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Agricultural Scoping Report for the Proposed Aristida and Themeda PV Facilities

Submitted by TerraAfrica Consult cc

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26 February 2022

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1. INTRODUCTION

Terra-Africa Consult cc was appointed by Aristida PV (Pty) Ltd and Themeda PV (Pty) Ltd to conduct the Agricultural Assessment for the proposed development of two solar PV facilities near the town of Lichtenburg in North West Province. The assessment forms part of the Scoping and Environmental Impact Assessment process required for Environmental Authorisation (EA) of the renewable energy projects. The EA process is managed by Cape Environmental Assessment Practitioners (Pty) Ltd. (Cape EAPrac).

The proposed two solar PV projects are collectively referred to as the Elandsfontein Cluster. The development area of the Elandsfontein Cluster is 437.7 ha that will be located on Portion 7 of the Farm Elandsfontein 34. The development area is located approximately 5 km north west of the town of Lichtenburg within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality of the North West Province (refer to **Figure 1**). The area is accessible via the R503, located south east of the development area.

The proposed two PV facilities will be referred to as the Aristida PV facility and the Themeda PV facility, respectively. Each of the projects are applied for by a separate applicant and within a separate assessment area. The details of each proposed project are present in **Table 1** and the layout of the two development areas in relation to each other, shown in **Figure 2**.

Table 1: Details of the proposed solar PV facilities within the Elandsfontein Cluster

Proposed PV facility	Applicant	Contracted capacity	Assessment area	Properties included in the assessment area
Aristida PV	Aristida PV (Pty) Ltd	Up to 100 MW	250.9 ha	Portion 7 of the Farm Elandsfontein 34
Themeda PV	Themeda PV (Pty) Ltd	Up to 100 MW	186.8 ha	Portion 7 of the Farm Elandsfontein 34

2. DETAILS OF THE SPECIALIST

The report is prepared by Mariné Pienaar of TerraAfrica Consult CC. Mariné is a scientist registered with the South African Council for Natural Scientific Professions (SACNASP) and is specialised in the fields of Agricultural Science and Soil Science. Her SACNASP Registration Number is 400274/10 (see Appendix 2). Mariné holds a BSc. degree in Agricultural Science (with specialisation in Plant Production) from the University of Pretoria and a MSc. Degree in Environmental Science from the University of the Witwatersrand.

The full details and contact details of the specialist is attached as Appendix B: Curriculum Vitae of Specialist.

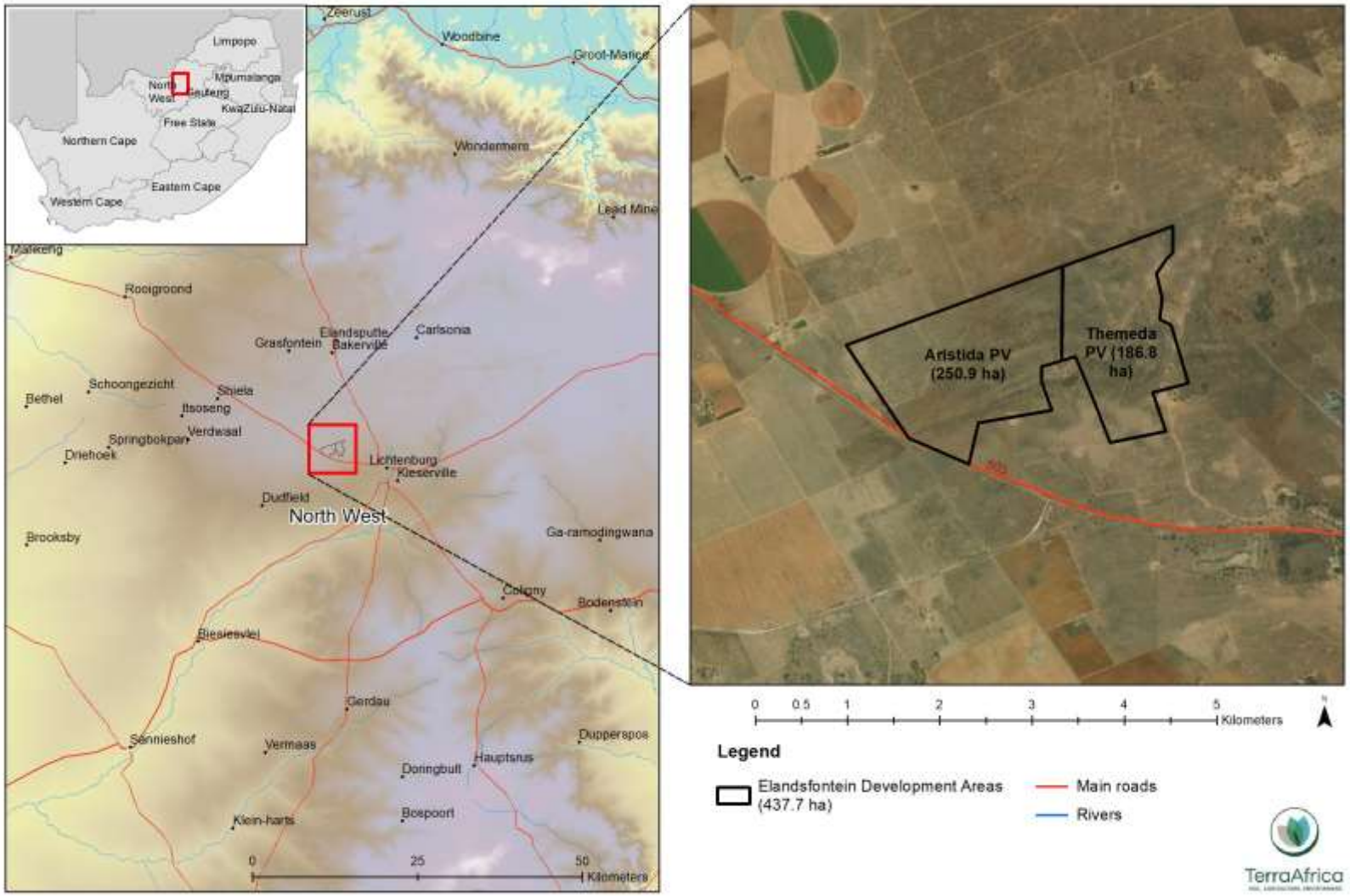

Figure 1: Locality of the Elandsfontein Cluster development area where three proposed PV projects will be developed

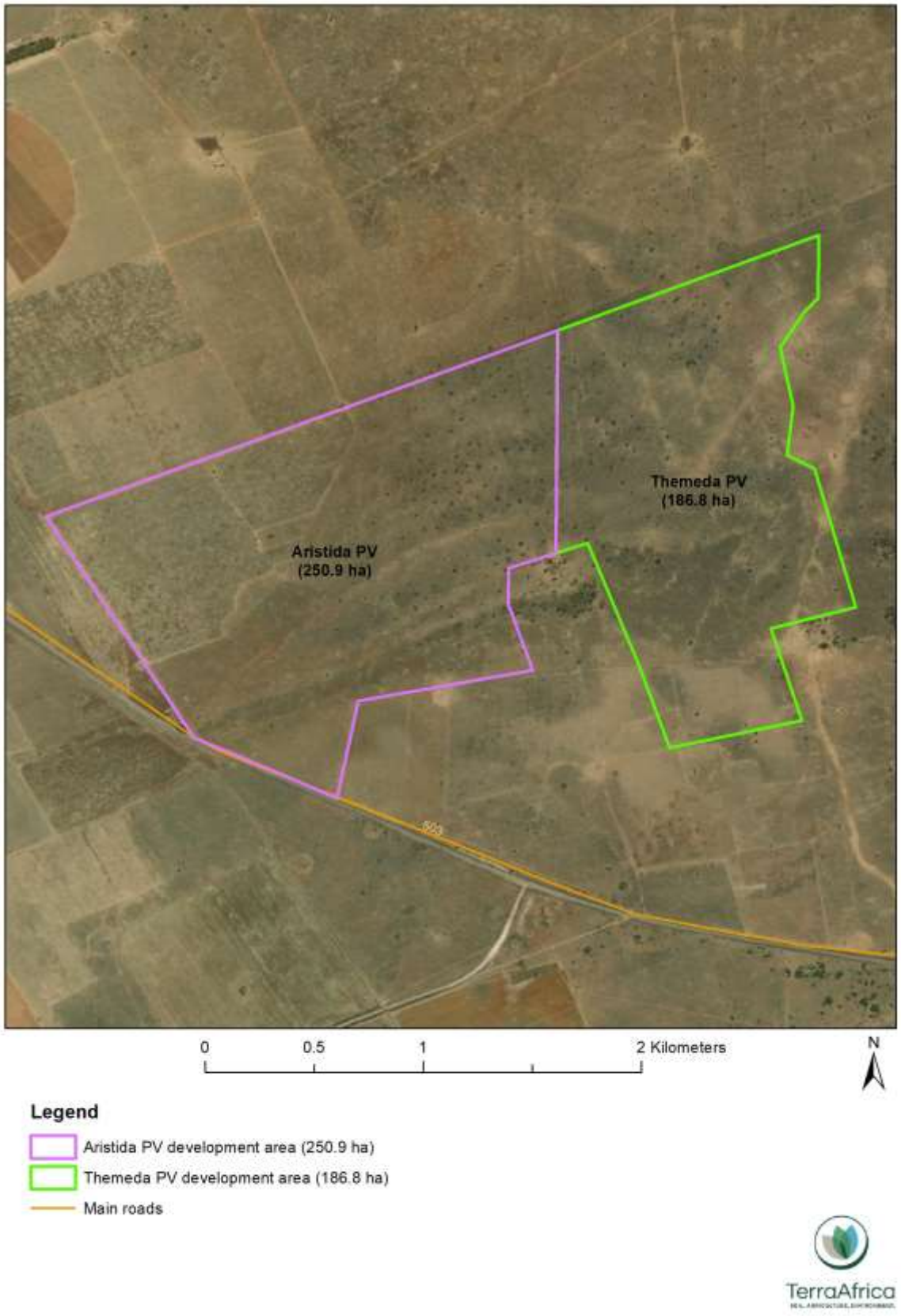

Figure 2: Footprints of the proposed Elandsfontein Cluster PV facilities within the development area

3. 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 and access road route
- Identify site sensitivities to the proposed project pertaining to the soil properties, associated land capabilities and the agricultural potential of the project area following the analysis of desktop data.
- Determine whether the proposed Elandsfontein Cluster development area falls within any High Potential Agricultural Areas of the North West province.
- Provide a preliminary site sensitivity rating following the data analysis and identify no-go areas for the process of micro-siting of the infrastructure associated with the proposed projects.
- Identify potential impacts that will be caused by the projects 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.
- Comply with the Protocol for the specialist assessment and minimum report content requirements of environmental impacts on agricultural resources by onshore wind and/or solar photovoltaic energy generation facilities where the electricity output is 20 megawatts or more, gazetted on 20 March 2020 in GN 320 (in terms of Sections 24(5)(A) and (H) and 44 of NEMA, 1998).

4. METHODOLOGY

The proposed assessment areas of the two PV facilities were superimposed on five data sets to describe high-level baseline characteristics and to determine the anticipated sensitivities of the properties to the development. The data sets are:

- Land type data for the project assessment zone 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.
- The Refined Land Capability Evaluation Raster Data for South Africa that was developed using a spatial evaluation modelling approach (DALRRD, 2016).
- The long-term grazing capacity for South Africa 2018 that present the long term grazing capacity of an area with the understanding that the veld is in a relatively good condition (South Africa, 2018).
- The North West Field Crop Boundaries show crop production areas may be present within the development area. The field crop boundaries include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, viticulture, old fields, small holdings and subsistence farming (DALRRD, 2019).
- The High Potential Agricultural Areas for Cultivation: North West Province, 2019 are

large, relatively homogeneous areas of land within the province regarded as having high potential and capability to contribute towards food production in both the province and the country (DALRRD, 2019).

5. RESULTS OF DESKTOP ASSESSMENT

5.1 Land type classification

The development area of the Aristida PV development area consists of three land types i.e. Land Type Bc11, Fa11 and Fb4. The western half of the development area consists of Land Type Bc 11 and about 85% of the eastern half consists of Land Type Fa11. Land Type Fb4 is present in the southern corner of the development area as well as a narrow strip along the eastern part of the southern boundary. The area north and west of the Aristida PV development area consists of Land Type Bc11 while a small section to the north as well as the area to the east, consists of Land Type Fa11. The area south of the development area consists of Land Type Fb4.

Two land types are present within the Themeda PV development area i.e. Land Type Fa11 and Land Type Fb4. Approximately 75% of the area consists of Land Fa11, located in the upper part of the development area while the bottom part consists of Land Type Fb4. The areas west, north and east of the development area consists of Land Type Fa11, while the area south of it, consists of Land Type Fb4. Each of the land types present are described below and the complete land type data sheets, are attached as Appendix C. The position of the land types for each area, is shown in **Figure 4**.

5.1.1 Land Type Fa11

The terrain forms of Land Type Fa11 are depicted in **Figure 3**. The crests and mid-slopes (Terrain units 1 and 3) are dominated by soil of the Glenrosa and Mispah forms. The rest of this land type consists of yellow-brown and red apedal (structureless) soil either underlain by unspecified material or by plinthic material (either soft or hard plinthite) along the toe-slopes and valley bottoms (Terrain units 4 and 5, respectively). According to the land type charts, 40 to 50% of foot slope and valley bottom positions consist of these deeper soil forms. The valley bottoms might potentially consist of a hydromorphic soil form that may have wetland potential. The slope of the terrain is very flat with Terrain unit 3 having the steepest slope (between 2% and 5%). The clay content of the topsoil horizons are estimated to range between 10% and 25% while subsoil clay content is estimated to range between 13% and 40%.

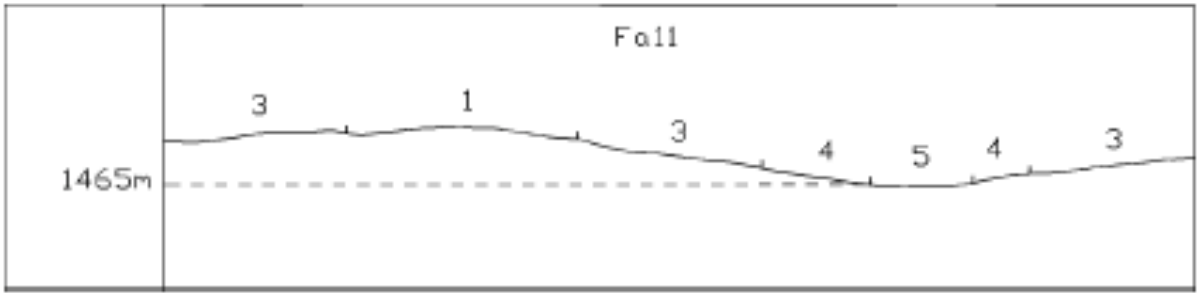

Figure 3: Terrain form sketch of Land Type Fa11

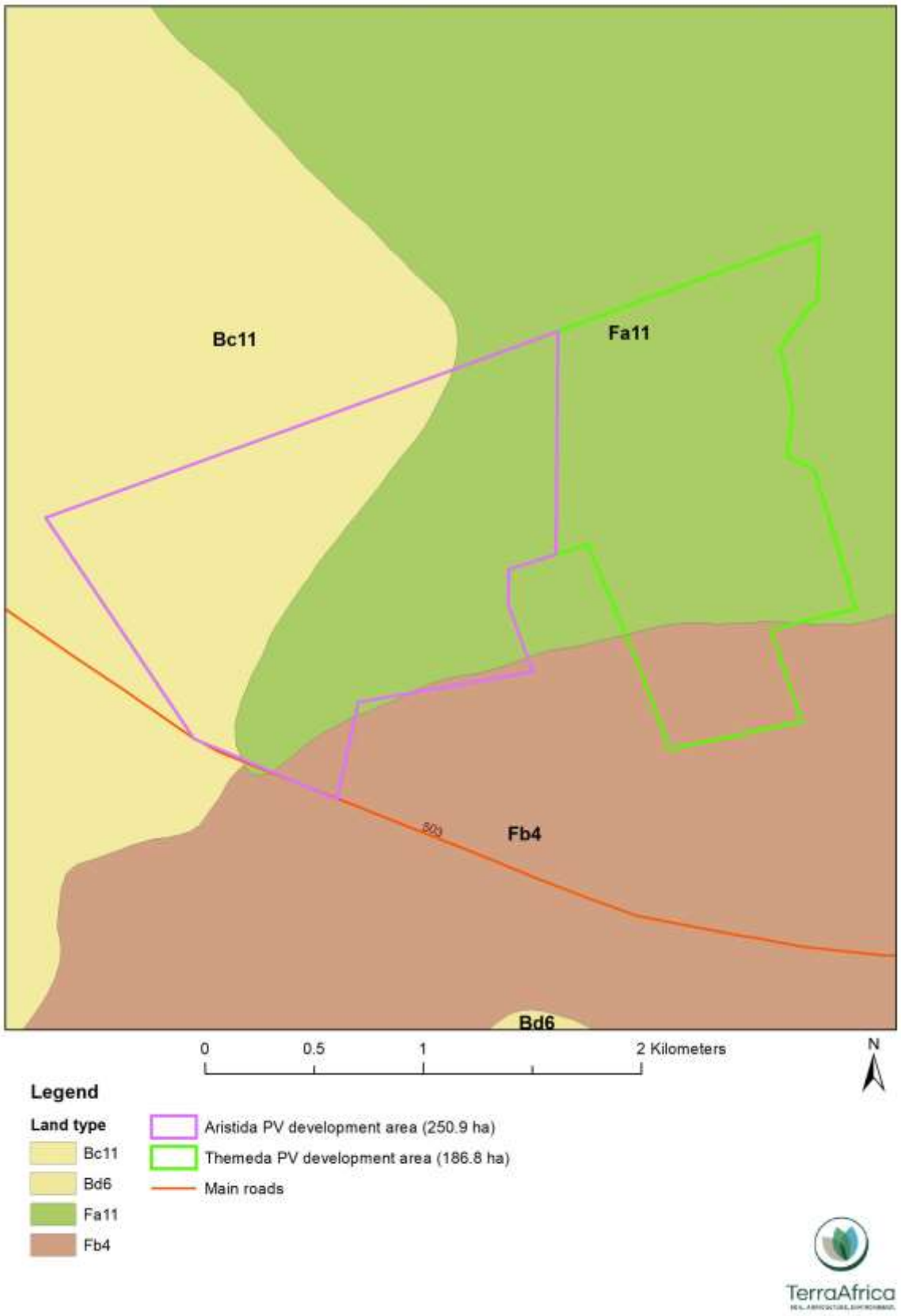

Figure 4: Land type map of the proposed Elandsfontein Cluster PV facilities (Aristida PV and Themeda PV)

5.1.2 Land Type Bc11

In comparison to Land Type Fa11, Land Type Bc11 consists only of two different terrain units that are illustrated in **Figure 5**. Of the entire land type area, 95% consists of flat toe-slopes (with slope between 0 and 2%) with slope length between 1300 and 1700m. These areas consist predominantly of Westleigh, Hutton, Avalon, Glencoe and Bainsvlei soil forms. The remaining 5% of the land type area consists of valley bottoms (Terrain unit 5). The valley bottoms have about 60% soils of the Sterkspruit form and 40% soils of the Rensburg form. The slope length of the valley bottoms are short (between 50 and 100m) and slope ranges between 0 and 1%.

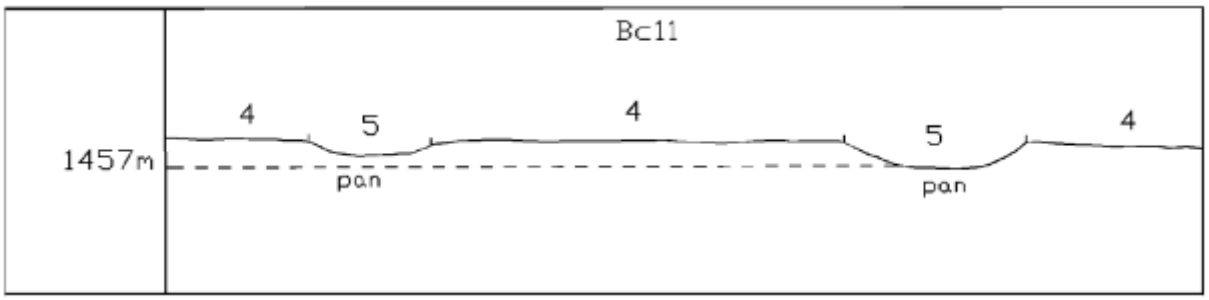

Figure 5: Terrain form sketch of Land Type Bc11

5.1.3 Land Type Fb4

The terrain forms of Land Type Fb4 are depicted in **Figure 6**. The crests and mid-slopes (Terrain units 1 and 3) form 30% and 45%, respectively, of the total land type area. Both these terrain units are dominated by soil of the Glenrosa and Mispah forms with lesser occurrence of Hutton, Clovelly and Westleigh soils. The crests are flat with slope of 0 to 1% and mid-slopes have slight slope of 2 to 4%. About 20% of the total land type area consists of footslopes (Terrain unit 4) where the slope is 1 to 2%. Footslopes have similar soils than the crests and mid-slopes but also include about 22% of Valsrivier soils. The valley bottoms (Terrain unit 5) are present in only 5% of the total land type area and consists of 40% Westleigh soils, 30% Valsrivier soils and 10% each of the Mispah and Glenrosa soils. It also includes about 10% solid rock.

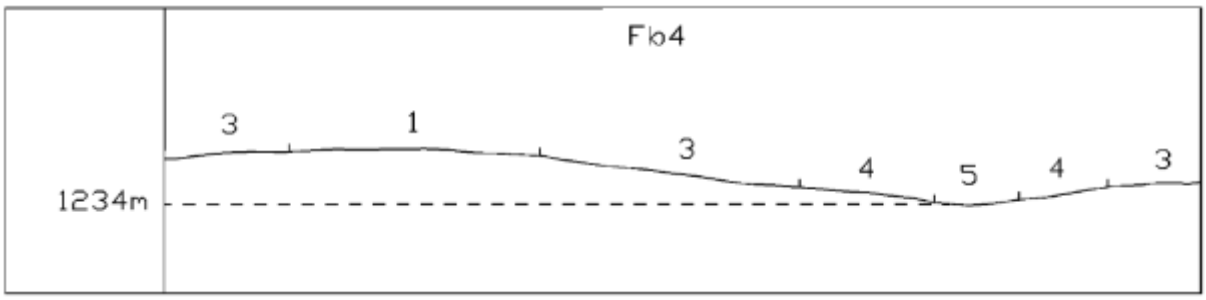

Figure 6: Terrain form sketch of Land Type Fb4

5.2 Land capability classification

The land capability classification of the three solar PV development areas according to the DALRR raster data (DALRRD, 2016), is shown in **Figure 7**.

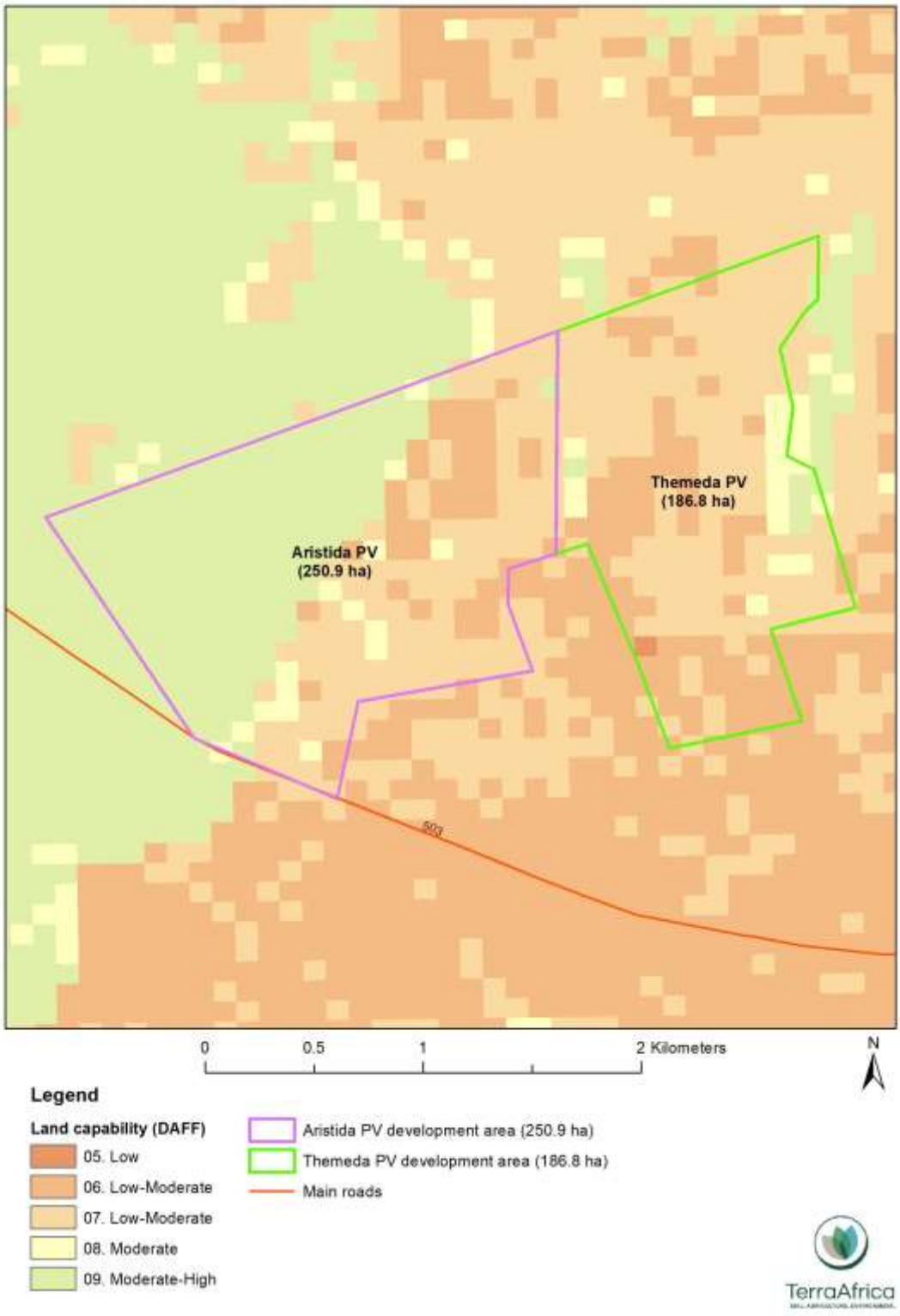

Figure 7: Land capability map of the proposed Elandsfontein Cluster PV facilities (Aristida PV and Themeda PV) (data source: DALRRD, 2016)

5.2.1 Aristida PV development area

The land capability classes of the Aristida PV development area can be divided into two categories i.e. land with capability for rainfed crop production that has Moderate-High (Class 09) land capability in the western half of the site. The eastern half consists of land suitable for livestock farming but marginal to no suitability for rainfed crop production. This area consists of a combination of land capability classes ranging from Low-Moderate (Class 06) to Moderate (Class 08). The area classified as land with Moderate-High (Class 09) land capability aligns with the area classified as Land Type Bc11 (refer to Section 5.1).

5.2.2 Themeda PV development area

Almost the entire Themeda PV development area consists of land with Low-Moderate (Classes 06 and 07) land capability. Two narrow sections along the western and eastern boundaries of the development area consist of land with higher land capability i.e. Moderate (Class 08) and Moderate-High (Class 09) land capability. One very small area along the western boundary consists of Low (Class 05) land capability.

5.3 Agricultural production

5.3.1 Aristida PV development area

According to the Crop Estimates Consortium (2019), the Aristida PV development area has one area where field crop boundaries are present (see **Figure 9**). This area is located in the north western corner of the development area and consists of either rainfed annual crops or planted pastures. The areas further north and west located directly outside the development area's boundaries consist of larger areas of similar fields. More crop fields with either rainfed annual crops or planted pastures, are located to the south of the development area. Centre pivot irrigation areas are located 1 km north west and further away to the north west of the development area.

Even though the field crop boundary data indicate the presence of a crop field in the north western corner of the development area, the analysis of aerial imagery available on Google Earth has shown that while the area was still cultivated in 2008, it was since left to revert back to grazing land with the soil left fallow to allow the natural vegetation of the area to re-establish itself. Currently, the land use of the entire Aristida PV development area is extensive livestock farming.

The grazing capacity of the development area is 8ha/LSU (**Figure 8**). The Aristida development area of 250.9 ha therefore has the capacity to feed 31 head of cattle. Land with grazing capacity of 8ha/LSU is considered to have moderate grazing potential. It is lower than the wetter, eastern parts of the country such as Mpumalanga where the grazing capacity ranges from 4 to 6 ha/LSU. However, it is higher than drier areas in the western parts of South Africa, such as the Kalahari. Grazing capacity in the Kalahari ranges between 11 and 17 ha/LSU. The grazing capacity of the Karoo is much lower than that, with some areas having grazing capacity as low as 70ha/LSU.

5.3.2 Themeda PV development area

According to the Crop Estimates Consortium (2019), the Themeda PV development area has one area where field crop boundaries are present (see **Figure 9**). This area is located in the most southern corner of the development area and consists of either rainfed annual crops or planted pastures. A small area of crops located directly south of this area, outside the development area's boundaries, consists of similar fields. More crop fields with either rainfed annual crops or planted pastures, are located further south and west of the development area. Centre pivot irrigation areas are located 2.5 km north west and further away to the north west of the development area.

Even though the field crop boundary data indicate the presence of a crop field in the most southern corner of the development area, the analysis of aerial imagery available on Google Earth has shown that while the area has not been cultivated from 2008 and onwards as it was left to revert back to grazing land with the soil left fallow to allow the natural vegetation of the area to re-establish itself. It is likely that cultivation of this area was stopped earlier than 2008 but aerial imagery is not available to confirm it. This information will be verified through discussion with the landowner during the EIA phase. Currently, the land use of the entire Themeda PV development area is extensive livestock farming.

The grazing capacity of the development area is 8ha/LSU (**Figure 8**). The Themeda development area of 186.8 ha therefore has the capacity to feed 23 head of cattle. Land with grazing capacity of 8ha/LSU is considered to have moderate grazing potential. It is lower than the wetter, eastern parts of the country such as Mpumalanga where the grazing capacity ranges from 4 to 6 ha/LSU. However, it is higher than drier areas in the western parts of South Africa, such as the Kalahari. Grazing capacity in the Kalahari ranges between 11 and 17 ha/LSU. The grazing capacity of the Karoo is much lower than that, with some areas having grazing capacity as low as 70ha/LSU.

5.4 High Potential Agricultural Areas

To determine whether the proposed development of the three PV facilities within the Elandsfontein Cluster will affect any High Potential Agricultural Areas (HPAAs) delineated within the North West Province, the development areas were depicted in relation to these areas (see **Figure 10**). None of the proposed facilities are part of any HPAA. The Aristida PV development area borders on a Category B Irrigation HPAA along its western and northern boundaries. A Category B Rainfed Category HPAA is present 300 m south of the Aristida development area. The Themeda PV development area doesn't border on any HPAA. Category A areas have the highest priority for conservation, followed by Category B areas and then Category C areas. Differentiation is also made between areas with irrigated and rainfed agriculture. Although large areas are delineated as HPAAs, not all within the area may be used for irrigated agriculture.

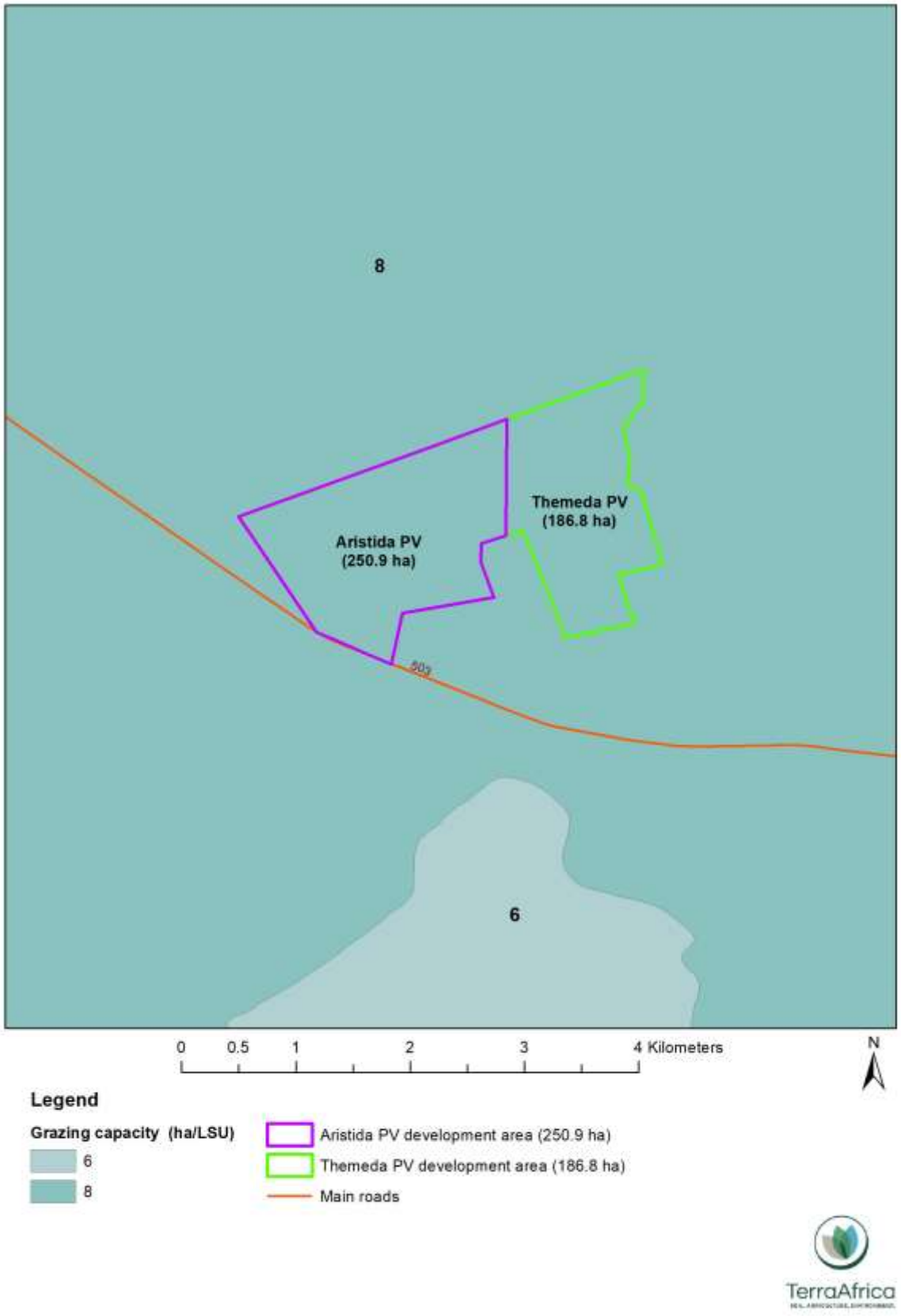

Figure 8 Grazing capacity of the proposed Elandsfontein Cluster PV facilities (Aristida PV and Themeda PV) (data source: South Africa, 2018)

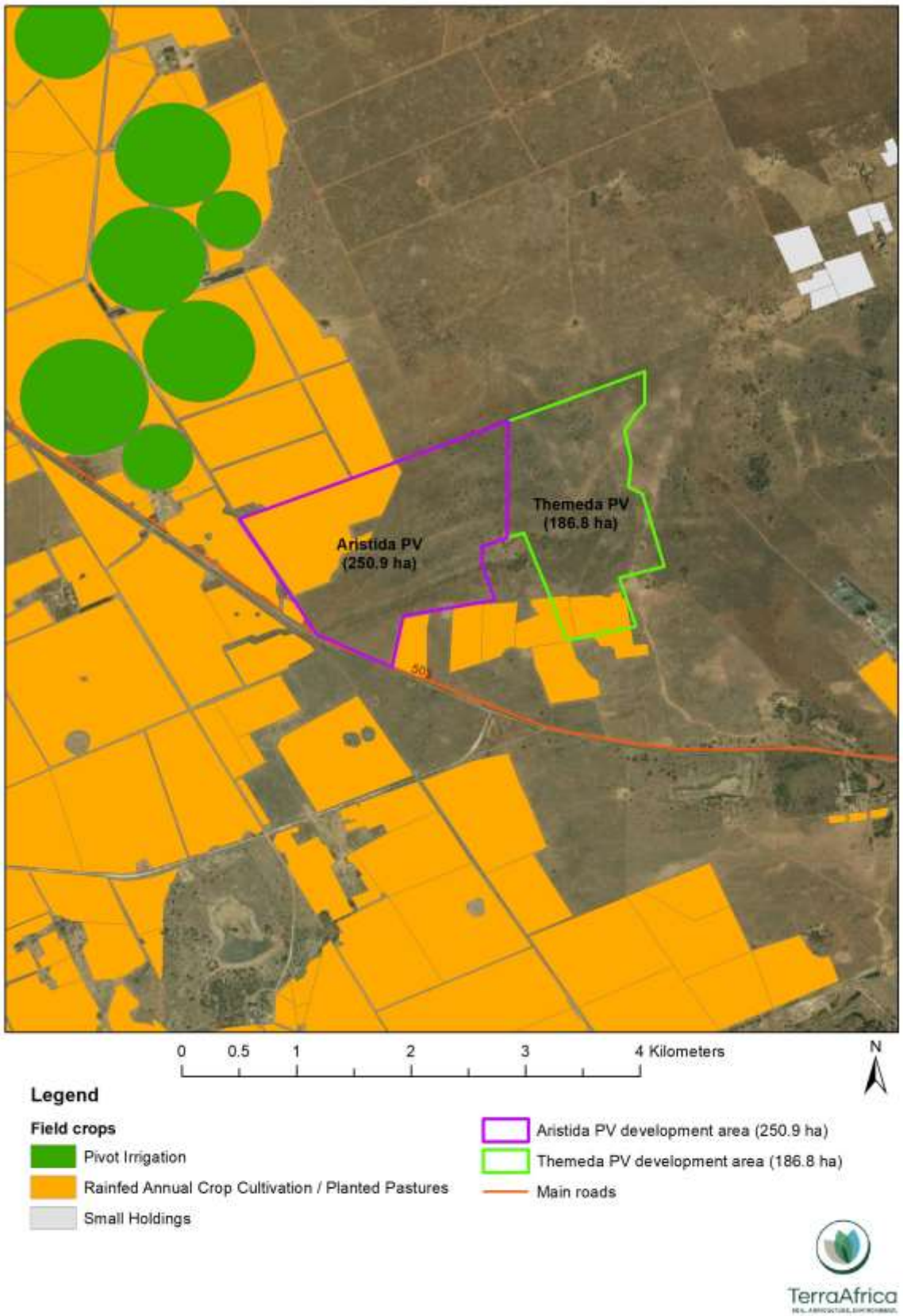

Figure 9 Field crop boundaries of of the proposed Elandsfontein Cluster PV facilities (Aristida PV and Themeda PV) (data source: Crop Estimates Consortium, 2019)

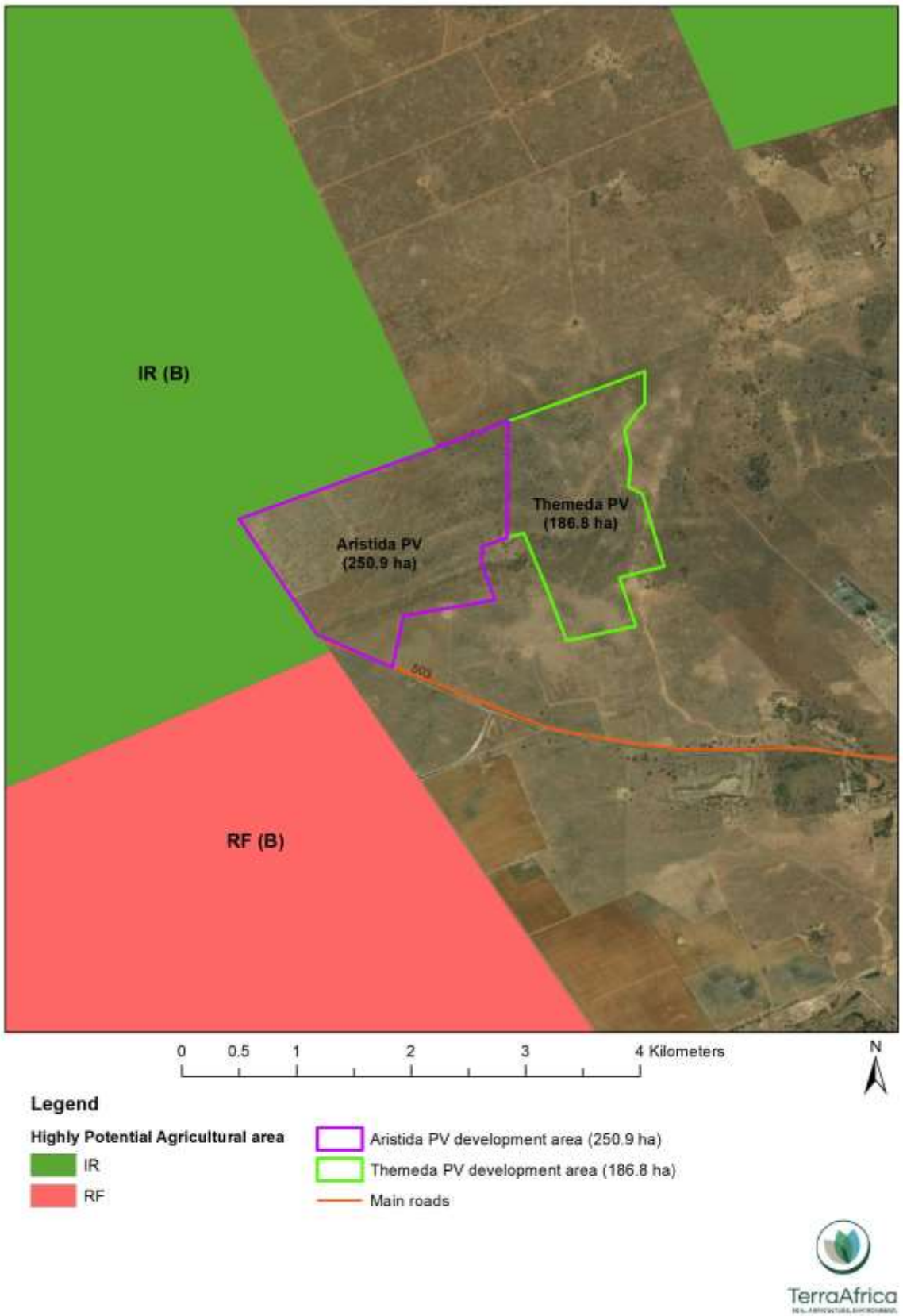

Figure 10 The development areas of the proposed Aristida PV and Themeda PV in relation to High Potential Agricultural Areas (DALRRD, 2019)

6. PRELIMINARY SENSITIVITY ANALYSIS

Considering the desktop data discussed in **Section 5** above, the site has been assigned a preliminary sensitivity rating (see **Figure 11**). In addition to the data discussed, the author's knowledge of the area around the site where soil and classification surveys have been conducted since 2018, has also informed the sensitivity rating. The assigned sensitivity rating is compared to the agricultural sensitivity as depicted in the screening tool report (refer to **Figure 12**).

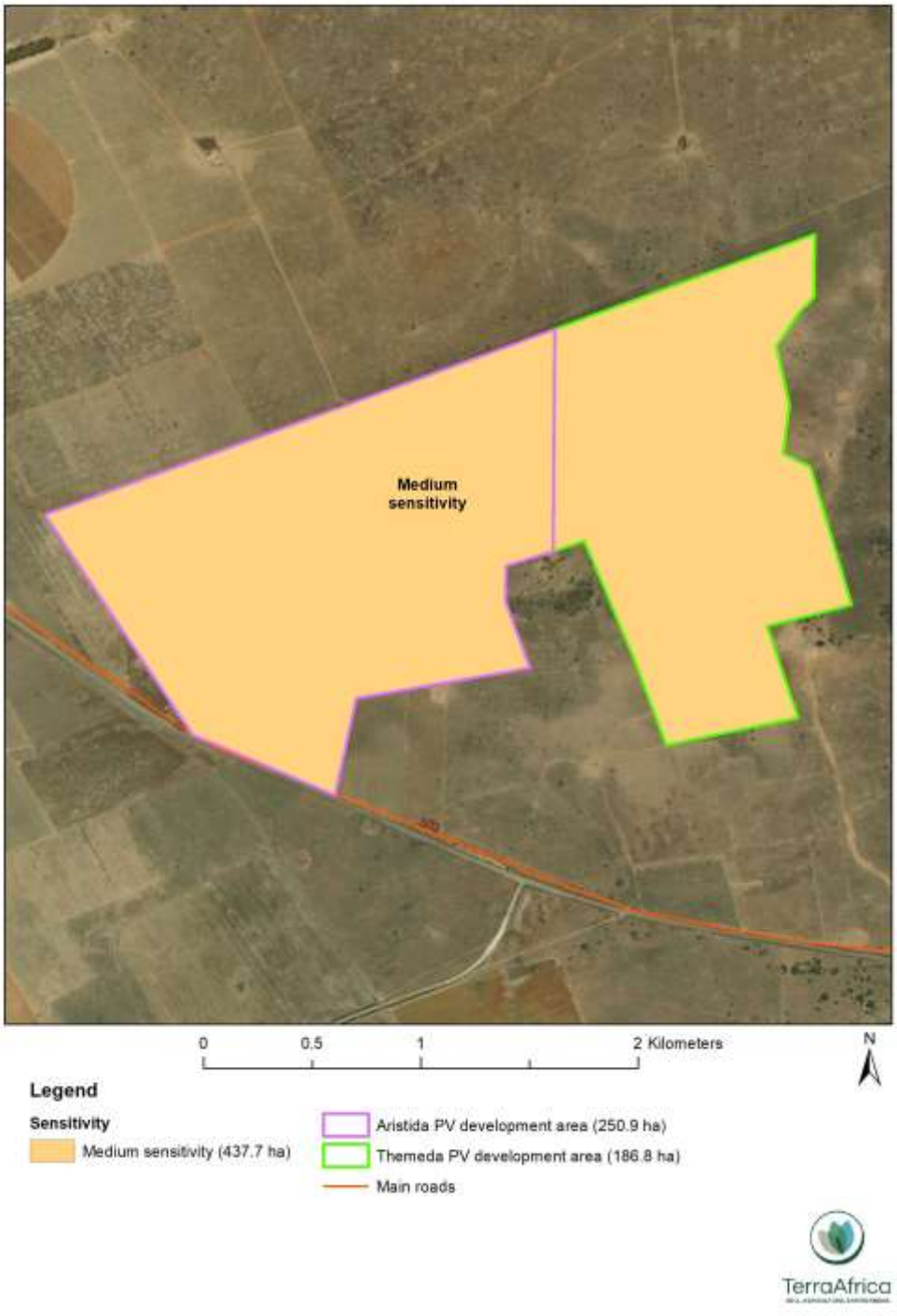

Figure 11 Agricultural sensitivity of the proposed Elandsfontein Cluster PV facilities (Aristida PV and Themeda PV)

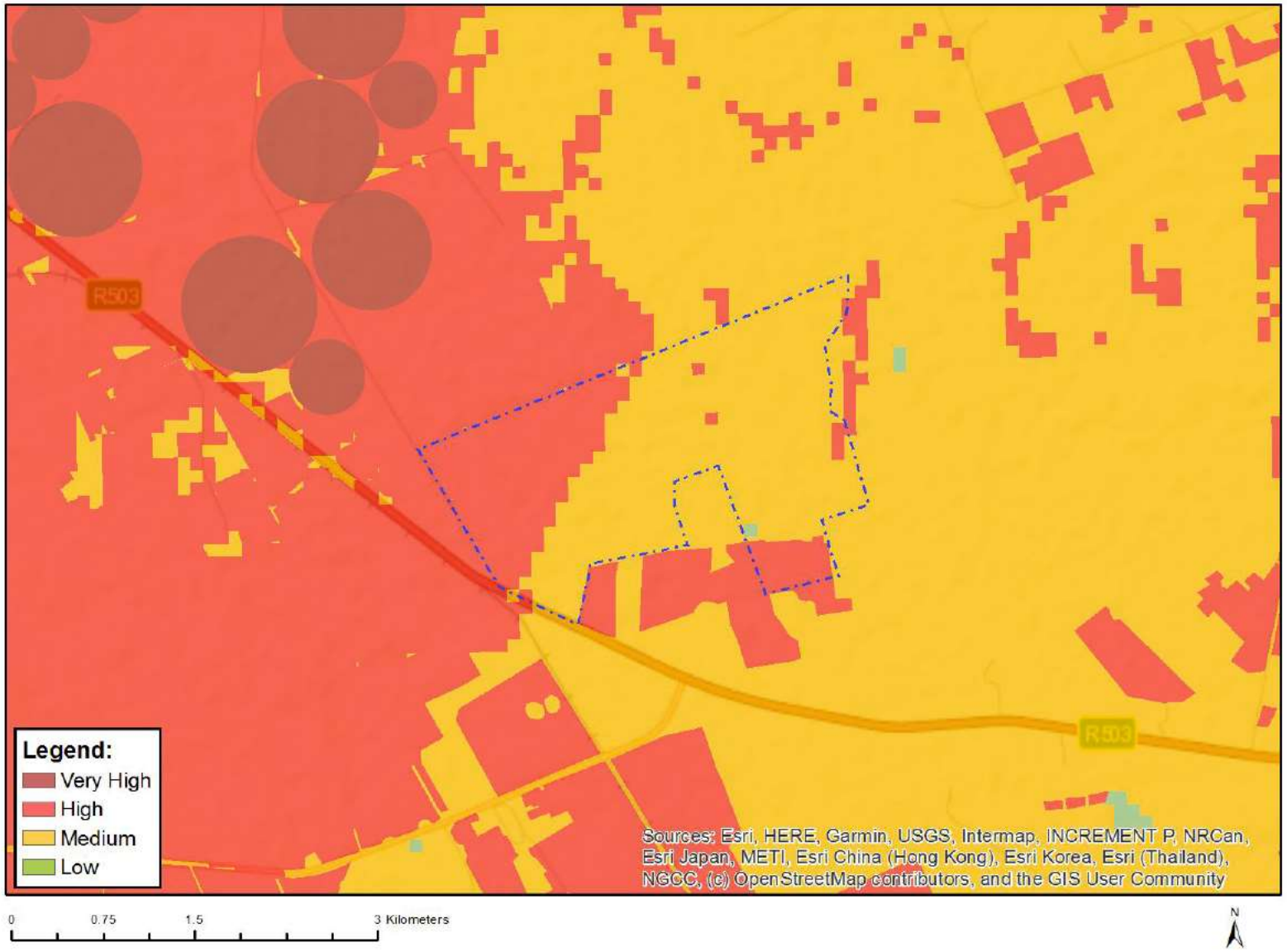

Figure 12 Agricultural combined sensitivity of the Elandsfontein Cluster development area and surrounding area (Screening Tool Report, 2021)

The entire development areas of the two proposed solar PV facilities, have Medium sensitivity to the proposed development. The sensitivity rating was assigned with the reasoning that although the north western corner of the Aristida site and the southern corner of the Themeda site both have Moderate-High land capability that is considered suitable for rainfed crop production, the entire development areas of both these areas are used for livestock farming. Crop production from these areas have already stopped in 2008 or earlier than tat. Even though the area may be suitable for irrigated farming, neither of the areas has any irrigation infrastructure. Therefore, neither of the development areas is considered to have High sensitivity to the proposed developments.

The sensitivity rating mainly agrees with the agricultural sensitivity rating of the area according to the screening tool report except for the areas that the screening tool identifies as High sensitivity (see Figure 12). These areas have likely been assigned higher sensitivity as a result of the Moderate-High (Class 09) land capability of these areas according to DALRRD (2016) as well as the crop field boundaries delineated in these areas by the Crop Estimates Consortium (2019). However, these areas are not currently used for rainfed crop production and has not been used for that since 2008, as is evident in aerial photography on Google Earth. It is therefore my professional opinion that these areas rather have Medium than High agricultural sensitivity.

During the detailed study for the EIA phase, the sensitivity rating of each facility's development area, will be refined based on the soil classification and verified land capability of the area.

7. POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

7.1 Project description

Each of the proposed solar PV facilities (Aristida PV and Themeda PV) will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 100 MW. Each facility will consist of a facility development area and a grid connection solution. The infrastructure associated with each 100MW PV facility includes:

- PV modules and mounting structures;
- Inverters and transformers;
- Battery Energy Storage System (BESS);
- Site and internal access roads (up to 8m wide);
- Auxiliary buildings (22kV or 33kV switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Temporary and permanent laydown area;
- Cabling between the panels, to be laid underground where practical; and
- An on-site facility substation stepping up from 22kV or 33kV to 132kV, with an extent of up to 1ha to facilitate the connection between the solar PV facility and the grid connection solution.

Each of the proposed PV facilities, intends to connect to the National Grid via the Watershed Main Transmission Substation (MTS) (approximately 5 km east of the facility), however, the connection infrastructure associated with this grid solution is being assessed as part of a separate Environmental Application.

7.2 Potential impacts of the proposed solar PV facilities

The three sites have similar baseline conditions and the same impacts on soil and agriculture are anticipated. Below follows a description of the potential impacts.

7.2.1 Potential impacts on agricultural production

Impact Loss of areas of grazing areas where livestock can be produced			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Areas where the PV modules and other infrastructure will be constructed, will no longer be available for livestock production.	Negative	Local	None
Description of expected significance of impact The sites have largely Low-Moderate land capability and is used for livestock production. The expected significance of this impact is Medium.			
Gaps in knowledge & recommendations for further study The final layout of the infrastructure, especially the need for additional access roads, will determine the size of the areas to be lost. Once the final layout is available, the impacts can be assessed in detail.			

7.2.2 Potential impacts on soil

Impact Soil compaction			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Soil compaction will occur wherever construction vehicles and equipment will traverse the site and where the PV modules and other long-term infrastructure will be erected.	Negative	Local	None
Description of expected significance of impact Wherever the impact occurs (where heavy vehicles traverse) the impact is expected to be of Medium significance during the construction phase. Once construction is finalised, areas that are affected by compaction outside of the development footprint, must be rehabilitated.			
Gaps in knowledge & recommendations for further study The exact footprint will be determined for the EIA phase and it is recommended that existing roads be used for the transport of equipment as far as possible to limit soil compaction.			

Impact: Soil erosion

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Wherever construction activities will result in bare soil surfaces, these surfaces 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 medium significance.

Gaps in knowledge & recommendations for further study

- Soil texture and soil organic carbon analysis results of the EIA phase will be used to calculate the erodibility of soils within the development footprint.

Impact: Loss of soil fertility through disturbance of in situ horizon organisation

Issue	Nature of Impact	Extent of Impact	No-Go Areas
In any area where topsoil will be stripped for construction purposes, the soil horizons will be mixed and the mixture may have lower soil fertility than before it was stripped.	Negative	Local	None

Description of expected significance of impact

Low to moderately low significance

Gaps in knowledge & recommendations for further study

The final results of the EIA phase soil classification survey will be used to develop guidelines for topsoil stripping and stockpile management during the construction phase.

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 an project description that includes detail of activities and materials that may result in soil pollution during the different project phases.

8. PLAN OF STUDY

Once the infrastructure layout has gone through the final process of micro-siting based on the recommendations of this report and other reports, the site visit will be conducted for the purpose of on-site verification. The survey will include soil classification according to the Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018).

The landowners and/or land users will be consulted individually for discussion of the productivity and employment data associated with the areas that will impacted by the proposed development. The discussion will also address the reasons for the conversion of crop fields to grazing veld within the last ten years as well as the limitations and risks of livestock production in the area in order to compare it to renewable energy production. This will be used to consider the acceptability of the project.

The reports 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. A separate report will be compiled for each proposed PV facility.

9. CONCLUSION

Following the desktop analysis of available data, it is concluded that the proposed development of the Aristida and Themeda PV facilities, will affect land with Medium agricultural sensitivity. No no-go areas have been identified for the proposed project from the perspective of soil and agricultural resource conservation. None of the proposed development areas overlap with delineated High Potential Agricultural Areas within the larger area where the projects will be located.

It is anticipated that the proposed project will have limited impact on the soil properties and land capability while the land use will change from livestock farming to generation of renewable energy. The detailed assessment and subsequent reporting will provide in-depth detail on all these aspects.

10. LIST OF REFERENCES

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The Soil Classification Working Group, 2018. *Soil Classification – Taxonomic System for South Africa.* Dept. of Agric., Pretoria.

APPENDIX A: DECLARATION OF INDEPENDENCE

DECLARATION OF THE SPECIALIST

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

I MARINÉ PIENAAR... as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that:

- In terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or
  - am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 of the NEMA EIA Regulations has 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, have throughout this EIA process met all of the requirements;
- I have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has 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
- I am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations.

2022-01-07

Signature of the EAP: Date:

TERRAFRICA CONSULT CC

Name of company (if applicable):

FORM NO. BAR10/2019

APPENDIX B: CURRICULUM VITAE OF SPECIALIST

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EXPERTISE

Soil Quality Assessment

Soil Policy and Guidelines

Agricultural Agro-Ecosystem Assessment

Sustainable Agriculture

Data Consolidation

Land Use Planning

Soil Pollution

Hydropedology

EDUCATION

MASTER'S DEGREE
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University of Witwatersrand
2010 – 2018

BACHELOR'S DEGREE
Agricultural Science
University of Pretoria
2001 – 2004

PROFESSIONAL PROFILE

I contribute specialist knowledge on agriculture and soil management to ensure long-term sustainability of projects in Africa. For the past thirteen years, it has been my calling and I have consulted on more than 200 projects. My clients include environmental and engineering companies, mining houses, and project developers. I enjoy the multi-disciplinary nature of the projects that I work on and I am fascinated by the evolving nature of my field of practice. The next section provide examples of the range of projects completed. A comprehensive project list is available on request.

PROJECT EXPERIENCE

Global Assessment on Soil Pollution

Food and Agricultural Organisation (FAO) of the United Nations (UN)

Author of the regional assessment of Soil in Sub-Saharan Africa. The report is due for release in February 2021. The different sections included:

- Analysis of soil and soil-related policies and guidelines for each of the 48 regional countries
- Description of the major sources of soil pollution in the region
- The extent of soil pollution in the region and as well as the nature and extent of soil monitoring
- Case study discussions of the impacts of soil pollution on human and environmental health in the region
- Recommendations and guidelines for policy development and capacitation to address soil pollution in Sub-Saharan Africa

Data Consolidation and Amendment

Range of projects: Mining Projects, Renewal Energy

These projects included developments where previous agricultural and soil studies are available that are not aligned with the current legal and international best practice requirements such as the IFC Principles. Other projects are expansion projects or changes in the project infrastructure layout. Tasks on such projects include the incorporation of all relevant data, site verification, updated baseline reporting and alignment of management and monitoring measures.

Project examples:

- Northam Platinum's Booysendal Mine, South Africa
- Musonoi Mine, Kolwezi District, Democratic Republic of Congo
- Polihali Reservoir and Associated Infrastructure, Lesotho
- Kaiha 2 Hydropower Project, Liberia
- Aquarius Platinum's Kroondal and Marikana Mines

PROFESSIONAL MEMBERSHIP

South African Council for Natural Scientific Professions (SACNASP)

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

Network for Industrially Contaminated Land in Africa (NICOLA)

LANGUAGES

English (Fluent)

Afrikaans (Native)

French (Basic)

PRESENTATIONS

There is spinach in my fish pond
TEDx Talk
Available on YouTube

♦

Soil and the Extractive Industries
Session organiser and presenter
Global Soil Week, Berlin (2015)

♦

How to dismantle an atomic bomb
Conference presentation (2014)
Environmental Law Association (SA)

PROJECT EXPERIENCE (Continued)

Agricultural Agro-Ecosystem Assessments

Range of projects: Renewable Energy, Industrial and Residential Developments, Mining, Linear Developments (railways and power lines)

The assessments were conducted as part of the Environmental and Social Impact Assessment processes. The assessment process includes the assessment of soil physical and chemical properties as well as other natural resources that contributes to the land capability of the area.

Project examples:

- Mocuba Solar PV Development, Mozambique
- Italthai Railway between Tete and Quelimane, Mozambique
- Lichtenburg PV Solar Developments, South Africa
- Manica Gold Mine Project, Mozambique
- Khunab Solar PV Developments near Upington, South Africa
- Bomi Hills and Mano River Mines, Liberia
- King City near Sekondi-Takoradi and Appolonia City near Accra, Ghana
- Limpopo-Lipadi Game Reserve, Botswana
- Namoya Gold Mine, Democratic Republic of Congo

Sustainable Agriculture

Range of projects: Policy Development for Financial Institutions, Mine Closure Planning, Agricultural Project and Business Development Planning

Each of the projects completed had a unique scope of works and the methodology was designed to answer the questions. While global indicators of sustainable agriculture are considered, the unique challenges to viable food production in Africa, especially climate change and a lack of infrastructure, in these analyses.

Project examples:

- Measurement of sustainability of agricultural practices of South African farmers – survey design and pilot testing for the LandBank of South Africa
- Analysis of the viability of avocado and mango large-scale farming developments in Angola for McKinsey & Company
- Closure options analysis for the Tshipi Borwa Mine to increase agricultural productivity in the area, consultation to SLR Consulting
- Analysis of risks and opportunities for farm feeds and supplement suppliers of the Southern African livestock and dairy farming industries
- Sustainable agricultural options development for mine closure planning of the Camutue Diamond Mine, Angola

PROFESSIONAL DEVELOPMENT

Contaminated Land Management 101 Training
Network for Industrially Contaminated Land in Africa
2020

Intensive Agriculture in Arid & Semi-Arid Environments
CINADCO/MASHAV R&D Course, Israel
2015

World Soils and their Assessment Course
ISRIC – World Soil Information Centre, Netherlands
2015

Wetland Rehabilitation Course
University of Pretoria
2010

Course in Advanced Modelling of Water Flow and Solute Transport in the Vadose Zone with Hydrus
University of Kwazulu-Natal
2010

Environmental Law for Environmental Managers
North-West University Centre for Environmental Management
2009

PROJECT EXPERIENCE (Continued)

Soil Quality Assessments

Range of projects: Rehabilitated Land Audits, Mine Closure Applications, Mineral and Ore Processing Facilities, Human Resettlement Plans

The soil quality assessments included physical and chemical analysis of soil quality parameters to determine the success of land rehabilitation towards productive landscapes. The assessments are also used to understand the suitability for areas for Human Resettlement Plans

Project examples:

- Closure Planning for Yoctolux Colliery
- Soil and vegetation monitoring at Kingston Vale Waste Facility
- Exxaro Belfast Resettlement Action Plan Soil Assessment
- Soil Quality Monitoring of Wastewater Irrigated Areas around Matimba Power Station
- Keaton Vanggatfontein Colliery Bi-Annual Soil Quality Monitoring

REFERENCES

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APPENDIX C: LAND TYPE DATA SHEETS

LAND TYPE / *LANDTIPE*..... : Fa11

CLIMATE ZONE / *KLIMAATSONE* ..... : 11S

Area / *Oppervlakte* ..... : 41880 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 1100 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*

2524 Mafikeng (430 ha) 2526 Rustenburg (10140 ha)

2624 Vryburg (2070 ha) 2626 Wes-Rand (29240 ha)

Inventory by / *Inventaris deur :*

R W Bruce

Modal Profiles / *Modale profiele :*

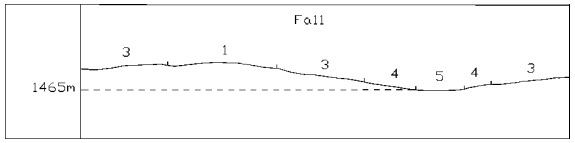
None / Geen

Terrain unit / *Terreineenheid* ..... :	1	3	4	5
% of land type / *% van landtipe* ..... :	25	60	10	5
Area / *Oppervlakte (ha)* ..... :	10470	25128	4188	2094
Slope / *Helling (%)* ..... :	0 - 2	2 - 5	1 - 2	0 - 1
Slope length / *Hellingslengte (m)* ..... :	400 - 600	800 - 1200	400 - 600	40 - 60
Slope shape / *Hellingsvorm* ..... :	Y	Z-Y	Z-X	X
MB0, MB1 (ha) ..... :	1256	11810	2094	1675
MB2 - MB4 (ha) ..... :	9214	13318	2094	419

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB	:	ha	%	ha	%	ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Soil-rock complex			:																
Grond-rotskompleks:			:																
Rock/Rots		4	:	1675	16	1759	7	712	17	126	6	4272	10.2						
Mispah Ms10, Klipfontein Ms11,			:																
Platt Gs14, Glenrosa Gs15,			:																
Trevanian Gs17	100-150	3	:	7538	72	11559	46	1382	33	293	14	20772	49.6	10-20			A	meSaLm-LmSa	so,R,hp
Msinga Hu26, Clansthal Hu24,			:																
Lichtenburg Hu23	250-1200+	0	:	1256	12	11810	47	2094	50	838	40	15998	38.2	10-25		13-30	B	meSaLm-SaClLm	R,so
Devon We22, Newport Cv27,			:																
Southwold Cv26, Avalon Av26,			:																
Chinyika Wo21	250-1200+	0	:							838	40	838	2.0	20-40		20-40	A	SaClLm-SaCl	sp

Terrain type / *Terreintipe :* A2

Terrain form sketch / *Terreinvormskets*



For an explanation of this table consult LAND TYPE INVENTORY (table of contents)

Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Geology: Dolomite and chert belonging to the Chuniespoort Group; chert gravels are abundant on middle and footslopes including valley bottoms.

Geologie: Dolomiet en chert van die Groep Chuniespoort; chertgruise is volop op middel- en voethange, asook valleivloere.

LAND TYPE / *LANDTIPE*..... : Bc11

CLIMATE ZONE / *KLIMAATSONE* ..... : 11S

Area / *Oppervlakte* ..... : 32540 ha

Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 1000 ha

Terrain unit / *Terreineenheid*	:	4	5
% of land type / *% van landtipe*	:	95	5
Area / *Oppervlakte (ha)*	:	30913	1627
Slope / *Helling (%)*	:	0 - 2	0 - 1
Slope length / *Hellingslengte (m)*	:	1300 - 1700	50 - 100
Slope shape / *Hellingsvorm*	:	Z-Y	Z-X
MB0, MB1 (ha)	:	30913	1627
MB2 - MB4 (ha)	:	0	0

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*

2524 Mafikeng (9100 ha) 2624 Vryburg (15830 ha)

2626 Wes-Rand (7610 ha)

Inventory by / *Inventaris deur :*

R W Bruce

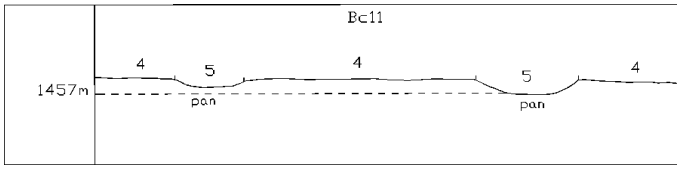
Modal Profiles / *Modale profiele :*

P113

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB		ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Rietvlei We12, Sibasa We13	500-700	0	:	9892	32			9892	30.4	15-25		30-40	B	fiSaClLm	B2gc
Shorrocks Hu36, Msinga Hu26	>1200	0	:	8037	26			8037	24.7	14-18		18-25	B	fiSaLm-SaClLm	R,so
Soetmelk Av36, Avalon Av26	900-1200	0	:	5255	17			5255	16.2	15-18		18-25	B	fiSaLm-SaClLm	B2gc
Lonetree Bv26, Bainsvlei Bv36	900-1100	0	:	4946	16			4946	15.2	15-18		18-25	B	fiSaLm-SaClLm	B2gc
Lichtenburg Hu23, Mangano Hu33	>1200	0	:	1546	5			1546	4.8	9-12		12-15	B	LmfiSa-SaLm	R,so
Leslie Gc36, Glencoe Gc26	500-700	0	:	1237	4			1237	3.8	15-18		18-25	B	fiSaLm-SaClLm	hp
Sterkspruit Ss26	200-250	0	:			976	60	976	3.0	18-25		35-40	A	fiSaLm-SaClLm	B2
Rensburg Rg20	700-900	0	:			651	40	651	2.0	30-50			A	fiSaCl-Cl	G

Terrain type / *Terreintipe :* A1

Terrain form sketch / *Terreinvormskets*



For an explanation of this table consult LAND TYPE INVENTORY (table of contents)
Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Geology: Thick aeolian sand on the Chuniespoort Group. In places calcrete underlies solums. Small pans occupy 5% of the land type.

Geologie: Dik eoliese sand op die Groep Chuniespoort.Kalkreet kom soms onder solums voor.Klein panne beslaan 5% van die landtipe.

LAND TYPE / *LANDTIPE*..... : Fb4

CLIMATE ZONE / *KLIMAATSONE* ..... : 9S

Area / *Oppervlakte* ..... : 111350 ha

Estimated area unavailable for agriculture
Beraamde oppervlakte onbeskikbaar vir landbou : 3000 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte :*
2524 Mafikeng (65110 ha) 2624 Vryburg (38300 ha)
2626 Wes-Rand (7940 ha)

Inventory by / *Inventaris deur :*
R W Bruce

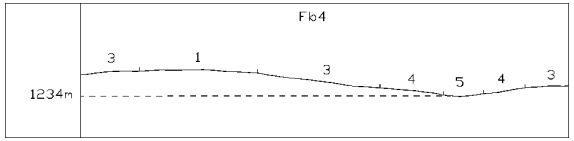
Modal Profiles / *Modale profiele :*
None / Geen

Terrain unit / *Terreineenheid* ..... :	1	3	4	5
% of land type / *% van landtipe* ..... :	30	45	20	5
Area / *Oppervlakte (ha)* ..... :	33405	50108	22270	5568
Slope / *Helling (%)* ..... :	0 - 1	2 - 4	1 - 2	0 - 1
Slope length / *Hellingslengte (m)* ..... :	400 - 600	800 - 1200	400 - 600	40 - 60
Slope shape / *Hellingsvorm* ..... :	Y	Z-Y	X	X
MB0, MB1 (ha) ..... :	21379	28060	13362	4454
MB2 - MB4 (ha) ..... :	12026	22047	8908	1114

Soil series or land classes *Grondseries of landklasse*	**Depth** *Diepte* (mm)	MB		ha	%	ha	%	ha	%	ha	%	**Total** *Totaal* ha	%	**Clay content %** *Klei-inhoud %* A	E	B21	Hor	**Texture** *Tekstuur* Class / *Klas*	**Depth limiting material** *Diepte-beperkende materiaal*
Soil-rock complex			:																
Grond-rotskompleks:			:																
Rock/Rots		4	:	1670	5	2004	4	1114	5	557	10	5345	4.8						
Loskop Ms12, Kalkbank Ms22	250-350	1	:	13362	40	14531	29	8463	38	557	10	36913	33.2	10-20			A	fiSaLm	ka
Mispah Ms10, Klipfontein Ms11	50-150	3	:	6013	18	11024	22	4454	20	557	10	22047	19.8	10-20			A	fiSaLm	R,hp
Glenrosa Gs15, Trevanian Gs17,			:																
Williamson Gs16, Platt Gs14	100-200	3	:	4343	13	9019	18	3340	15			16702	15.0	10-20			A	meSaLm	so,R
Blinkklip Cv36, Dudfield Cv46,			:																
Annandale Cv33, Leslie Gc36	250-350	0	:	2338	7	5512	11					7850	7.1	8-20		13-25	B	fiSaLm	so,R,hp
Shorrocks Hu36, Msinga Hu26	250-350	0	:	3340	10	4510	9					7850	7.1	10-20		15-25	B	fiSaLm	so,R
Bonheim Bo41, Weenen Bo40,			:																
Lindley Va41, Graythorne Mw21	150-250	0	:					4899	22	1670	30	6570	5.9	25-40		35-55	A	fiSaClLm	B2,R
Rietvlei We12, Devon We22	300-500	0	:	2338	7	3508	7					5846	5.3	15-25		30-35	B	fiSaClLm	B2gc
Rensburg Rg20, Sarasdale Wo20	500-800	0	:							2227	40	2227	2.0	30-55			A	fiSaCl-Cl	G

Terrain type / *Terreintipe :* A2

Terrain form sketch / *Terreinvormskets*



For an explanation of this table consult LAND TYPE INVENTORY (table of contents)
Ter verduideliking van hierdie tabel kyk LANDTIPE - INVENTARIS (inhoudsopgawe)

Geology: Andesitic to basaltic lavas of the Ventersdorp Supergroup often overlain by calcrete.

Geologie: Andesitiese tot basaltiese lawas van die Supergroep Ventersdorp;op baie plekke met kalkreet bedek.