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AGRICULTURAL AND SOILS IMPACT ASSESSMENT FOR PROPOSED BOITSHOKO SOLAR POWER PLANT NEAR KATHU NORTHERN CAPE PROVINCE

EIA PHASE REPORT

Report by
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Executive Summary

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the proposed site is on land which is unsuitable for cultivation due to both climate and soil limitations.

The key findings of this study are:

- Soils on the site are shallow, sandy soils on underlying hardpan carbonate (Coega, and Plooysburg soil forms).
- The major limitations to agriculture are the limited climatic moisture availability and the shallow, poor soils.
- As a result, the site is unsuitable for cultivation and agricultural land use is limited to grazing.
- The land capability is classified as Class 7 - non-arable, low potential grazing land. The site has a grazing capacity of 14-17 hectares per large stock unit.
- No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.
- The low agricultural potential of the site limits the significance of all agricultural impacts.
- Three potential negative impacts of the development on agricultural resources and productivity were identified as:
  - Loss of agricultural land use caused by direct occupation of land by the energy facility footprint.
  - Loss of topsoil in disturbed areas, causing a decline in soil fertility.
  - Soil Erosion caused by alteration of the surface characteristics.
- Two potential positive impacts of the development on agricultural resources and productivity were identified as:
  - Generation of alternative / additional land use income through land rental by the energy facility, which will improve the financial sustainability of the farming enterprise.
  - Increased security against stock theft and predation for small stock farming within fenced panel areas.
- All impacts were assessed as having low significance.
- Recommended mitigation measures include facilitation of small stock grazing within the panel areas during the operational phase to mitigate loss of agricultural land use; implementation of an effective system of storm water run-off control to mitigate erosion; and topsoil stripping and re-spreading to mitigate loss of topsoil.
- Because of the low agricultural potential of the site and resultant low agricultural impacts, the development should, from an agricultural impact perspective, be authorised.

- Despite any cumulative regional impact that may occur, it is preferable to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.
- Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site.
- There are no conditions resulting from this assessment that need to be included in the environmental authorisation.

1 INTRODUCTION

Development of Boitshoko Solar Power Plant is proposed on the Remaining Extent of Portion 1 of the farm Limebank No. 471, approximately 12 kilometres north west of the town of Kathu (see Figure 1). The facility will deliver a total capacity of 100MW, with maximum 115MW installed. It will consist of arrays of photovoltaic panels supported by mounting structures, inverter stations, internal access roads, cabling, fencing, an on-site substation with a 132kv connection to the Eskom grid, and a building for a workshop, storage, and offices. The footprint of the energy facility will utilise up to 300 hectares, of the total farm portion of 1,296 hectares.

The objectives of this study are to identify and assess all potential impacts of the proposed development on agricultural resources, including soils, and agricultural production potential, and to provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts. Johann Lanz was appointed by Boitshoko Solar Power Plant (RF) (Pty) Ltd as an independent specialist to conduct this Soils and Agricultural Impact Assessment.

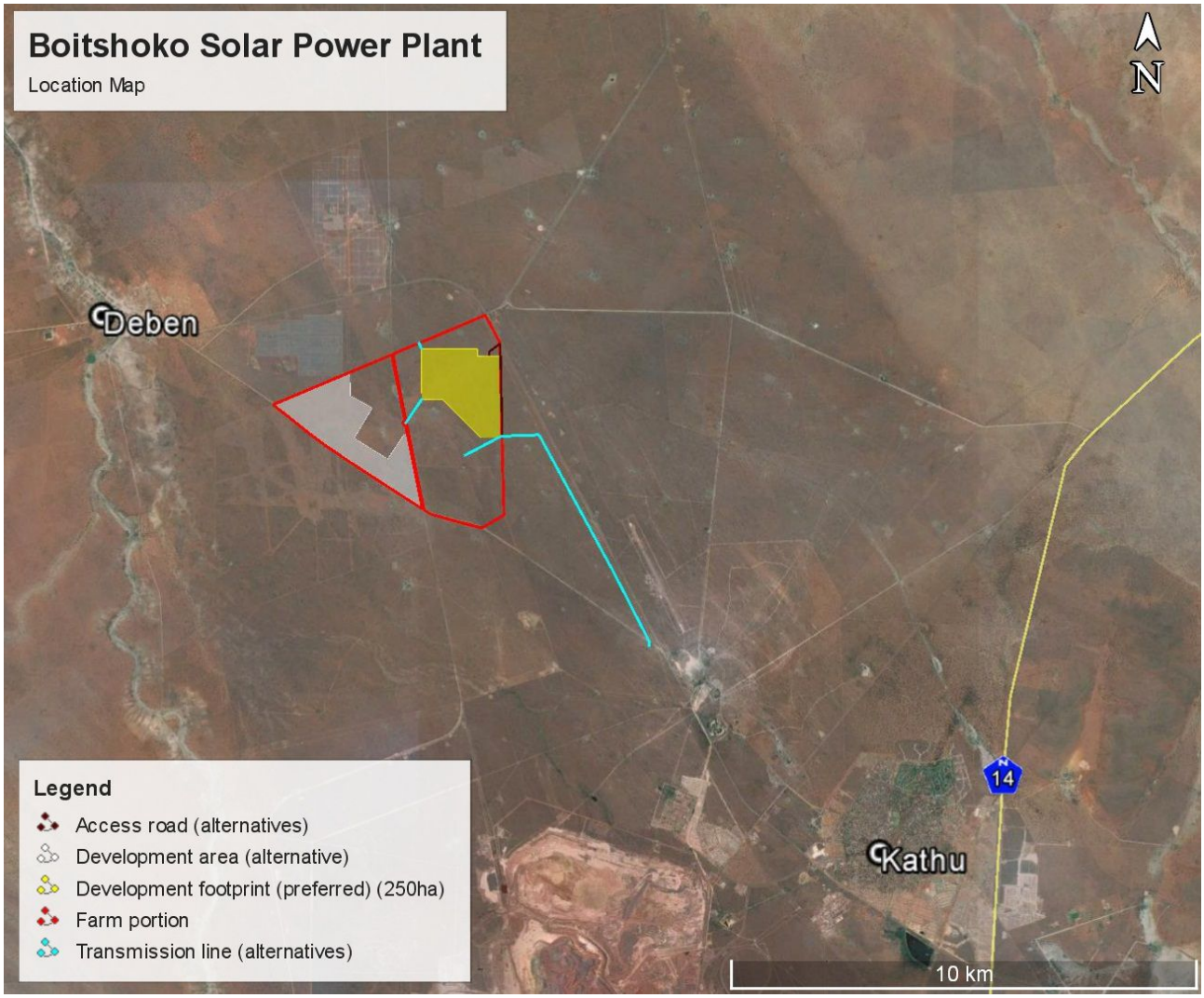

Figure 1. *Location map of the proposed site, north west of the town of Kathu.*

2 TERMS OF REFERENCE

The terms of reference for the study fulfills the requirements for a soils and agricultural study as described in the National Department of Agriculture's document, *Regulations for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011. The study applies an appropriate level of detail for the agricultural suitability and soil variation on site, which, because it is justified (see section 3.1), is less than the standardised level of detail stipulated in the above regulations.

The above requirements may be summarised as:

- Identify and assess all potential impacts (direct, indirect and cumulative) of the proposed development on soils and agricultural potential.
- Describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Describe the topography of the site.
- Describe the climate in terms of agricultural suitability.
- Summarise available water sources for agriculture.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Describe the erosion, vegetation and degradation status of the land.
- Determine the agricultural potential across the site.
- Determine the agricultural sensitivity to development across the site.
- Provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts.

The report also fulfils the requirements of Appendix 6 of the 2014 EIA Regulations (See Table 1).

The scope of the assessment included the PV Solar Energy Facility and its associated structures and infrastructure (such as the power line and access route). The impacts associated with the power line and access route that run beyond the site are considered to be negligible since the actual footprints of disturbance of the power lines is confined to the pylon bases. Furthermore, the power line and access route are aligned with existing roads as far as possible to avoid any negative environmental impacts.

The investigation also includes a brief geotechnical assessment, based on geological maps and the walk-over inspection of the site. The following terms of reference apply to the geotechnical assessment:

- Verify the underlying geology and soil cover by means of limited surface mapping.
- Assessing the suitability of the area with regard to the proposed development, based on the available geological- and geotechnical information.
- Identify the general constraints and required precautionary measures that may be

required for the proposed development from a planning perspective.

- Make recommendations on the most-, intermediately- and least suitable portions of the project area with regard to the proposed development.

Table 1. Compliance with the Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. A specialist report prepared in terms of these Regulations must contain a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	 Title page Accompanies report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Accompanies report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 and 2
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.1
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 3
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 6.8
g) an identification of any areas to be avoided, including buffers;	Section 6.8
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 8
k) any mitigation measures for inclusion in the EMPr;	Section 8
l) any conditions for inclusion in the environmental authorisation;	Section 9
m)any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	 Section 9 Section 8
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3.1
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable

q) any other information requested by the competent authority.	Not applicable

3 METHODOLOGY OF STUDY

3.1 Methodology for assessing soils and agricultural potential

The assessment was based largely on existing soil and agricultural potential data for the site. The source of this data was the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated). Satellite imagery of the site available on Google Earth was also used for evaluation.

The AGIS data was supplemented by a field investigation. This was aimed at ground-proofing the AGIS data and achieving an understanding of specific soil and agricultural conditions, and the variation of these across the site. The field investigation involved a drive and walk over of the site using assessment of surface conditions and existing cuttings / excavations. The field assessment was done on 2 April 2016.

Soils were classified according to the South African soil classification system (Soil Classification Working Group, 1991).

It is my opinion that the level of soil mapping detail in the above DAFF requirements is appropriate for arable land only. It is not appropriate for this site. Detailed soil mapping has little relevance to an assessment of agricultural potential in this environment, where cultivation potential is extremely limited, soil conditions are generally poor and the agricultural limitations are overwhelmingly climatic. In such an environment, even where soils suitable for cultivation may occur, they cannot be cultivated because of the aridity constraints. Conducting a soil assessment at the required level of detail would be very time consuming and be a waste of that time, as it would add almost no value to the assessment. The level of soil assessment that was conducted for this report (reconnaissance ground proofing of land type data) is considered more than adequate for a thorough assessment of all agricultural impacts.

An assessment of soils (soil mapping) and long term agricultural potential is in no way affected by the season in which the assessment is made, and therefore the fact that the assessment was done in summer has no bearing on its results.

The field investigation also included a visual assessment of erosion and erosion potential on site, taking into account the proposed development layout.

Consultation was done with the current farmer of the land, Mr Hendrik van der Merwe, to get details of farming activities.

3.2 Methodology for assessing impacts and determining impact significance

In assessing the significance of each impact the following criteria are used:

GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.

2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative	The impact would result in insignificant cumulative effects.

	impact	
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

4 CONSTRAINTS AND LIMITATIONS OF STUDY

The field investigation for this assessment is considered more than adequate for the purposes of this study (see section 3.1) and is therefore not seen as a limitation. A more detailed soil investigation is not considered likely to have added anything significant to the assessment of agricultural soil suitability for the purposes of determining the impact of the facility on

agricultural resources and productivity.

However the limited subsurface investigation has relevance for the geotechnical assessment. With the level of field investigation undertaken, it is only possible to provide a characterisation of the likely geotechnical conditions. These have not been ground proven in any detail.

The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

There are no other specific constraints, uncertainties and gaps in knowledge for this study.

5 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

A change of land use (re-zoning) for the development on agricultural land needs to be approved in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). This is required for long term lease, even if no subdivision is required. Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). No application is required in terms of CARA. The EIA process covers the required aspects of this. The Department of Agriculture, Forestry and Fisheries reviews and approves applications in terms of these Acts according to their *Guidelines for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011.

6 DESCRIPTION OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

6.1 Climate and water availability

Rainfall for the site is given as 369 mm per annum (The World Bank Climate Change Knowledge Portal, undated). The average monthly distribution of rainfall is shown in Figure 2. One of the most important climate parameter for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. Moisture availability is classified into 6 categories across the country (see Table 2). The site falls into the second driest 5th category, which is labelled as a severe limitation to agriculture.

There are several wind pumps across the farm. These are used for stock watering. The farm does not have access to water for irrigation.

Table 2. The classification of moisture availability climate classes for summer rainfall areas across South Africa (Agricultural Research Council, Undated)

Climate class	Moisture availability (Rainfall/0.25 PET)	Description of agricultural limitation
C1	>34	None to slight
C2	27-34	Slight
C3	19-26	Moderate
C4	12-18	Moderate to severe
C5	6-12	Severe
C6	<6	Very severe

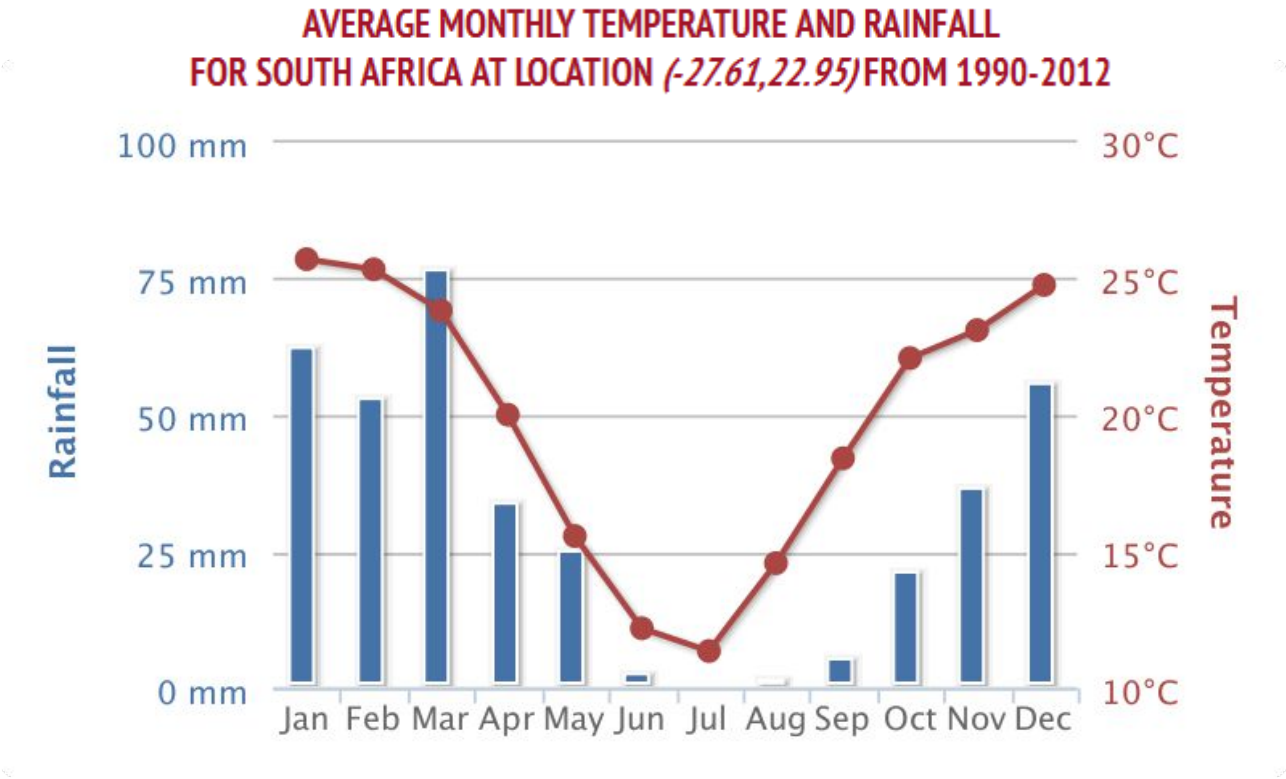

Figure 2. *Average monthly temperature and rainfall for the site (The World Bank Climate Change Knowledge Portal, undated).*

6.2 Terrain, topography and drainage

The proposed development is located on a terrain unit of level plains with some relief at an altitude of around 1,150 meters. Slope is approximately 1% across the site. A satellite image map of the site is shown in Figure 3. Access roads and grid connections are shown in Figure 4. Photographs of site conditions are shown in Figures 5 and 6.

The geology is surface limestone, alluvium and red wind-blown sand of Tertiary to Recent age with a few occurrences of amygdaloidal andesitic lava (Ongeluk Formation).

There are no water courses on or near the site. There are wetlands around the site, but these

have been purposefully excluded from the site.

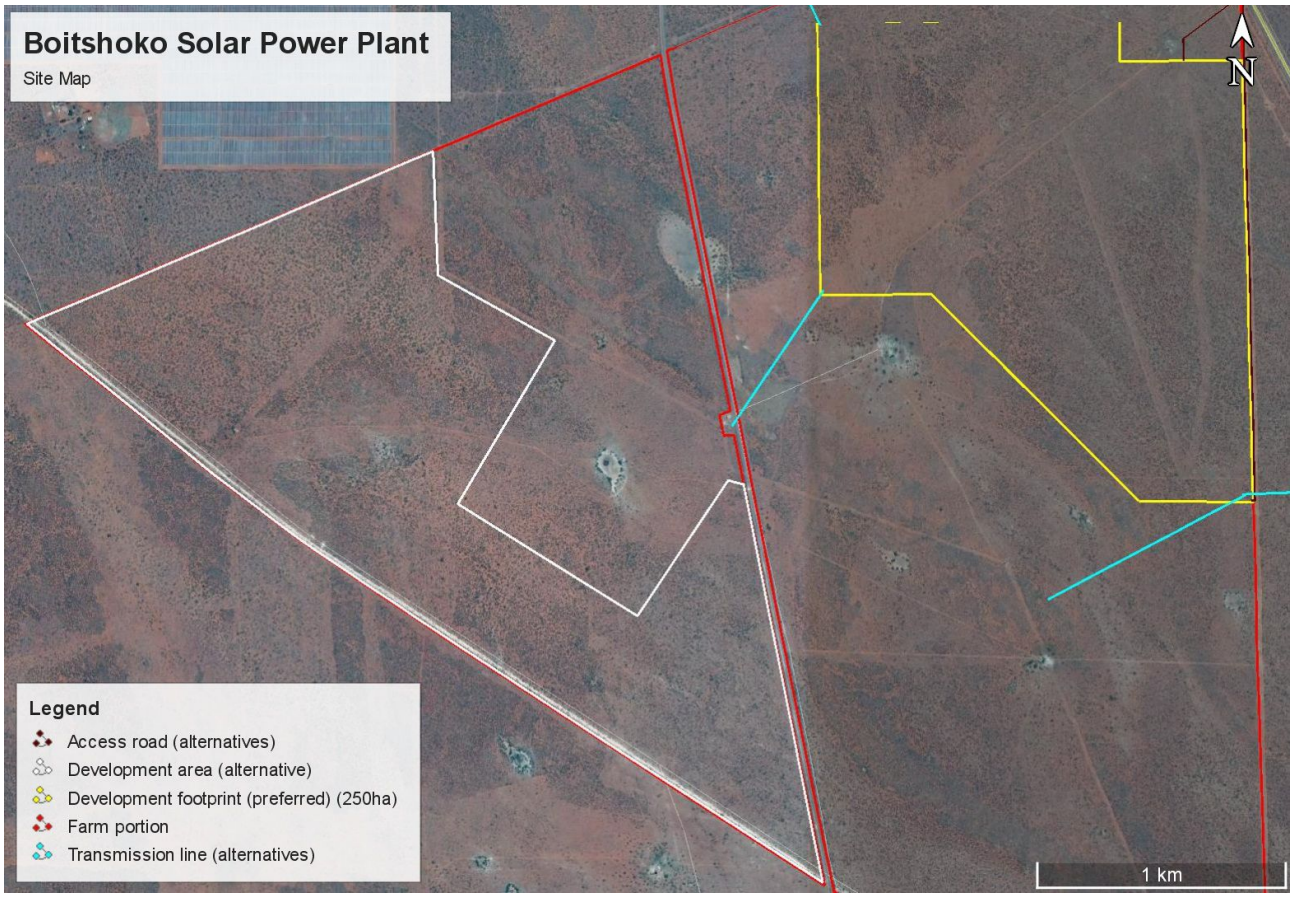

Figure 3. *Satellite image of the proposed site.*

6.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climate conditions into different land types. There is a single land type across the site, namely Ag110. Soils of this land types are predominantly shallow, sandy soils on underlying hardpan carbonate or rock. These soils fall into the Calcic and Lithic soil groups according to the classification of Fey (2010). A summary detailing soil data for the land type is provided in Appendix 1, Table A1. The field investigation confirmed that the site is underlain by hardpan carbonate (see Figures 5-6). Soils are predominantly of the Coega soil form, with lesser coverage of shallow Plooysburg form. It should be noted that the land type classification presented in Table A1 made use of the older South African soil classification system, which did not include the Coega and Plooysburg forms. These forms would have been classified, according to the older system, as Mispah and Hutton respectively.

The soils are classified as having low to moderate susceptibility to water erosion (class 5), and as highly susceptible to wind erosion (class 1b).

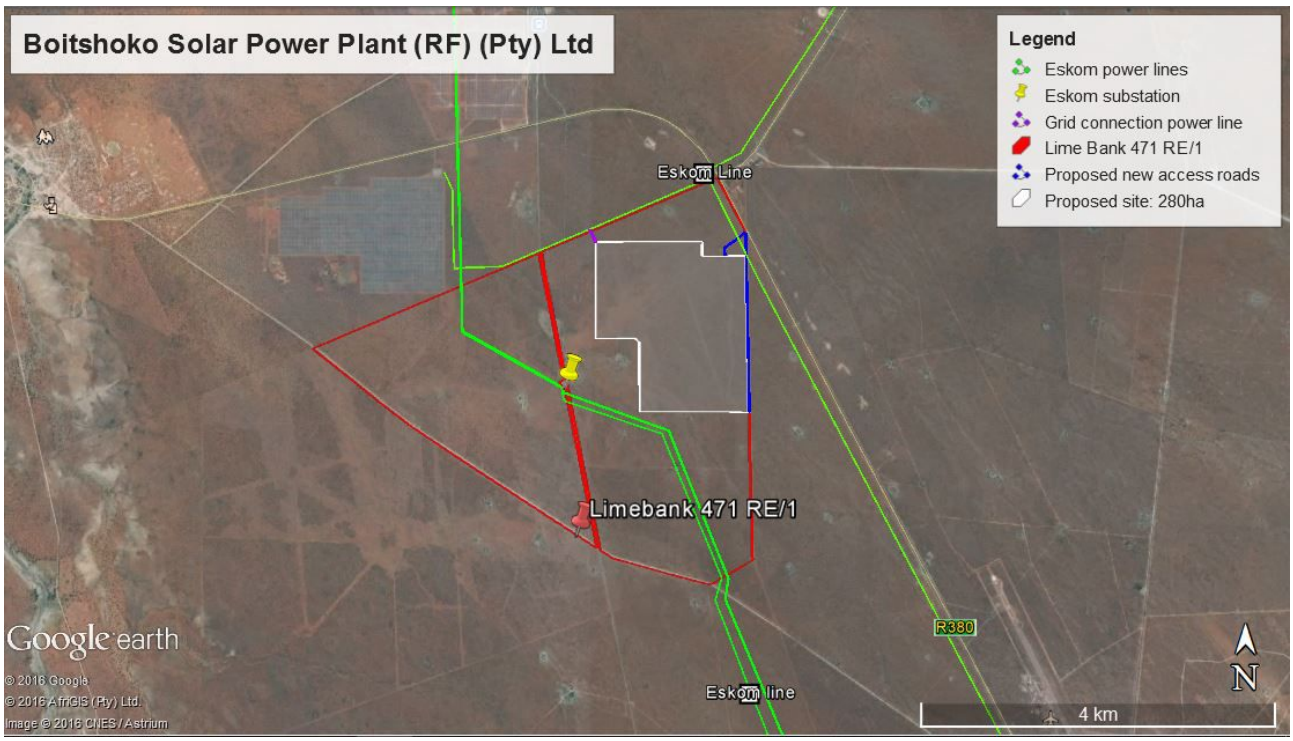

Figure 4. *Access route and preferred power line.*

6.4 Agricultural capability

Land capability is the combination of soil suitability and climate factors. The site and surrounds has a land capability classification, on the 8 category scale, of Class 7 – non-arable, low potential grazing land.

The limitations to agriculture are both climate and soil related. The moisture availability class 5 classification, with high variability of rainfall is a very severe limitation to agriculture, which makes any cultivation without irrigation completely non-viable. The extremely shallow soils, with very limited water holding capacity, across the site make the site totally unsuitable for irrigation. The grazing capacity on AGIS is classified almost entirely across the site as 14-17 hectares per large stock unit, although a small part is lower at 18-21 hectares per large stock unit.

Figure 5. *View of typical conditions across the site. Note the hardpan carbonate occurring at the soil surface.*

Figure 6. *View of excavations on site that have unearthed the shallow hardpan carbonate layer.*

6.5 Land use and development on and surrounding the site

The farm is located within a cattle farming agricultural region and currently used only for grazing. There has never been any cultivation on the farm.

There are no buildings on the site. The only agricultural infrastructure on the site is wind pumps, stock watering points and fencing into grazing camps. There is no farmstead on the farm portion.

Road access to the site is a short distance off the tarred R380.

6.6 Status of the land

The biome classification for the site is Kathu Bushveld. The vegetation is grazed and sparse due to low rainfall, but there is no evidence of significant erosion or other land degradation on the site.

6.7 Possible land use options for the site

Because of the climate and soil limitations, the site is totally unsuitable for cultivated crops, and viable agricultural land use is limited to grazing only.

6.8 Agricultural sensitivity

Agricultural conditions and potential are uniform across the site and the choice of placement of infrastructure therefore has no influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the investigated site and no parts of it therefore need to be avoided by the development. There are no required buffers.

7 BRIEF GEOTECHNICAL ASSESSMENT

Factors relevant to a geotechnical description of the site have been discussed in sections 6.1 to 6.6, above. Some aspects are highlighted here for geotechnical purposes.

Probably the entire site is underlain by shallow, hardpan carbonate that varies between 0 and 40cm below surface. It is likely to vary in thickness between about 20 and 80cm. There is a thin covering (0-40cm) of unconsolidated, sandy soil above the hardpan.

The foundations for mounting structures will need to be erected through the hardpan carbonate layer.

None of the following occur on the site:

- Shallow water table (less than 1.5m deep)
- Sinkhole or doline areas.
- Seasonally wet soils (often close to water bodies)
- Unstable rocky slopes or steep slopes with loose soil
- Dispersive soils (soils that dissolve in water)
- Soils with high clay content (clay fraction more than 40%)
- Any other unstable soil or geological feature

Soils across the site are susceptible to wind erosion.

The geotechnical conditions are assessed, in terms of this investigation, as suitable for the development of a solar energy facility. Because soil conditions are fairly uniform across the site, there are no more and less suitable parts of the project area for development, but drainage areas between wetlands should be avoided.

8 IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the site by the footprint of the facility
- Constructional activities that disturb the soil profile and vegetation, for example for levelling, excavations, etc.

The following five potential impacts of the development on agricultural resources and productivity are identified, and assessed in the table formats below. The assessment includes the impacts of the associated power lines that run beyond the site. These impacts are negligible because the actual footprint of disturbance of the power lines is confined to the pylon bases. All grazing can continue undisturbed below the lines themselves and the footprint of the power line is therefore minuscule in relation to available grazing land.

Mitigation and monitoring recommendations are included in the table for each impact.

All five impacts are associated with all the phases of the development - construction, operational, and decommissioning.

1. Nature: Loss of agricultural land use Caused by: direct occupation of land by total footprint of energy facility infrastructure; And having the effect of: taking affected portions of land out of agricultural production.
Comments: The impact is reversible after the life of the project, with effective topsoiling of the land during rehabilitation, where necessary. During the operational phase the site can be used for grazing of small stock between the panels. Much less land is therefore excluded from agricultural use during the operational phase than during the construction phase.

	Without mitigation	**With mitigation**
Geographical extent	Low (1) - Site	Low (1) - Site
Probability	Definite (4)	Definite (4)
Duration	Long term (3)	Long term (3)
Intensity / Magnitude	Medium (2)	Low (1)
Reversibility	Partly reversible (2)	Partly reversible (2)
Irreplaceable loss of resources?	None (1)	None (1)
Cumulative effect	Low (2)	Negligible (1)
Significance	Low (26)	Low (12)
Status	Negative	Negative
Mitigation: Set up the facility and the agreements with land owners in such a way that facilitates grazing of small stock within the panel areas during the operational phase. Minimise disturbance to vegetation during the construction phase so that the veld within panel areas remains in tact for grazing during the operational phase.		
Monitoring: Record all periods when the panel area is used for grazing of small stock to prove ongoing agricultural land use. Specifically record whether any predation to small stock occurs or not within the panel area. On the event of any predation taking place, the fence must be inspected and repaired to be jackal proof again.		

2. Nature: Generation of alternative land use income through rental for energy facility. This is a positive impact for agriculture. It will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability.		
Geographical extent	Low (1) - Site	
Probability	Definite (4)	
Duration	Long term (3)	
Intensity / Magnitude	Medium (2)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources?	None (1)	
Cumulative effect	Low (2)	
Significance	Low (24)	
Status	Positive	
Optimization: None		
Monitoring: None		

3. Nature: Increased security against stock theft and predation. This is a positive impact for agriculture. Because the energy facility is likely to be fenced with secure fencing that is jackal proof and because it will need to be secured against human entry, it offers grazing land for small stock that has increased security against both stock theft and predation. This has the potential to improve the production of small stock farming on site, particularly because both stock theft and predation are significant limitations to small stock farming on site.

	Without mitigation	**With mitigation**
Geographical extent	Low (1) - Site	Low (1) - Site
Probability	Possible (2)	Definite (4)
Duration	Long term (3)	Long term (3)
Intensity / Magnitude	Medium (2)	Medium (2)
Reversibility	Completely reversible (1)	Completely reversible (1)
Irreplaceable loss of resources?	None (1)	None (1)
Cumulative effect	Low (2)	Low (2)
Significance	Low (20)	Low (24)
Status	Positive	Positive

Optimization: Set up the facility and the agreements with land owners in such a way that facilitates grazing of small stock within the panel areas during the operational phase.
Ensure that the security fencing around the facility is jackal proof.
Minimise disturbance to vegetation during the construction phase so that the veld within panel areas remains in tact for grazing during the operational phase.

Monitoring: Record all periods when the panel area is used for grazing of small stock to prove ongoing agricultural land use.
Specifically record whether any predation to small stock occurs or not within the panel area. On the event of any predation taking place, the fence must be inspected and repaired to be jackal proof again.

4. Nature: Loss of topsoil
Caused by: poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.)
And having the effect of: loss of soil fertility on disturbed areas after rehabilitation.

	Without mitigation	**With mitigation**
Geographical extent	Low (1) - Site	Low (1) - Site
Probability	Possible (2)	Unlikely (1)
Duration	Long term (3)	Long term (3)
Intensity / Magnitude	Medium (2)	Medium (2)
Reversibility	Partly reversible (2)	Partly reversible (2)
Irreplaceable loss of resources?	Marginal (2)	Marginal (2)
Cumulative effect	Negligible (1)	Negligible (1)
Significance	Low (22)	Low (20)
Status	Negative	Negative

Mitigation:
If an activity will mechanically disturb below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation.
Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.

Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land.
During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.
Erosion must be controlled where necessary on topsoiled areas.

Monitoring:
Establish an effective record keeping system for each area where soil is disturbed for constructional purposes. These records should be included in environmental performance reports, and should include all the records below.
Record the GPS coordinates of each area.
Record the date of topsoil stripping.
Record the GPS coordinates of where the topsoil is stockpiled.
Record the date of cessation of constructional (or operational) activities at the particular site.
Photograph the area on cessation of constructional activities.
Record date and depth of re-spreading of topsoil.
Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.

5. Nature: Erosion due to alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal, presence of panel surfaces, and the establishment of hard standing areas and roads. Erosion will cause loss and deterioration of soil resources.

Comments: The erosion risk is low due to the low slope gradients and low to moderate erodibility of the soils.

	Without mitigation	**With mitigation**
Geographical extent	Low (1) - Site	Low (1) - Site
Probability	Possible (2)	Unlikely (1)
Duration	Medium term (2)	Medium term (2)
Intensity / Magnitude	Medium (2)	Medium (2)
Reversibility	Partly reversible (2)	Partly reversible (2)
Irreplaceable loss of resources?	Marginal (2)	Marginal (2)
Cumulative effect	Negligible (1)	Negligible (1)
Significance	Low (20)	Low (18)
Status	Negative	Negative

Mitigation: Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there.

Monitoring: Include periodical site inspection in environmental performance reporting that inspects the effectiveness of the run-off control system and specifically records occurrence or not of any erosion on site or downstream.

8.1 Cumulative impacts

There is potential for cumulative impacts to arise as a result of other projects that impact on agricultural land in the area.

Although the loss of individual project portions of land has low significance, as discussed above, the cumulative impacts of land loss regionally can become more significant. However, despite this cumulative impact, it is still agriculturally strategic from a national perspective to steer as much of the country's renewable energy development as possible to sites such as this one, with very low agricultural potential. It is preferable to incur a higher cumulative loss in a region with low agricultural potential, than to lose agricultural land with a higher production potential elsewhere in the country.

Because of the very low agricultural potential of the site considered in this report, its contribution to any cumulative impact is low.

8.2 Comparative assessment of alternatives

There is no significant difference between the preferred and alternative sites in terms of agricultural impact. No proposed grid connection alternatives will have any bearing on agricultural impacts. The no-go alternative has zero impact on agriculture, compared to the low, negative impact for the development. But the no-go alternative also means that the two positive impacts of the project will not be realised.

9 CONCLUSION AND RECOMMENDATIONS

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the investigated site is on land which is of low agricultural potential and is not suitable for cultivation.

Because of the low agricultural potential of the site, the development should, from an agricultural impact perspective, be authorised. It is preferable to incur a loss of agricultural land on such a site, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.

No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.

Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site. There are no conditions resulting from

this assessment that need to be included in the environmental authorisation.

10 REFERENCES

Agricultural Research Council. Undated. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town.

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

The World Bank Climate Change Knowledge Portal available at http://sdwebx.worldbank.org/climateportal/

APPENDIX 1: SOIL DATA

Table A1. Land type soil data for site.

Land type	Land capability class	Soil series (forms)	Depth (cm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ag110	7	Hutton	0-30	2-6	4-8	ca, R	55
		Mispah	0-30	6-15		ca	22
		Hutton	45-90	4-8	6-15	R, ca	14
		Hutton	45-90	8-15	15-25	R, ca	5
		Mispah	0-30	6-15		R	5

Land capability classes: 7 = non-arable, low potential grazing land.

Depth limiting layers: R = hard rock; ca = hardpan carbonate.