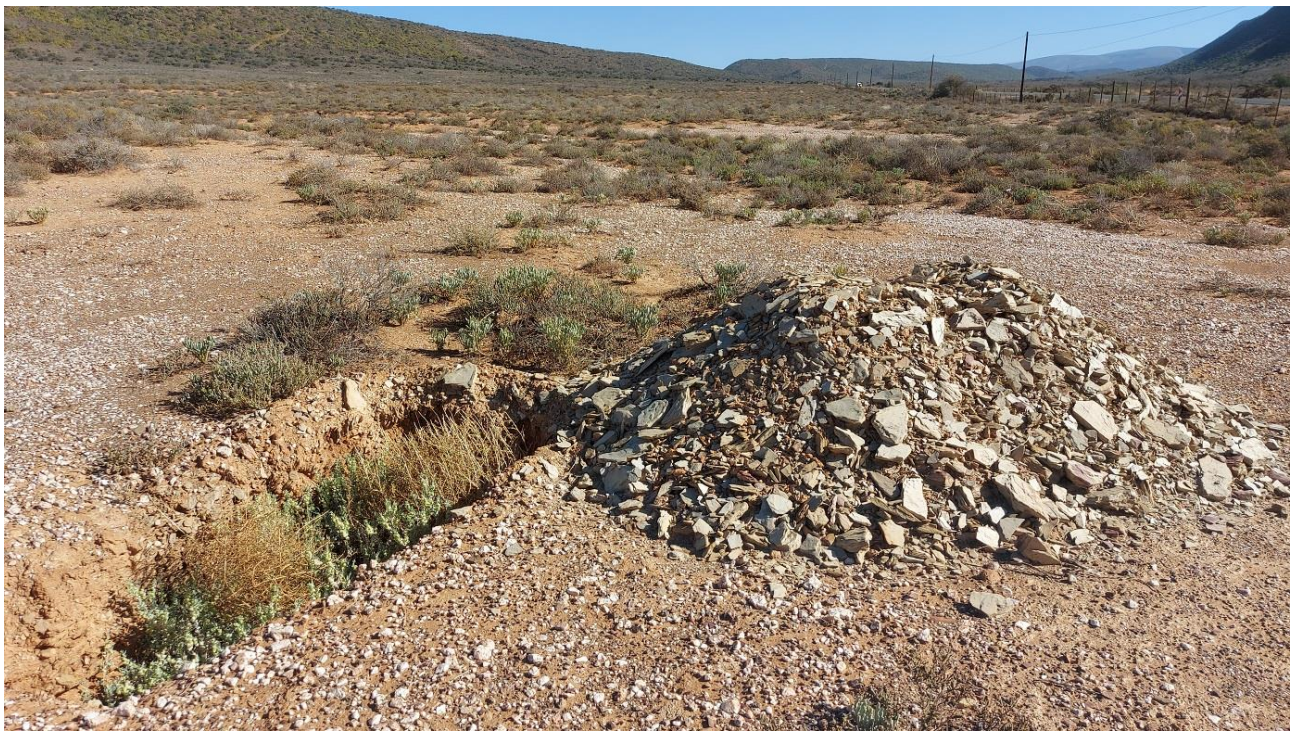

Figure 5. *View looking westwards across the site from the end of the orchard. The nature of the root zone that will be created after soil preparation is visible in the heap of excavated material.*

5 CONCLUSION

A soil investigation of the site confirmed that the soil is suitable for almond orchards. The soils are shallow Glenrosa soils on underlying weathered rock. When the weathered rock of the B and C horizons of Glenrosa soils like these is sufficiently broken by ripping during soil preparation, the resultant medium, even though it is very rocky, is highly suitable as a rooting medium for orchard trees. The recommended area in Figure 2 is considered to be the most suitable part of the site for orchard establishment, and will therefore be the application area in terms of the 24G process.

The soil as well as the borehole water that is partly used for irrigation has salinity limitations. If this were the only available water for irrigation, it would have considerable risk for the sustainability of the almond orchards. However, low salinity *leibeurt* water is available from the Kandelaars River. The use of this water to irrigate the orchards whenever possible is likely to prevent salt build up in the soil and thereby ensure the sustainability of the orchards.

The sustainable yield of available borehole water was determined to be 422,750m^3/year. This is a sufficient quantity of water for the irrigation of the application area, especially since additional water will be applied from the river.

The site is considered suitable for orchard establishment in terms of soil, climate, slope and the availability of irrigation water. From an agricultural suitability point of view, it is recommended that

the application be approved.

6 RECOMMENDATIONS

Salinity management will be important and will be dependent on leaching salts from the soil through applications of non-saline river water. River water should be applied instead of borehole water as much as possible. Potential salinity build-up in the soil should be monitored. Mulch should be used on the tree rows to facilitate water infiltration.

In terms of soil preparation, deep cross-ripping at approximately 45 degrees between rip directions and with the second, deepest action directly downhill is recommended to create sufficient rooting depth and to facilitate drainage out of the soil. The drainage is important to leach salinity from the root zone.

7 REFERENCES

Department of Agriculture, Forestry and Fisheries (DAFF), 2002. National land type inventories data set. Pretoria.

Soil Classification Working Group. 1991. Soil classification: a taxonomic system for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria.

Steenekamp, G. 2020. Kellershoogte: Report on geohydrological investigation as technical input to the water use license application. Unpublished Report.

Water Research Commission. 2020. Irrigation user manual. WRC report no. TT 819/2/20
ISBN 978-0-6392-0146-7. Available at www.wrc.org.za.

APPENDIX 1: SPECIALIST CURRICULUM VITAE

Johann Lanz
Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - 1997
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I have been registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science since 2012 (registration number 400268/12) and am a member of the Soil Science Society of South Africa.

Soil & Agricultural Consulting **Self employed** **2002 - present**

Within the past 5 years of running my soil and agricultural consulting business, I have completed more than 170 agricultural assessments (EIAs, SEAs, EMPRs) in all 9 provinces for renewable energy, mining, electrical grid infrastructure, urban, and agricultural developments. I was the appointed agricultural specialist for the nation-wide SEAs for wind and solar PV developments, electrical grid infrastructure, and gas pipelines. My regular clients include: Zutari; CSIR; SiVEST; SLR; WSP; Arcus; SRK; Environamics; Royal Haskoning DHV; ABO; Enertrag; WKN-Windcurrent; JG Afrika; Mainstream; Redcap; G7; Mulilo; and Tiptrans. Recent agricultural clients for soil resource evaluations and mapping include Cederberg Wines; Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; and Goedgedacht Olives.

In 2018 I completed a ground-breaking case study that measured the agricultural impact of existing wind farms in the Eastern Cape.

Soil Science Consultant **Agricultural Consultors International (Tinie du Preez)** **1998 - 2001**

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist **De Beers Namaqualand Mines** **July 1997 - Jan 1998**

Completed a contract to advise soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

APPENDIX 2: DECLARATION OF THE SPECIALIST

Note: Duplicate this section where there is more than one specialist.

I, **Johann Lanz**, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
  - other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
  - ~~am not independent, but another specialist that meets the general requirements set out in Regulation 13 have been appointed to review my work (Note: a declaration by the review specialist must be submitted);~~
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

Signature of the specialist: 

Date: **29 July 2022**

Name of company: **Johann Lanz – soil scientist (sole proprietor)**