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Soil and Agricultural Potential Scoping Report for the Proposed Vrede Solar Energy Facility

Submitted by TerraAfrica Consult cc

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19 November 2020

Declaration of the Specialist

Details of Specialist

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Declaration of Independence

I, Mariné Pienaar, hereby declare that TerraAfrica Consult, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

I further declare that I was responsible for collecting data and compiling this report. All assumptions, assessments and recommendations are made in good faith and are considered to be correct to the best of my knowledge and the information available at this stage.

TerraAfrica Consult cc represented by M Pienaar
24 October 2020

1. INTRODUCTION

Terra-Africa Consult cc was appointed by Savannah Environmental (Pty) Ltd to conduct the agricultural agro-ecosystem specialist assessment as part of the Scoping and Environmental Impact Assessment process for the proposed development of a solar energy facility.

The development area for this project are located approximately 13 km south-west of Kroonstad within in the Moqhaka Local Municipality which falls within jurisdiction of the Fezile Dabi District Municipality of the Free State Province (**Figure 1**). The proposed infrastructure will be developed on the following properties:

- Remainder of the Farm Vrede 1125
- Portion 1 of the Farm Uitval 1104

These properties are collectively referred to as the project site and have a combined extent of around 538ha. Within this area, a development area of approximately 279ha has been identified as the planned area for the Vrede Solar PV Facility.

2. TERMS OF REFERENCE

The terms of reference applicable to the soil and agricultural potential scoping assessment include the following:

- Conduct a desktop assessment of the baseline soil and agricultural properties for the proposed development area.
- Identify site sensitivities to the proposed project pertaining to the soil properties, associated land capabilities and the agricultural potential of the project area.
- Identify potential impacts that will be caused by the project and that will have to be assessed as part of the detail study phase.
- Identify a plan of study that will include the methodology to be followed during the detailed soil and agricultural potential impact assessment that will form part of the final EIA report that will be submitted.

3. METHODOLOGY

The proposed development area was superimposed on four data sets to determine the anticipated sensitivities of the properties to the development. The data sets are:

- The newly released National Land Capability Evaluation Raster Data Layer was obtained from the DAFF to determine the land capability classes of the development area assessment zone according to this system. The data was developed using a spatial evaluation modelling approach (DAFF, 2017).

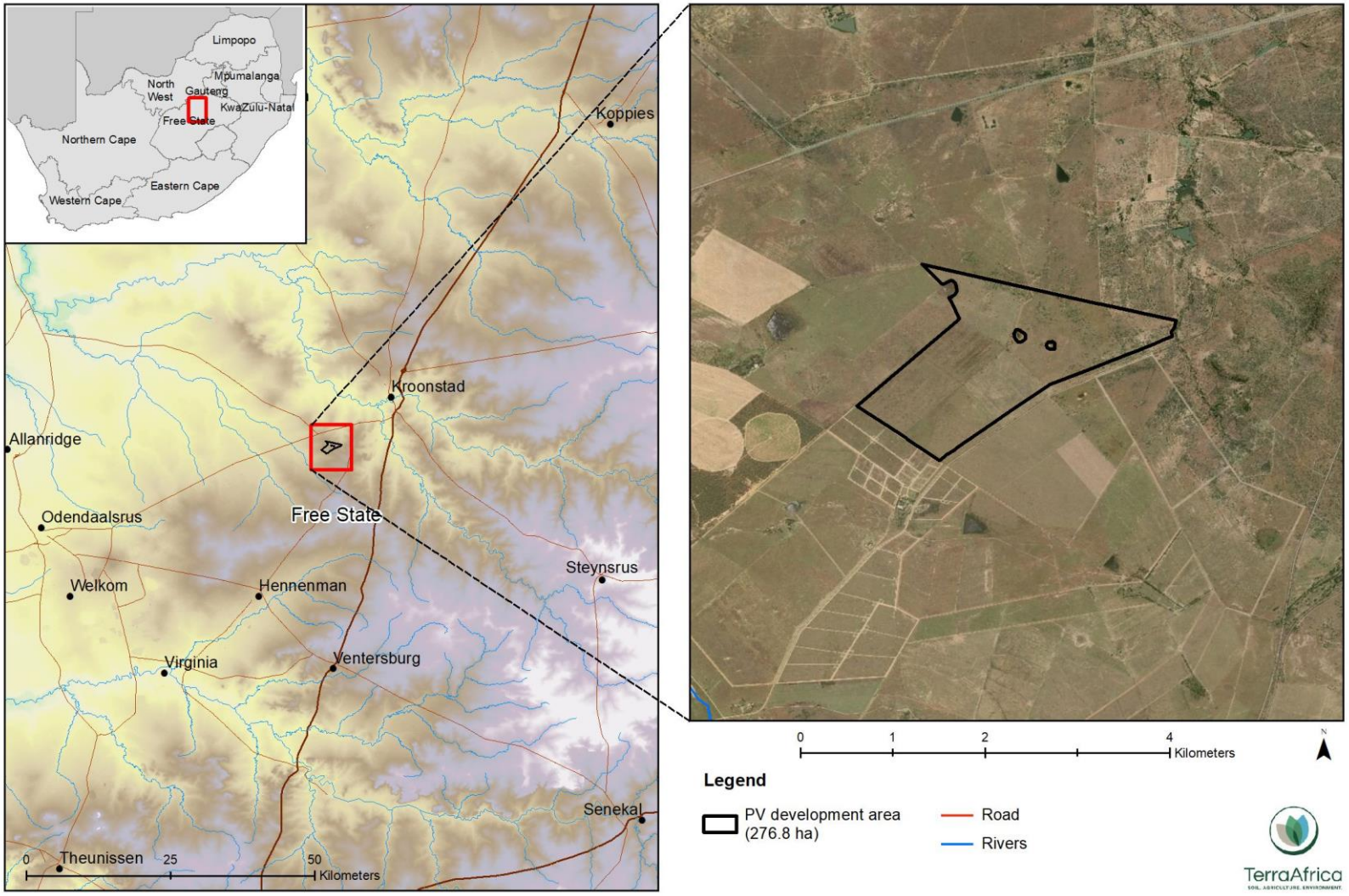

Figure 1 Locality of the proposed Vrede PV Facility

- The long-term grazing capacity for South Africa 2018 was analysed for the area and surrounding area of the project assessment zone. This data set includes incorporation of the RSA grazing capacity map of 1993, the Vegetation type of SA 2006 (as published by Mucina L. & Rutherford M.C.), the Land Types of South Africa data set as well as the KZN Bioresource classification data. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition.
- The Free State Field Crop Boundaries (November 2019) was analysed to determine whether the proposed PV development area falls within the boundaries of any crop production areas. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, viticulture, old fields, small holdings and subsistence farming.
- Land type data for the development area was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units.

4. BASELINE DESCRIPTION

4.1 Land capability

The Vrede Solar PV Facility development area includes five different land capability classes according to the land capability data (DAFF, 2017). **Figure 2** indicates the position of the different classes within the farm portions that form the proposed development area. The entire development area largely consists of land with Moderate (Class 8) to Moderate High (Class 9) land capability. Smaller patches in the centre and south-west consist of land with Low-Moderate (Classes 06 and 07) land capability. Classes 08 and 09 have potential for the production of specific crops under rainfed conditions while classes 06 and 07 are likely to be very marginal arable land that is more suitable for livestock grazing.

4.2 Field crop boundaries

The Vrede Solar PV Facility development area includes areas where field crops have previously been produced. Although the DAFF data layer indicates these areas still as rainfed annual crops (or planted pastures) (see Figure 3), the development area consists only of pasture and planted pastures since 2005. The landowner has confirmed that he could not continue to cultivate grain crops on the farm as it was economically non-viable.

Several pivot irrigation fields are located outside the development area, mostly south-west and south of it. Large fields with rainfed crops and/or planted pastures are located to the west and south of the development area with old fields to the north.

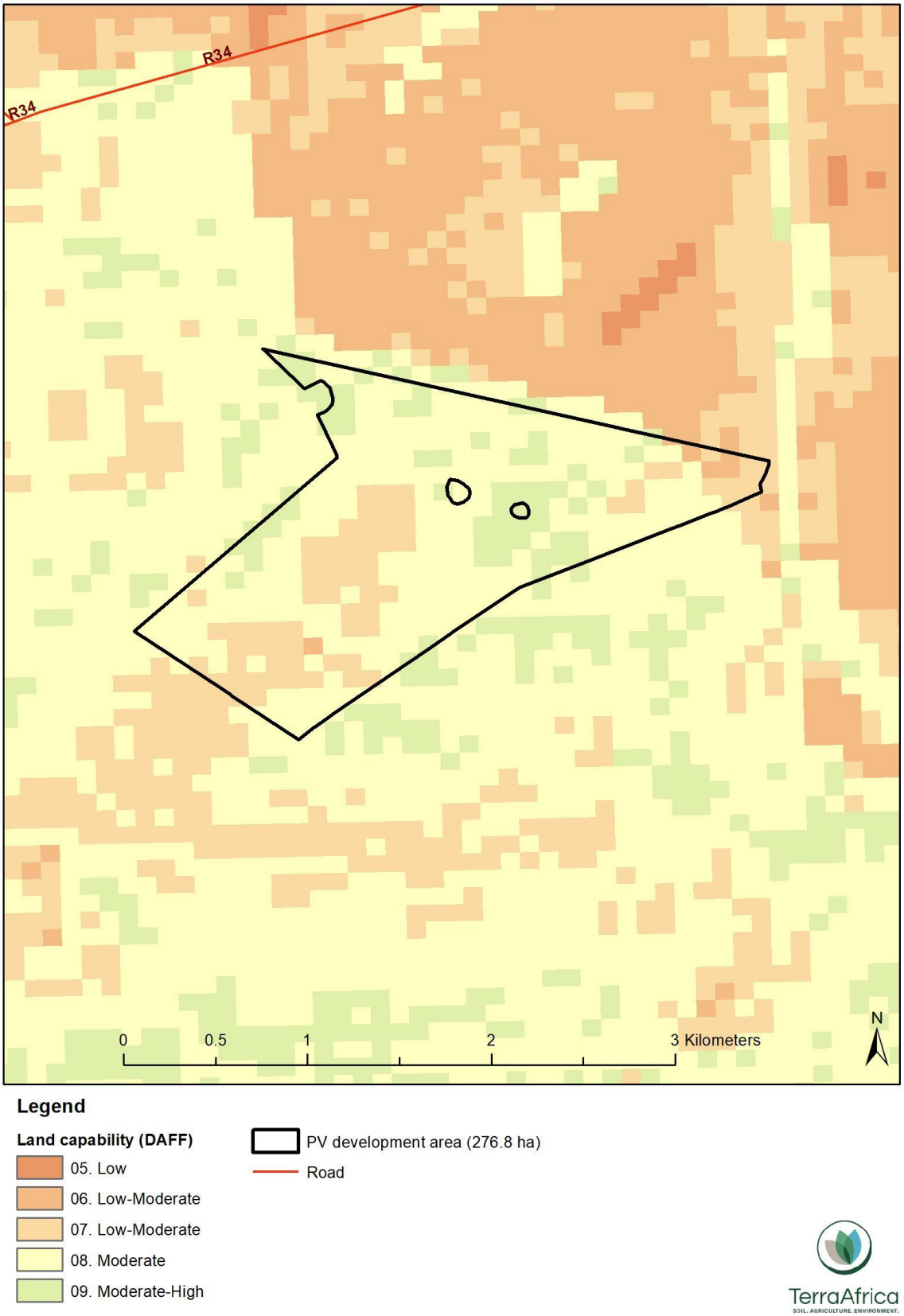

Figure 2 Land capability classification of the proposed Vrede Solar PV Facility

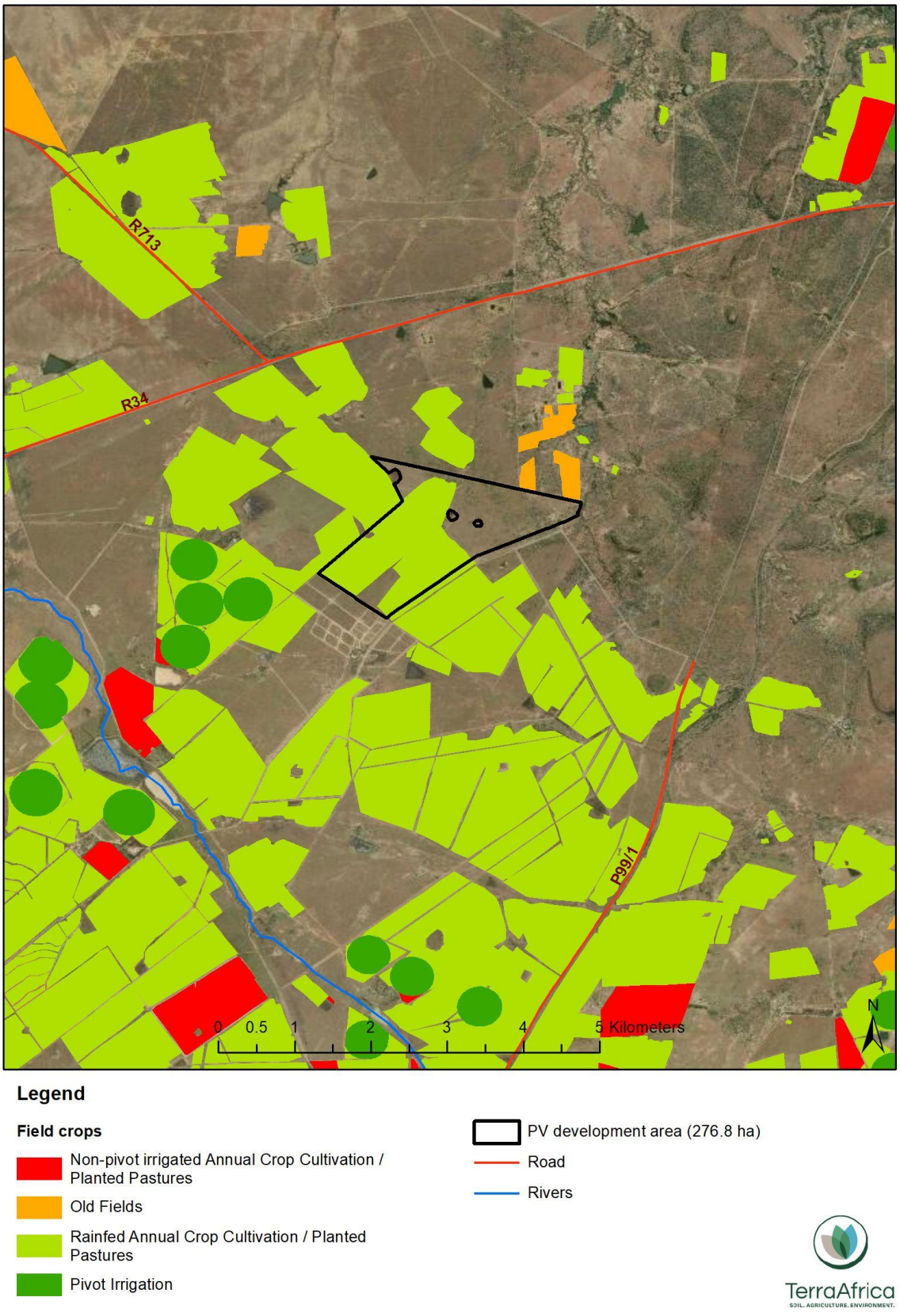

Figure 3 Locality of field crops within and around the development area of the Vrede Solar PV Facility (source: DAFF 2019)

Figure 4 Long-term grazing capacity of the proposed development area of the Vrede Solar Energy Facility

Figure 5 Land type classification of the proposed development area of the Vrede Solar Energy Facility

4.3 Grazing capacity

The ideal grazing capacity is an indication of the long-term production potential of the vegetation layer growing in an area. More specifically, it relates to its ability to maintain an animal with an average weight of 450 kg (defined as 1 Large Stock Unit (LSU)) with an average feed intake of 10 kg dry mass per day over the period of approximately a year. This definition includes the condition that this feed consumption should also prevent the degradation of the soil and the vegetation. The grazing capacity is therefore expressed in a number of hectares per LSU (ha/LSU) (South Africa, 2018).

Following the metadata layer obtained from DAFF, the grazing capacity of the largest section of the development area, is 6 ha/LSU. (**Figure 4**). A small area in the north-eastern corner of the development area, has grazing capacity of 5 ha/LSU.

Since the proposed infrastructure within the development area will be fenced off, it will no longer be available for livestock grazing.

4.4 Land type classification

The largest part of the development area consists of Land Type Bd21. The remaining small section in the north-eastern corner, consists of Land Type Dc10. The characteristics of the land types are described below and their positions in the landscape depicted in **Figure 5**.

Land Type Bd21

Land Type Bd21 consists of four terrain units and the landscape can be described as slightly undulating with slopes ranging between 1 and 3% (
). The soil formed from sandstone, mudstone and shale. The crest (Terrain unit 1) is dominated by deep Clovelly and Hutton soil forms (0.9 – 1.2m) and shallower Westleigh soil form (0.4 – 0.6m). The texture of soil in this terrain unit is dominated by sand-clay-loam with the clay fraction estimated as 10 - 20%. Terrain unit 3 (mid-slope) forms 50% of land type Bd21.

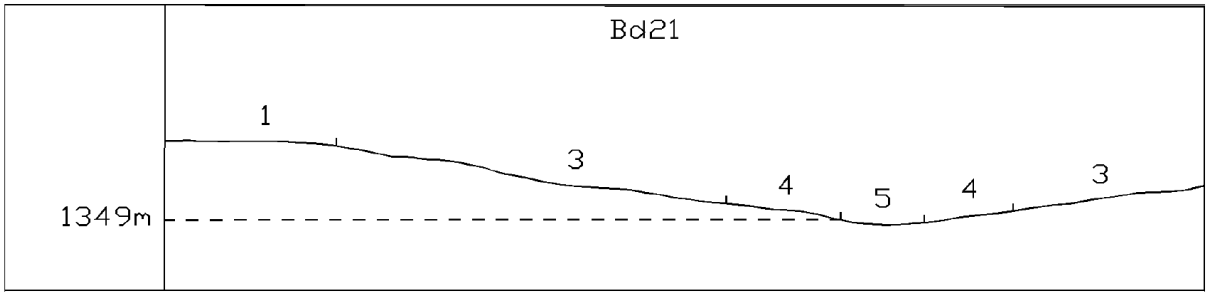

Figure 6 Terrain form sketch of Land Type Bd21

The mid-slopes consist of deep Hutton and Clovelly soil forms (0.9 – 1.2m), Westleigh soil form (0.4 – 0.6m) Valsrivier soil form (0.25 – 0.35m). The toe-slopes (Terrain unit 4) is dominated by the shallow Valsrivier soil form. Sterkspruit, Bonheim and Kroonstad soil forms are also present in the toe slope. Terrain unit 5 (Valley bottom) consists of Dundee, Bonheim, Valsrivier

and Sterkspruit soil forms. The soil depth ranges from 0.25m (Valsrivier) to 1.2m (Dundee).The clay content ranges from 20 – 45% and the texture ranges from sand-clay-loam to sand-clay.

Land Type Dc10

Land Type Dc10 comprise of five terrain units where Terrain Units 1, 3 and 4 which dominate the landscape (93%) represent an undulating landscape (**Figure 7**). Terrain Unit 5 are the areas of slight depression at the valley bottoms with a slope of 1 – 2%. Terrain unit 2 (upper slope) has steep slopes of >100% but represent only 1% of the Land Type. Terrain unit 3 (lower slope) has a slope of 4 – 12%while the slopes of the other terrain units (crest and toe slope) range between 1 and 5%. The soil originated on the crests and scarps (upper slopes) from dolerite or sandstone and the mid slopes and toe slopes mainly from mudstone and shale.

The texture of soil in this land type is dominated by sandy clay and clay on the mid slope and toe slope with the clay ranging between 15 and 30%. Terrain units 3 and 4 that represent 71% of this land type mainly consists of rock, shallow soil profiles (0.1 – 0.3m) of the Swartland and Mispah forms with an estimated 7 - 12% of areas in these terrain units consisting of deeper soil profiles (0.3 – 0.58m) of the Bonheim form. The valley bottoms are dominated by deep soil profiles (>1.2m) of the Dundee and Inhoek soil forms.

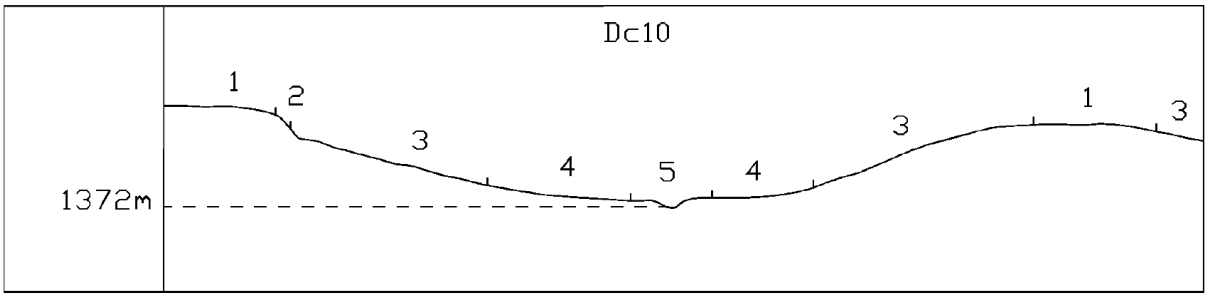

Figure 7 Depiction of the terrain forms of Land Type Dc10

5. POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

5.1 Project description

The project will entail the construction and operation of a 100 MW Photovoltaic (PV) Solar Facility ('Vrede Solar PV Facility') and associated Battery Energy Storage System (BESS). The development area will be approximately 279 ha.

5.2 Potential impacts on soil

The anticipated impacts of the proposed project on soil are soil compaction, erosion, soil pollution and the loss of soil fertility from the topsoil horizons to be stripped and stockpiled during the construction phase. Below follows a description of the impacts anticipated:

The most significant impact will most likely be caused by the traversing of vehicles over the terrain during the construction phase. This will result in soil compaction. Soil compaction affects

the infiltration of rain into the soil and will increase the risk of erosion as a result of this. Deep level soil compaction (as caused by heavy vehicle traffic) is difficult to alleviate.

Impact: Soil compaction			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Soil compaction reduces the water infiltration rate of soil that increase the risk of run-off	Negative	Local	None
Description of expected significance of impact Wherever the impact occurs (where heavy vehicles traverse) the impact is expected to be of moderate significance.			
Gaps in knowledge & recommendations for further study • Soil samples that will be taken during the site visit will be analysed to determine whether the soil physical properties of the site are particularly sensitive to soil compaction.			

Soil erosion is considered another possible impact, especially where vegetation will be removed during the construction phase of the project.

Impact: Soil erosion			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Bare soil surfaces are prone to loss of soil particles as a result of wind and water movement	Negative	Local	None
Description of expected significance of impact The impact is expected to be of moderate significance.			
Gaps in knowledge & recommendations for further study • Soil samples that will be taken during the site visit will be analysed to determine the erodibility risk of the soil in the development area.			

In any area where topsoil will be stripped for construction purposes, the inherent soil fertility and in situ soil horizon organisation will be compromised.

Impact: Loss of soil fertility through disturbance of in situ horizon organisation			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Earthworks as part of construction of the Solar Energy Facility will result in disturbance of in situ soil profiles	Negative	Local	None
Description of expected significance of impact Low to moderately low significance			
Gaps in knowledge & recommendations for further study • The results of the soil survey that will be conducted will be used to determine the sensitivity of the in situ profiles to this impact.			

Chemical soil pollution may occur as a result of oil and fuel spills from construction vehicles as well as any other waste products that may be generated on site and not properly handled.

Impact: Soil chemical pollution			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Oil and fuel spillages as well as waste generation during the project cycle will result in soil chemical pollution.	Negative	Local	None
Description of expected significance of impact The significance of this impact is moderate to high.			
Gaps in knowledge & recommendations for further study • The only knowledge gap is the full project description that includes detail of activities and materials that may result in soil pollution during the different project phases.			

Potential impacts on agriculture

The proposed Vrede Solar PV Facility project will result in changing the current land use from agriculture (both crop production and livestock farming) to renewable energy generation. The cumulative impact on land use is that portions of land that were previously used for agriculture in the region are converted into alternative land uses.

Impact: Reduction or loss of agricultural productivity			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
The proposed project will change reduce the areas where crops and livestock are produced.	Negative	Local	None / Will be determined during the detail assessment
Description of expected significance of impact The proposed project may have a low to high impact on the agricultural production of the development area.			
Gaps in knowledge & recommendations for further study The economic viability of rainfed annual crop production and livestock farming within the development area, will be calculated during the detail study phase.			

Impact: Change in numbers of employment opportunities			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
The proposed project will result in the possible loss of agricultural employment opportunities.	Negative to Positive	Local	None / Will be determined during the detail assessment
Description of expected significance of impact Although the change in land use may result in a loss of agricultural jobs, it may be substituted or improved by the number of employment opportunities that will be created by the proposed project.			
Gaps in knowledge & recommendations for further study			

It is not currently know how many agricultural jobs are made possible by the agricultural activities within the proposed Vrede SEF development area. This will be investigated through informal discussions with the current landowner (or person/entity leasing the land for agricultural production)

Potential impacts on land capability

The land capability of the area where the proposed project will be located will not be affected by the proposed project.

Impact Change in the land capability of the site			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Where in situ soil profiles are disturbed by construction activities, the land capability may be altered	Negative	Local	None
Description of expected significance of impact The site has low-moderate to moderate-high land capability and the proposed project will reduce the land capability of the surface infrastructure footprint. The significance of this impact ranges from low to moderate-high, depending on the specific land capabilities of the soil within the development area.			
Gaps in knowledge & recommendations for further study The final land capability will be determined during the detail study phase.			

6. PLAN OF STUDY

A site visit will be conducted to determine the soil properties and associated agricultural potential of the proposed Vrede Solar PV Facility The area to be surveyed is the development area of 279 ha. This area includes for the proposed surface footprint as well as a 50m buffered area around it.

The area will be surveyed according to planned survey point as indicated in Figure **8**. The soil will be classified according to the most recent Soil Classification System for South Africa (Soil Classification Working Group, 2018). The following data will be recorded during the site visit:

- Soil forms present within the development area
- Soil depth
- Topsoil and subsoil clay percentages
- Terrain units and slope of the development area

The data points of the spatial data that will be generated during the site visit, will be interpreted for the soil and land capability mapping of the final Soil and Agricultural EIA-level report to be submitted for the proposed Vrede Solar Energy Facility. The productivity and employment data will be gathered through discussion sessions with the land owners of the farm portions or otherwise the main users.

Following the results of the survey and data analysis, the final proposed project infrastructure layout will be used to calculate whether the proposed Vrede SEF will be within the allowable development limits for renewable energy developments or where it exceeds it.

The report will be prepared in alignment with all the relevant NEMA regulations as well as General Notice 320 of 2020 that specifically address Agricultural Compliance reporting for the renewable energy sector.

7. CONCLUSION

Following the desktop analysis of available data, it is concluded that the proposed development of the Vrede Solar PV Facility and supporting infrastructure, will affect land with low-moderate to moderate-high land capability. Soil in the area include oxidic yellow-brown and red apedal forms, soils with higher clay content and structure such as that of the Bonheim, Valsrivier and Swartland forms, shallower soil forms underlain by hard plinthite (Westleigh form) as well as gley soils of the Kroonstad from.

The development area has been used for livestock farming after crop fields have been converted to planted pastures between 2000 and 2004. Since 2005, no crop cultivation has taken place within the development area.

The soil and agricultural sensitivity of the site therefore varies between low and moderate-high, depending on the soil properties, topography and other landscape features of the development area.

No no-go areas have been identified for the proposed project from the perspective of soil and agricultural resource conservation. It is anticipated that the proposed project will have low to moderate-high impact on the soil properties and land capability. Further investigation of the site sensitivities will be conducted during the EIA phase to confirm the sensitivities as well as the anticipated impacts of the proposed Vrede Solar PV Facility.

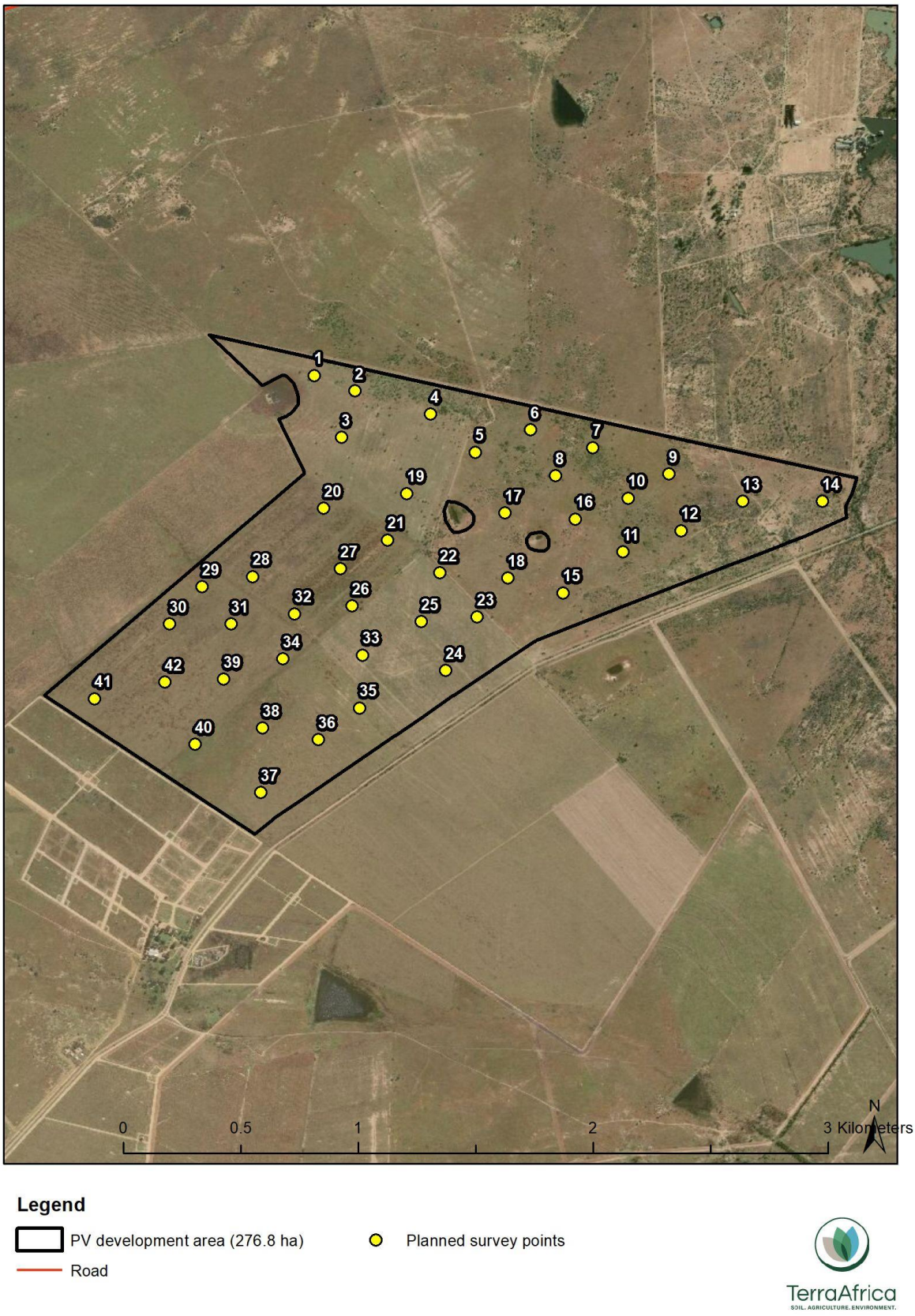

Figure 8 Planned survey points within the proposed development area of the Vrede Solar Energy Facility

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