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SITE SENSITIVITY VERIFICATION AND AGRICULTURAL AGRO-ECOSYSTEM SPECIALIST ASSESSMENT FOR THE PROPOSED CAMDEN 1 SOLAR ENERGY FACILITY NEAR ERMELO IN MPUMALANGA PROVINCE

Report by
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27 September 2022

Table of Contents

Executive Summary 1
1 Introduction 3
2 Project description 4
3 Terms of reference 4
4 Methodology of study 7
4.1 Methodology for assessing soils and agricultural potential 7
5 Assumptions, uncertainties or gaps in knowledge or data 8
6 Applicable legislation and permit requirements 8
7 Site sensitivity verification 9
8 Baseline description of the agro-ecosystem 11
8.1 Soils 11
8.2 Terrain and slope 14
8.3 Available water sources 14
8.4 Vegetation 14
8.5 Agro-climatic information 14
8.6 Land use and development on and surrounding the site 14
8.7 Agricultural potential and productivity 15
8.8 Agricultural employment 15
8.9 Existing impacts on the site 15
9 Assessment of agricultural impact 15
9.1 What constitutes and agricultural impact? 15
9.2 The significance of agricultural impact and the factors that determine it 15
9.3 Impact identification 17
9.4 Cumulative impacts 18
9.5 Impacts of the no-go alternative 19
9.6 Alternative development footprints and comparative assessment of alternatives 19
9.7 Long term project benefits versus agricultural benefits 20
9.8 Additional environmental impacts 20
9.9 Micro-siting to minimize fragmentation and disturbance of agricultural activities 20
9.10 Allowable development limits 20
9.11 Mitigation measures 22
9.12 Impact assessment and statement 23
10 Conclusions 25
11 References 25
Appendix 1: Specialist Curriculum Vitae 27
Appendix 2: Details of the specialist, declaration of interest and undertaking under oath 28
Appendix 3: Map of projects considered for cumulative impact 30
Appendix 4: Soil data of land type 31

EXECUTIVE SUMMARY

The purpose of the agricultural component in the Environmental Authorisation process is to ensure that South Africa balances the need for development against the need to ensure the conservation of the natural agricultural resources, including land, required for agricultural production and national food security.

South Africa needs agricultural production for food security. It also urgently needs renewable energy development. In order to achieve its renewable energy generation goals, agriculturally zoned land will inevitably need to be used for renewable energy generation. The ideal, win-win scenario for both agricultural production and for electricity generation in South Africa, is for renewable energy facilities to be integrated with agricultural production in a way that provides benefits to agriculture and leads to very little loss of future agricultural production potential. In this scenario, renewable energy development does not pose a threat to agricultural production or to the agricultural economy of rural areas.

It is important to assess the agricultural impact of the Camden 1 SEF within the context of the net overall agricultural impact of the whole Camden renewable energy project of which it is a part. Within this context, the conclusion of this assessment is that the agricultural impact of the proposed development will be acceptable because:

1. It is a necessary part of the greater Camden renewable energy project which offers benefits to agriculture that can only be realised if the project includes a solar component which must necessarily impinge partially on cropland. The trade-off for agriculture of losing 114 hectares of cropland is likely to be more than compensated by the agricultural benefits of the greater project. These include increased economic viability for agricultural operations on site, security benefits against stock theft and other crime, an improved road network, with associated storm water handling system, that can be used for farming operations, and that the project will decrease the need for coal power and thereby contribute to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land in the area.
2. The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
3. In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.

The impact of the proposed development on the agricultural production capability of the site is assessed as being acceptable because of the above factors. Therefore, from an agricultural impact point of view, it is recommended that the development be approved.

INTRODUCTION

Environmental authorisation is being sought for the proposed Camden 1 Solar Energy Facility near Ermelo in Mpumalanga Province (see location in Figure 1). In terms of the National Environmental Management Act (Act No 107 of 1998) (NEMA), an application for environmental authorisation requires an agricultural assessment, in this case an Agricultural Agro-Ecosystem Specialist Assessment.

Johann Lanz was appointed as an independent agricultural specialist to conduct the agricultural assessment. The objective and focus of an agricultural assessment is to assess whether or not the proposed development will have an unacceptable agricultural impact by assessing the potential agricultural impacts of the proposed development, and based on this, to make a recommendation on whether or not it should be approved.

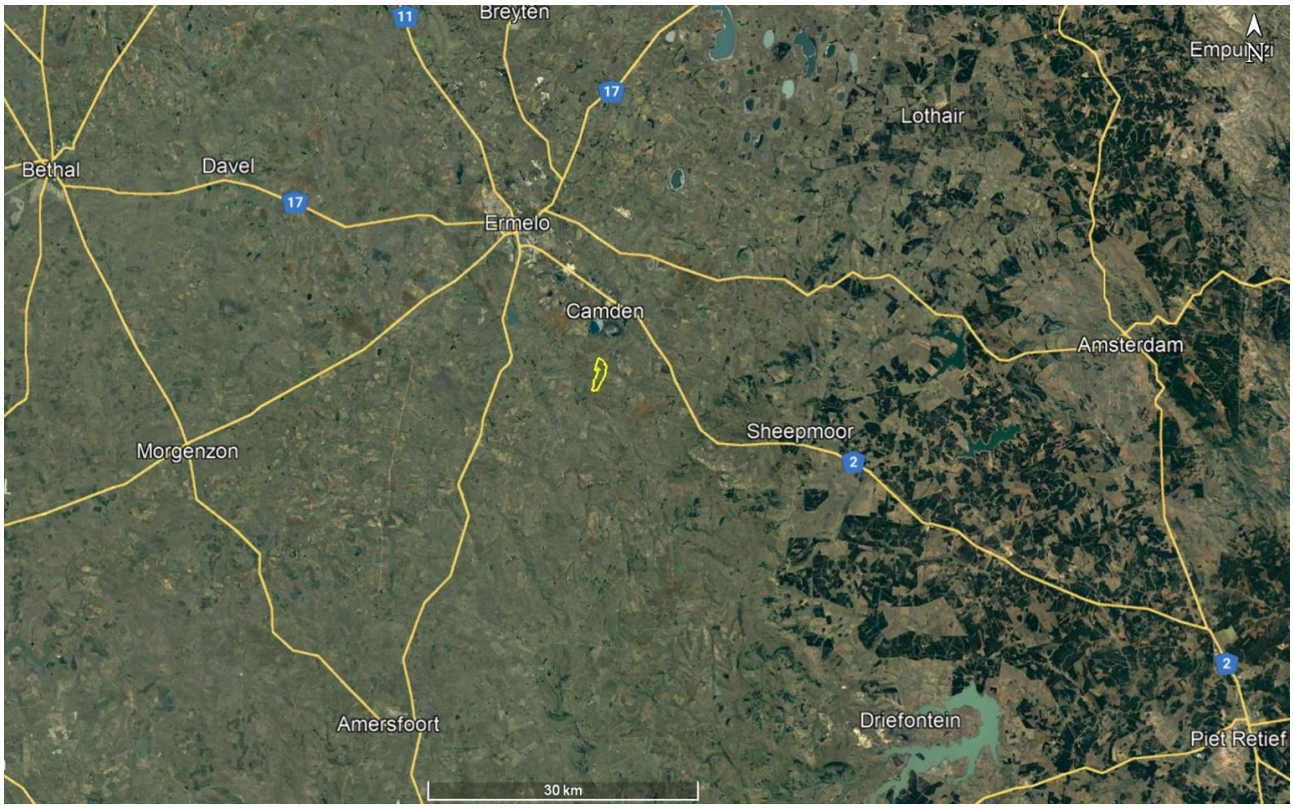

Figure 1. *Locality map of the proposed energy facility (yellow outline) south-east of the town of Ermelo.*

The purpose of the agricultural component in the Environmental Authorisation process is to preserve the agricultural production potential of, particularly scarce arable land, by ensuring that development does not exclude existing or potential agricultural production from the land or impact it to the extent that its future production potential is reduced.

PROJECT DESCRIPTION

The proposed facility will consist of the standard infrastructure of a PV energy facility including PV array; inverters; on-site substation; battery storage; auxiliary buildings; access and internal roads; temporary laydown areas; and fencing and will have a total generating capacity of up to 100MW. The grid connection infrastructure is subject to a separate assessment and EA.

The exact nature and layout of the different infrastructure within a solar energy facility has absolutely no bearing on the significance of agricultural impacts. It is therefore not necessary to detail the design and layout of the facility any further in this assessment. All that is of relevance is simply the total footprint of the facility that excludes agricultural land use or impacts agricultural land, referred to as the agricultural footprint. This is the area within the facility fence. Whether that footprint comprises a solar array, a road or a substation is irrelevant to agricultural impact. The total agricultural footprint of the facility is 290 hectares.

TERMS OF REFERENCE

The terms of reference for this study is to fulfill the requirements of 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).

The site includes land that is classified by the national web-based environmental screening tool as high sensitivity for impacts on agricultural resources. The level of agricultural assessment required in terms of the protocol (and hence in terms of NEMA) is therefore an Agricultural Agro-Ecosystem Specialist Assessment. The terms of reference for such an assessment, as stipulated in the protocol, are listed below, and the section number of this report which fulfils each stipulation is given after it in brackets. The protocol also requires that a Site Sensitivity Verification be done.

1. The assessment must be undertaken by a soil scientist or agricultural specialist registered with the South African Council for Natural Scientific Professions (SACNASP) (Appendix 1).
2. The assessment must be undertaken on the preferred site and within the proposed development footprint (Figure 3).
3. The assessment must be undertaken based on a site inspection as well as an investigation of the current production figures, where the land is under cultivation or has been within the past 5 years, and must identify:
    1. the extent of the impact of the proposed development on the agricultural resources (Section 9.12);
    2. whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site (Section 11), and in the event where it does, whether such a negative impact is outweighed by the positive impact of the

proposed development on agricultural resources.

4. The status quo of the site must be described, including the following aspects which must be considered as a minimum in the baseline description of the agro-ecosystem:
    1. The soil form/s, soil depth (effective and total soil depth), top and sub-soil clay percentage, terrain unit and slope (Sections 8.1 & 8.2);
    2. Where applicable, the vegetation composition, available water sources as well as agro-climatic information (Sections 8.3, 8.4 & 8.5);
    3. The current productivity of the land based on production figures for all agricultural activities undertaken on the land for the past 5 years, expressed as an annual figure and broken down into production units (Section 8.7);
    4. The current employment figures (both permanent and casual) for the land for the past 3 years, expressed as an annual figure (Section 8.8);
    5. Existing impacts on the site, located on a map where relevant (e.g. erosion, alien vegetation, non-agricultural infrastructure, waste, etc.)(Section 8.9).
5. Assessment of Impacts, including the following which must be considered as a minimum in the predicted impact of the proposed development on the agro-ecosystem:
    1. Change in productivity for all agricultural activities based on the figures of the past 5 years, expressed as an annual figure and broken down into production units (Section 9.12);
    2. Change in employment figures (both permanent and casual) for the past 5 years expressed as an annual figure (Section 9.12);
    3. Any alternative development footprints within the preferred site which would be of “medium” or “low” sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification (Section 9.6).
6. The findings of the Agricultural Agro-Ecosystem Specialist Assessment must be written up in an Agricultural Agro-Ecosystem Specialist Report that contains as a minimum the following information:
    1. Details and relevant experience as well as the SACNASP registration number of the soil scientist or agricultural specialist preparing the assessment including a curriculum vita (Appendix 1);
    2. A signed statement of independence by the specialist (Appendix 2);
    3. The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment (Section 4.1);
    4. A description of the methodology used to undertake the on-site assessment inclusive of the equipment and models used, as relevant (Section 4.1);
    5. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the screening tool (Figure 2);
    6. An indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development (Section 9.12);

7. an indication of possible long-term benefits that will be generated by the project in comparison to the benefits of the agricultural activities on the affected land (Section 9.7);
8. Additional environmental impacts expected from the proposed development based on the current status quo of the land including erosion, alien vegetation, waste, etc. (Section 9.8);
9. Information on the current agricultural activities being undertaken on adjacent land parcels (Section 8.6);
10. a motivation must be provided if there were development footprints identified as per point 5.3 above that were identified as having a medium or low agricultural sensitivity and that were not considered appropriate (not applicable);
11. Confirmation from the soil scientist or agricultural specialist that all reasonable measures have been considered in the micro-siting of the proposed development to minimise fragmentation and disturbance of agricultural activities (Section 9.9);
12. A substantiated statement from the soil scientist or agricultural specialist with regards to agricultural resources on the acceptability or not of the proposed development and a recommendation on the approval or not of the proposed development (Section 9.12);
13. Any conditions to which this statement is subjected (Section 9.11 & Section 11);
14. Where identified, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr) (Section 10);
15. A description of the assumptions made and any uncertainties or gaps in knowledge or data (Section 5).
16. calculations of the physical development footprint area for each land parcel as well as the total physical development footprint area of the proposed development (including supporting infrastructure) (Section 9.10);
17. confirmation whether the development footprint is in line with the allowable development limits set in Table 1 above, including where applicable any deviation from the set development limits and motivation to support the deviation, including (Section 9.10):
    a. where relevant, reasons why the proposed development footprint is required to exceed the limit;
    b. where relevant, reasons why this exceedance will be in the national interest; and
    c. where relevant, reasons why there are no alternative options available including evidence of alternatives considered; and
18. a map showing the renewable energy facilities within a 50km radius of the proposed development (Appendix 3)

METHODOLOGY OF STUDY

Methodology for assessing soils and agricultural potential

The assessment was based on an on-site investigation of the soils and agricultural conditions and was also informed by existing soil and agricultural potential data for the site. The following sources of existing information were used:

- Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries (DAFF). This data set originates from the land type survey that was conducted from the 1970's until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of hundreds of years.
- Land capability data was sourced from the 2017 National land capability evaluation raster data layer produced by the DAFF, Pretoria.
- Field crop boundaries were sourced from Crop Estimates Consortium, 2019. *Field Crop Boundary data layer, 2019*. Pretoria. Department of Agriculture, Forestry and Fisheries
- Rainfall and evaporation data was sourced from the SA Atlas of Climatology and Agrohydrology (2009, R.E. Schulze) available on Cape Farm Mapper. Note that Cape Farm Mapper includes national coverage of climate, grazing and certain other data.
- Grazing capacity data was sourced from the 2018 DAFF long-term grazing capacity map for South Africa, available on Cape Farm Mapper.
- Satellite imagery of the site and surrounds was sourced from Google Earth.

The aim of the on-site Site Sensitivity Verification was to:

1. ground-truth cropland status and consequent agricultural sensitivity;
2. ground-truth the land type soil data and assess the soil potential across the site that will be impacted;
3. gain an understanding of overall agricultural production potential across the site.

This was achieved by a drive and walk-over investigation across the site. The site investigation was conducted on 29 March 2022. An interview was also conducted with farmer, Louis Reyneke, to get details of farming practices on the site.

The soil investigation was based on the investigation of soil auger samples, some existing excavations, as well as indications of the surface conditions and topography. Soils were classified according to the South African soil classification system (Soil Classification Working Group, 1991). This level of soil assessment is considered entirely adequate for an understanding of on-site soil potential for the purposes of this study.

An assessment of soils 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.

ASSUMPTIONS, UNCERTAINTIES OR GAPS IN KNOWLEDGE OR DATA

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

APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

A renewable energy facility requires approval from the National Department of Agriculture, Land Reform and Rural Development (DALRRD) if the facility is on agriculturally zoned land. There are two approvals that apply. The first is a No Objection Letter for the change in land use issued by the Deputy Director General (Agricultural Production, Health and Food Safety, Natural Resources and Disaster Management). This letter is one of the requirements for receiving municipal rezoning. It is advisable to apply for this as early in the renewable development process as possible because not receiving this DALRRD approval is a fatal flaw for a project. Note that a positive EA does not assure DALRRD's approval of this. This application requires a motivation backed by good evidence that the development will not significantly compromise the future agricultural production potential of the development site.

The second required approval is a consent for long-term lease in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). If DALRRD approval for the development has already been obtained in the form of the No Objection letter, then SALA approval should be easy and not present any difficulties. Note that SALA approval is not required if the lease is over the entire farm portion, i.e. no subdivision is applicable. SALA approval (if required) can only be applied for once the Municipal Rezoning Certificate and EA is in hand.

Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). A consent in terms of CARA is required for the cultivation of virgin land. Cultivation is defined in CARA as "any act by means of which the topsoil is disturbed mechanically". The purpose of this consent for the cultivation of virgin land is to ensure that only land that is suitable as arable land is cultivated. Therefore, despite the above definition of cultivation, disturbance to the topsoil that results from the construction of a renewable energy facility and its associated infrastructure does not constitute cultivation as it is understood in CARA. This has been corroborated by Anneliza Collett (Acting Scientific Manager: Natural Resources Inventories and Assessments in the Directorate: Land and Soil Management of the Department of Agriculture, Land Reform and Rural Development (DALRRD)). The construction and operation of the facility will

therefore not require consent from the Department of Agriculture, Land Reform and Rural Development in terms of this provision of CARA.

SITE SENSITIVITY VERIFICATION

In terms of the gazetted agricultural protocol, a site sensitivity verification must be submitted that:

1. confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;
2. contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity.

Agricultural sensitivity, as used in the national web-based environmental screening tool, is a direct function of the capability of the land for agricultural production. The general assessment of agricultural sensitivity that is employed in the national web-based environmental screening tool, identifies all arable land that can support viable crop production, as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable crop production is much less of a priority to conserve for agricultural use and is rated as medium or low agricultural sensitivity.

The screening tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is used for cropland or not. All cropland is classified as at least high sensitivity, based on the logic that if it is under crop production, it is indeed suitable for it, irrespective of its land capability rating.

The screening tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. The data is generated by GIS modelling. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land, based on its soil, climate and terrain. The higher land capability values (≥8 to 15) are likely to be suitable as arable land for crop production, while lower values are only likely to be suitable as non-arable grazing land.

A map of the proposed development area overlaid on the screening tool sensitivity is given in Figure 2.

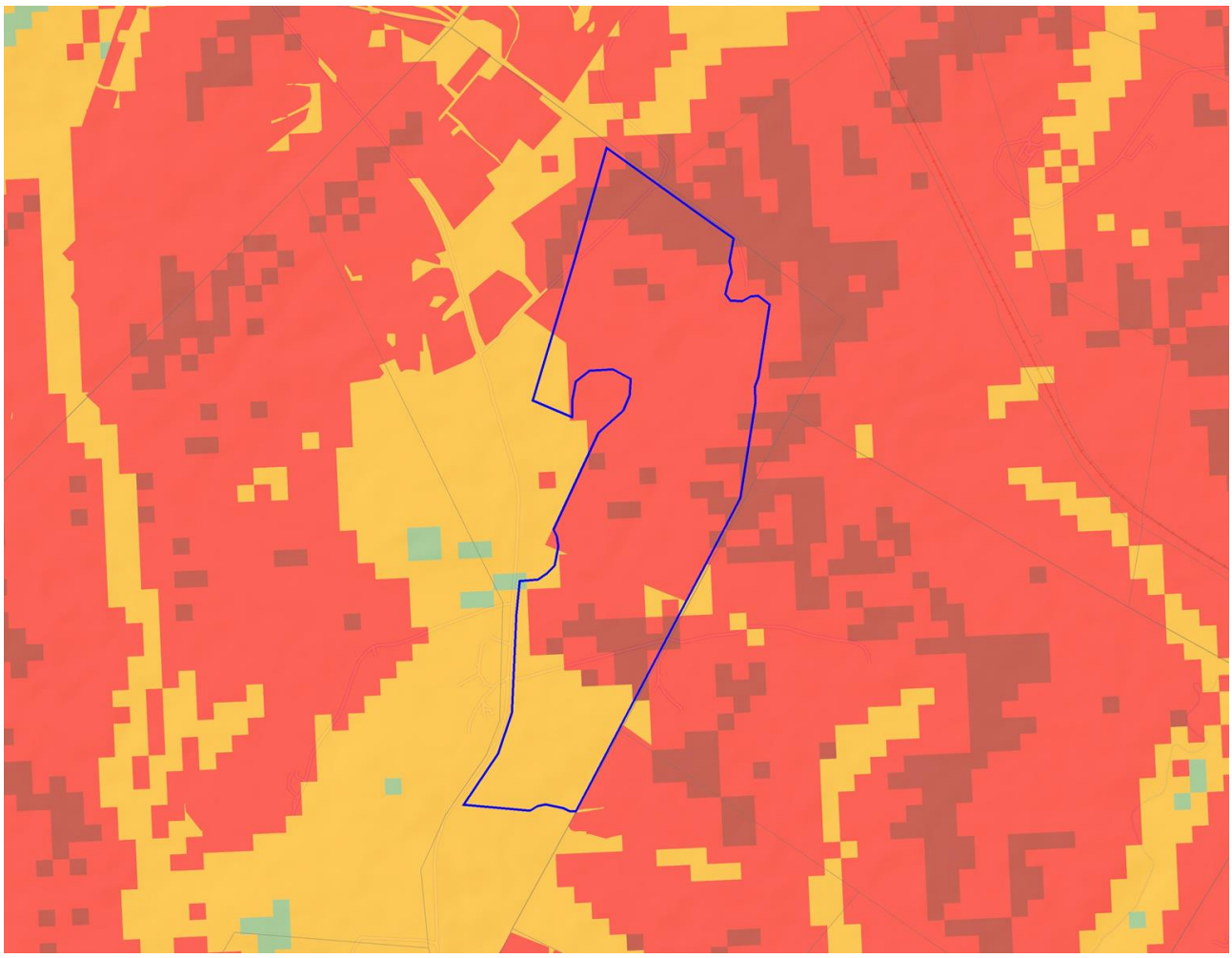

Figure 2. *The proposed development footprint (blue outline) overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high; dark red = very high).*

The land capability of the site on the screening tool is predominantly 10 but varies from 7 to 11. The small scale differences in land capability across the project area are not very accurate or significant at this scale and are more a function of how the land capability data is generated by modelling, rather than actual meaningful differences in agricultural potential on the ground. However, the southern part of the site that is rated with the lowest land capability (7 and 8) is on shallow rocky soils. Values of 7 to 8 translate to a medium agricultural sensitivity, values of 9 to 10 translate to a high agricultural sensitivity and values of 11 translate to a very high agricultural sensitivity.

In reality the soils (and therefore the land capability) vary in a fairly complex pattern across the landscape, which is not reflected at the scale of the land capability data. The most reliable indication of soil cropping potential is historical land use. The suitable versus the unsuitable soils have been identified over time through trial and error. In an agricultural environment like the one being assessed, all the suitable soils are generally cropped, and uncropped soils can therefore fairly reliably be considered to be unsuitable for crop production. Cropped areas are shown in Figure 3.

Much of the site is classified as high agricultural sensitivity because of both its land capability and because of its status as cropland. The agricultural sensitivity, as identified by the screening tool, is confirmed by this assessment.

BASELINE DESCRIPTION OF THE AGRO-ECOSYSTEM

The aim of this section of the report is to present the baseline information that controls the agricultural production potential of the site and then, based on that information, to make an assessment of the production potential. That assessment is provided near the end of this section in sub-section 8.7.

A satellite image map of the footprint of the proposed project is shown in Figure 3 and photographs of site conditions and soils are shown in Figures 4 to 6.

Soils

The footprint falls across two land types, Ba51 and Ca3 (see table of soil data in Appendix 4). The geology is predominantly shale and sandstone of the Ecca Group of the Karoo Supergroup and includes dolerite. Approximately half of both land types comprise deep, red and yellow, reasonably-drained, loamy soils of the Avalon, Hutton, Glencoe, and other soil forms that are good for crop production. The other half comprises other soils that have various limitations for crop production, which are predominantly the result of poor drainage or limited depth due to underlying clay or bedrock. These soils are of the Mispah and Glenrosa soil forms (shallow bedrock) and the Kroonstad, Estcourt Valsrivier, Longlands, and other soil forms (poor drainage and underlying clay).

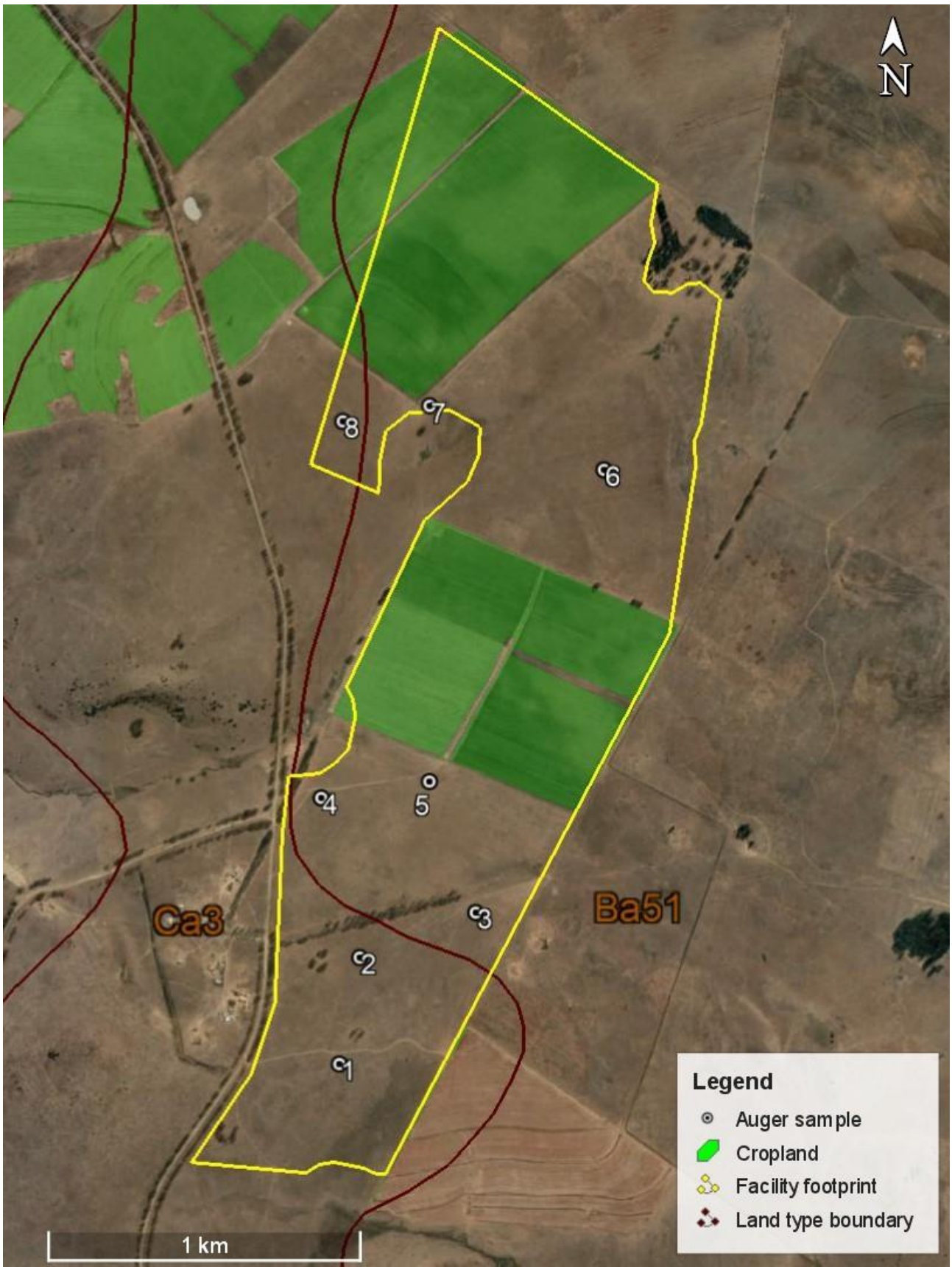

Figure 3. *Satellite image map of the proposed facility footprint.*

Figure 4. *View of typical site conditions with grazing lands in foreground and croplands in background.*

Figure 5. *View from the southern part of the site looking north.*

Figure 6. *View of typical rock outcrops and related shallow soils in the southern part of the site.*

Terrain and slope

The site is situated on elevated, slightly hilly terrain, with different aspects, at an altitude of between 1,670 and 1,700 metres and slopes up to about 5%.

Available water sources

There is no irrigated crop production on the site because water for irrigation is generally not available in the area.

Vegetation

Natural vegetation of the site is Eastern Highveld Grassland, which has been disturbed by agricultural activities.

Agro-climatic information

The site has a summer rainfall with a mean annual rainfall of between 722 and 754 mm and a mean annual evaporation of approximately 1,210 mm (Schulze, 2009).

Land use and development on and surrounding the site

The site is located in a grain and cattle farming agricultural region, but the soils vary in their suitability for crop production. Crops in the area include mainly maize and soya beans. Farmers generally utilise all suitable soil as cropland. Only soil that is not suitable for crop production is used for grazing of cattle and sheep. Limitations that render the soil unsuitable for crop production are poor drainage and depth limitations due to rock or dense clay in the subsoil.

Coal-fired electricity generation and mining take place in the surrounding area.

Agricultural potential and productivity

Because of the favourable climate and suitable soils on the croplands, crop yields are fairly high with average maize yields of around 7 tons per hectare according to the farmers on site. The long-term grazing capacity of the area is fairly high at 4.5 hectares per large stock unit (DAFF, 2018).

Agricultural employment

The Reyneke family on whose land the facility is located employ only members of two families that reside on the farm.

Existing impacts on the site

There are no existing impacts on the site that are relevant to agricultural impact.

ASSESSMENT OF AGRICULTURAL IMPACT

What constitutes and agricultural impact?

An agricultural impact is a temporary or permanent change to the future production potential of land. If a development will not change the future production potential of the land, then there is no agricultural impact. A decrease in future production potential is a negative impact and an increase is a positive impact. The significance of the agricultural impact is directly proportional to the extent of the change in production potential.

The significance of agricultural impact and the factors that determine it

The purpose of the agricultural component in the Environmental Authorisation process is to ensure that South Africa balances the need for development against the need to ensure the conservation of the natural agricultural resources, including land, required for agricultural production and national food security.

When the agricultural impact of a development involves the permanent or long term non-agricultural use of potential agricultural land, as it does in this case, the focus and defining question of the agricultural impact assessment is to determine the importance, from an agricultural production point of view, of that land not being utilised for the development and kept solely for agriculture.

In other words, the significance of an agricultural impact should be evaluated by asking the question: Does the loss of future agricultural production potential that will result from this development, justify keeping the land solely for agricultural production and therefore not approving the development? If the loss is small, then it is unlikely to justify non approval. If the loss is big, then it is likely to justify it.

The extent of the loss is a direct function of two things, firstly the amount of land that will be lost and secondly, the production potential of the land that will be lost. The land's production potential must be evaluated on a scale of land capability (which equates to production potential) that is applicable across the country, because the need is to conserve the higher potential land in the country, not the lower potential land. If the land capability is below a certain threshold then its loss as agricultural production land may be justified, depending on the importance and value of the proposed non-agricultural land use that will replace it. That threshold is determined by the scarcity of arable crop production land in South Africa and the relative abundance of land that is only good enough to be used for grazing. If land is of sufficient land capability to support viable and sustainable crop production then it is considered to be above the threshold for being conserved as agricultural production land. If land is not of sufficient land capability to support viable and sustainable crop production, then it is considered to be below the threshold and its loss as agricultural production land may be justified. When the replacing land use is something that has high national importance and benefit, such as renewable energy development, the use of agricultural land that is below the threshold is considered to be justified.

It is also important to note that renewable energy facilities have both positive and negative effects on the production potential of land (see Section 9.3) and so it is the net sum of these positive and negative effects that determines the extent of the change in future production potential.

Another aspect to consider is the scale at which the significance of the agricultural impact is assessed. The change in production potential of a farm or significant part of a farm is likely to be highly significant at the scale of that farm, but may be much less so at larger scales. This assessment considers a regional and national scale to be the most appropriate one for assessing the significance of the loss of agricultural production potential because, as has been discussed above, the purpose is to ensure the conservation of agricultural land required for national food security.

It should be noted that, in assessing agricultural impact, the exact nature and layout of the different

infrastructure within a solar energy facility has absolutely no bearing on the significance of agricultural impacts. All that is of relevance is simply the total footprint of the facility that excludes agricultural land use or impacts agricultural land, referred to as the agricultural footprint.

Impact identification

There is ultimately only ever a single agricultural impact of a development and that is a change to the future agricultural production potential of the land. This impact occurs by way of different mechanisms some of which lead to a decrease in production potential and some of which lead to an increase. It is the net sum of positive and negative effects that determines the overall agricultural impact.

Two direct mechanisms have been identified that lead to decreased agricultural potential by:

1. **occupation of land** - Agricultural land directly occupied by the development infrastructure will become restricted for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime.
2. **soil erosion and degradation –** Erosion can occur as a result of the alteration of the land surface run-off characteristics, predominantly through the establishment of hard surface areas including roads, and through the disturbance of existing contour bank systems that control erosion. Soil erosion is completely preventable. The storm water management that will be an inherent part of the engineering on site and standard, best practice erosion control measures recommended and included in the EMPr, are likely to be effective in preventing soil erosion. Loss of topsoil can result from poor topsoil management during construction related excavations.

Two indirect mechanisms have been identified that lead to increased agricultural potential through:

1. **increased financial security for farming operations -** Reliable income will be generated by the farming enterprise through the lease of the land to the energy facility. This is likely to increase its cash flow and financial security and could improve farming operations and productivity through increased investment into farming.
2. **improved security against stock theft and other crime** due to the presence of security infrastructure and security personnel at the energy facility.

Considering what is detailed in Section 9.2 above, the extent to which any of these mechanisms is likely to actually affect levels of agricultural production is small and the overall impact of a change in agricultural production potential is therefore small.

Cumulative impacts

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. It is important to note that the cumulative impact assessment for a particular project, like what is being done here, is not the same as an assessment of the impact of all surrounding projects. The cumulative assessment for this project is an assessment only of the impacts associated with this project, but seen in the context of all surrounding impacts. It is concerned with this project's contribution to the overall impact, within the context of the overall impact,but it is not simply the overall impact itself.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

> What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

DFFE requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

DFFE compliance for this project requires considering all renewable energy project applications within a 30 km radius. According to the DFFE database, there are no other renewable energy projects within a 30 km radius of the Camden 1 site. There is however, the associated Camden 1 and 2 Wind Energy Facilities and the Ummbila Emoyeni Wind and Solar Energy Facilities. In quantifying the cumulative impact, the area of land taken out of agricultural use as a result of these projects (total generation capacity of up to 1,366 MW) will amount to a total of approximately 1,070 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind

and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30km radius (approximately 282,700 ha), this amounts to only 0.38% of the surface area. That is considered to be within an acceptable limit in terms of loss of agricultural land.

As discussed above, the risk of a loss of agricultural potential by soil degradation can effectively be mitigated for renewable energy developments. If the risk for each individual development is low, then the cumulative risk is also low.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use will not have an unacceptable negative impact on the agricultural production capability of the area. The proposed development is therefore acceptable in terms of cumulative impact, and it is therefore recommended that it is approved.

Impacts of the no-go alternative

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. There are no agricultural impacts of the no-go alternative. However it should be noted that any future coal mining on the site will have a significant and much greater agricultural impact than the proposed solar energy facility.

The development offers an alternative income source to agriculture, but it restricts agricultural use of the site. Therefore, the negative agricultural impact of the development is more significant than that of the no-go alternative, and so, purely from an agricultural impact perspective, the no-go alternative is the preferred alternative between the development and the no-go. However, the no-go option would prevent the proposed development from contributing positive agricultural impacts to the farm as well as contributing to the environmental, social and economic benefits associated with the development of renewable energy in South Africa.

Alternative development footprints and comparative assessment of alternatives

The agricultural protocol requires identification of any alternative development footprints within the preferred site which would be of “medium” or “low” sensitivity for agricultural resources as identified by the screening tool and verified through the site sensitivity verification.

The facility is located partially on cropland because options for the location of the solar component are constrained by a number of competing factors that include engineering and other environmental constraints. The proposed site has been chosen to balance the competing constraints. The majority of the 290 hectare site (61%) has been located off cropland, but 114 hectares of cropland need to be included in the site. No site that could balance competing constraints without impinging partially on cropland is available elsewhere on the site.

Long term project benefits versus agricultural benefits

The development will generate a significant (at the scale of an individual farm),reliable and predictable additional income for the directly affected farming enterprise, without significantly compromising the existing farming income or requiring expense and effort on behalf of the landowner (i.e. passive income). In this manner it also promotes multiple land uses on the existing property. It will also generate additional income and employment in the local economy. In addition, it will contribute to the country's need for energy generation, particularly renewable energy that has lower environmental and agricultural impact on a national scale than existing, coal powered energy generation. The renewable energy complex also aims to beneficially utilise existing infrastructure by connecting into the Camden Power Station, infrastructure otherwise intended for decommissioning. In supplying generated energy to the hydrogen and ammonia plant associated with the Camden Renewable Energy Developments, the project is indirectly stimulating the green hydrogen economy and in particular hydrogen-specific skills and market participation in green hydrogen and ammonia fuel products, both of which have large-scale potential in international and local markets. This in turn therefore supports the indirect diversification of the local economy and assists in maintaining existing ammonia supply chains, and promoting future hydrogen supply chains.

Additional environmental impacts

There are no additional environmental impacts of the proposed development that are relevant to agriculture.

Micro-siting to minimize fragmentation and disturbance of agricultural activities

The agricultural protocol requires confirmation that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities. As discussed in Section 9.6 above, the facility could reduce its negative impact on agricultural production potential by avoiding all cropland.

Allowable development limits

The agricultural protocol achieves its purpose, in relation to renewable energy developments on agricultural land, by imposing allowable development limits on different agricultural sensitivity categories of land. The allowable development footprint is the area of a particular sensitivity category of land that can be directly occupied by the agricultural footprint of a renewable energy development. The purpose of the development limits is to conserve valuable agricultural land for agricultural production by steering renewable energy development away from higher potential agricultural land and onto lower potential land. There are six different allowable development

footprints, defined according to a combination of land capability and cropping status, as specified in Table 1, below.

Table 1: Allowable development limits as specified in the agricultural protocol.

Allowable footprint category	Agricultural sensitivity on screening tool	Allowable footprint (ha/MW)	Definition of category
1	Very high	0.00	Land capability of 11-15; or irrigated land; or dryland horticulture or viticulture
2	High	0.20	Land capability of 8-10 on existing field crops
3	High	0.25	Land capability of 6-7 on existing field crops
4	High	0.30	Land capability of 1-5 on existing field crops
5	High	0.35	Land capability of 9-10 outside of existing field crops
	Medium		Land capability of 8 outside of existing field crops
6	Medium	2.5	Land capability of 6-7 outside of existing field crops
	Low		Land capability of 1-5 outside of existing field crops

Solar energy is effectively prevented by the limits, from being developed on any land other than land of category 6 in Table 1 above.

The agricultural protocol requires confirmation of whether the development footprint is in line with the allowable development limits or not, and requires motivation to support any deviation from the limits. The proposed development site for the Camden 1 SEF includes cropland of category 2, which means that the facility will not therefore be within the allowable development limits. However, there are good reasons for exceeding the allowable development limits for the Camden 1 SEF. These are detailed below.

The overall Camden renewable energy project which, in addition to the SEF, includes two wind energy facilities and a hydrogen / ammonia plant, is desirable in the area for the positive economic impacts that it will introduce in addition to the long term project benefits discussed in section 9.7. This greater project is integrated with agricultural production in a way that provides benefits to agriculture and leads to very little loss of future agricultural production potential. It offers increased financial security for the on-site farming operations through reliable, additional rental income generation without loss of production income. This is an important source of improving economic viability for agricultural operations in an increasingly challenging agricultural economic environment. Other benefits to the on-site farming operations include security benefits against stock theft and other crime and an improved road network. Furthermore the project will decrease the need for coal power and thereby contribute to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land in the area.

The net overall agricultural impact of the greater project is likely to be positive and to benefit agriculture in the area through the positive impacts discussed above. However, the viability of the greater project is dependent on having a solar component due to the energy feed requirements of the hydrogen / ammonia plant.

Options for the location of the solar component are constrained by a number of competing factors that include engineering and other environmental constraints. The proposed site has been chosen to balance the competing constraints. The majority of the 290 hectare site (61%) has been located off cropland, but 114 hectares of cropland need to be included in the site.

In summary, the greater Camden renewable energy project offers benefits to agriculture that can only be realised if the project includes a solar component which must necessarily impinge partially on cropland. The trade-off for agriculture of losing 114 hectares of cropland is likely to be more than compensated by the agricultural benefits of the project and a deviation from the allowable development limits to include this cropland in the Camden 1 SEF is considered justified.

Mitigation measures

Mitigation measures to prevent soil degradation are all inherent in the project design and / or are standard, best-practice for construction sites.

- A system of storm water management, which will prevent erosion, will be an inherent part of the engineering on site. 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.
- Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 30 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it is at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase to control dust and erosion.

The loss of cropland could possibly be mitigated by designing the solar facility along agro-voltaic principles, which increases the height of the solar panels to allow cropping to be practised below them. However, this technology is very new to South Africa and has not really been tested here. Its

viability for the particular site conditions is not known and would be dependent on a number of engineering and agricultural factors. Where feasible and desirable, this option may be implemented by the proponent to further reduce agricultural impact.

Impact assessment and statement

An Agricultural Agro-Ecosystem Specialist Assessment is required by the protocol to identify the extent of the impact of the proposed development on agricultural resources. The assessment of impacts in an environmental impact assessment is done according to a prescribed, semi-quantitative rating methodology that is supposed to cover all specialist disciplines and allow comparison of the impacts across them. However, the system was designed for biological components of the ecosystem such as plants and animals and does not rate agricultural impacts in a sensible or particularly useful way. As has been discussed above, the significance of the agricultural impact is simply the degree to which the future agricultural production potential of the site will be changed and that is predominantly a function of the size of the area of land that is impacted and the production potential of that impacted land. The prescribed methodology is presented below for compliance purposes but is not really an effective indication of the significance of the agricultural impact.

Furthermore, it is important to assess the agricultural impact within the context of the whole Camden renewable energy project. It does not make sense to consider the agricultural impacts of the different components of the project in isolation from each other, in the way that the rating methodology forces one to do. The context of the net overall agricultural impact of the greater project, as discussed in Section 9.7 and 9.10 is important to take into account.

Aspect:	Agricultural production potential
Description:	Decrease in agricultural production potential
Stage:	There is only one agricultural impact and it occurs for the duration of the project life time. To differentiate between the different phases of the project does not really make sense, but for compliance purposes the impact, as assessed below, can be considered to be identical across the construction, operation and decommissioning phases of the project.
Character:	Negative
Ease of mitigation:	High

	Without mitigation	**With mitigation**
Magnitude (M)	Medium (3)	Medium (3)
Extent (E)	Site only (1)	Site only (1)

Reversibility (R)	Recoverable (3)	Recoverable (3)
Duration (D)	Long term (4)	Long term (4)
Probability (P)	Probable (3)	Probable (3)
Significance (S)	N3 – Moderate (33)	N3 – Moderate (33)

Mitigation measures against soil degradation are standard best-practice for construction sites and renewable energy facilities, but will not change the significance rating as assessed above.

An agricultural assessment is required by the protocol to provide a substantiated statement on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development.

The conclusion of this assessment is that the agricultural impact of the proposed development will be acceptable because:

1. It is a necessary part of the greater Camden renewable energy project which offers benefits to agriculture that can only be realised if the project includes a solar component which must necessarily impinge partially on cropland. The trade-off for agriculture of losing 114 hectares of cropland is likely to be more than compensated by the agricultural benefits of the greater project. These include increased economic viability for agricultural operations on site, security benefits against stock theft and other crime, an improved road network, with associated storm water handling system, that can be used for farming operations, and that the project will decrease the need for coal power and thereby contribute to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land in the area, along with other long term project benefits discussed in section 9.7.
2. The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
3. In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.

The impact of the proposed development on the agricultural production capability of the site is assessed as being acceptable because of the above factors. Therefore, from an agricultural impact point of view, it is recommended that the development be approved.

The agricultural protocol requires an indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development. The development will result in production losses of 114 hectares of annual crops. No losses of agricultural employment are expected because the site occupies only a small proportion of

a much larger farming operation and the cessation of cropping on the site will not significantly reduce the farm's labour requirement.

CONCLUSIONS

The conclusion of this assessment is that the agricultural impact of the proposed development is acceptable because:

1. It is a necessary part of the greater Camden renewable energy project which offers benefits to agriculture that can only be realised if the project includes a solar component which must necessarily impinge partially on cropland. The trade-off for agriculture of losing 114 hectares of cropland is likely to be more than compensated by the agricultural benefits of the greater project. These include increased economic viability for agricultural operations on site, security benefits against stock theft and other crime, an improved road network, with associated storm water handling system, that can be used for farming operations, and that the project will decrease the need for coal power and thereby contribute to reducing the large agricultural impact that open cast coal mining has on highly productive agricultural land in the area. , along with other long term project benefits discussed in section 9.7
2. The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
3. In addition, the proposed development will contribute to the country's urgent need for energy generation, particularly renewable energy that has much lower environmental and agricultural impact than existing, coal powered energy generation.

The impact of the proposed development on the agricultural production capability of the site is assessed as being acceptable because of the above factors. Therefore, from an agricultural impact point of view, it is recommended that the development be approved.

The conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any conditions, other than recommended mitigation.

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APPENDIX 1: SPECIALIST CURRICULUM VITAE

Johann Lanz
Curriculum Vitae

Education

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

Professional work experience

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

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

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

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

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

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

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

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

Publications

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

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

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

APPENDIX 2: DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

THE PROPOSED CAMDEN 1 SOLAR ENERGY FACILITY NEAR ERMELO IN MPUMALANGA PROVINCE

Kindly note the following:

- This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
- This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
- A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
- All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
- All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Private Bag X447, Pretoria, 0001
Physical address: Department of Environmental Affairs, Attention: Chief Director: Integrated Environmental Authorisations, Environment House, 473 Steve Biko Road, Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1 SPECIALIST INFORMATION

Specialist Company Name:	Johann Lanz – Soil Scientist			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Johann Lanz			
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)			
Professional affiliation/registration:	Registered Professional Natural Scientist (Pr.Sci.Nat.) Reg. no. 400268/12 Member of the Soil Science Society of South Africa			
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal code:	7800	Cell:	082 927 9018	
Telephone:	082 927 9018	Fax:	Who still uses a fax? I don't	
E-mail:	johann@johannlanz.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company:

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company

5 September 2022

Date

SERGEANT
WOPULA. A
715 20660

Signature of the Commissioner of Oaths

2022-09-05.

Date

SUID-AFRIKAANSE POLISIEDIENS
STATION WYNBERG
CSC
05 SEP 2022
CSC
STATION WYNBERG
SOUTH AFRICAN POLICE SERVICE

APPENDIX 3: MAP OF PROJECTS CONSIDERED FOR CUMULATIVE IMPACT

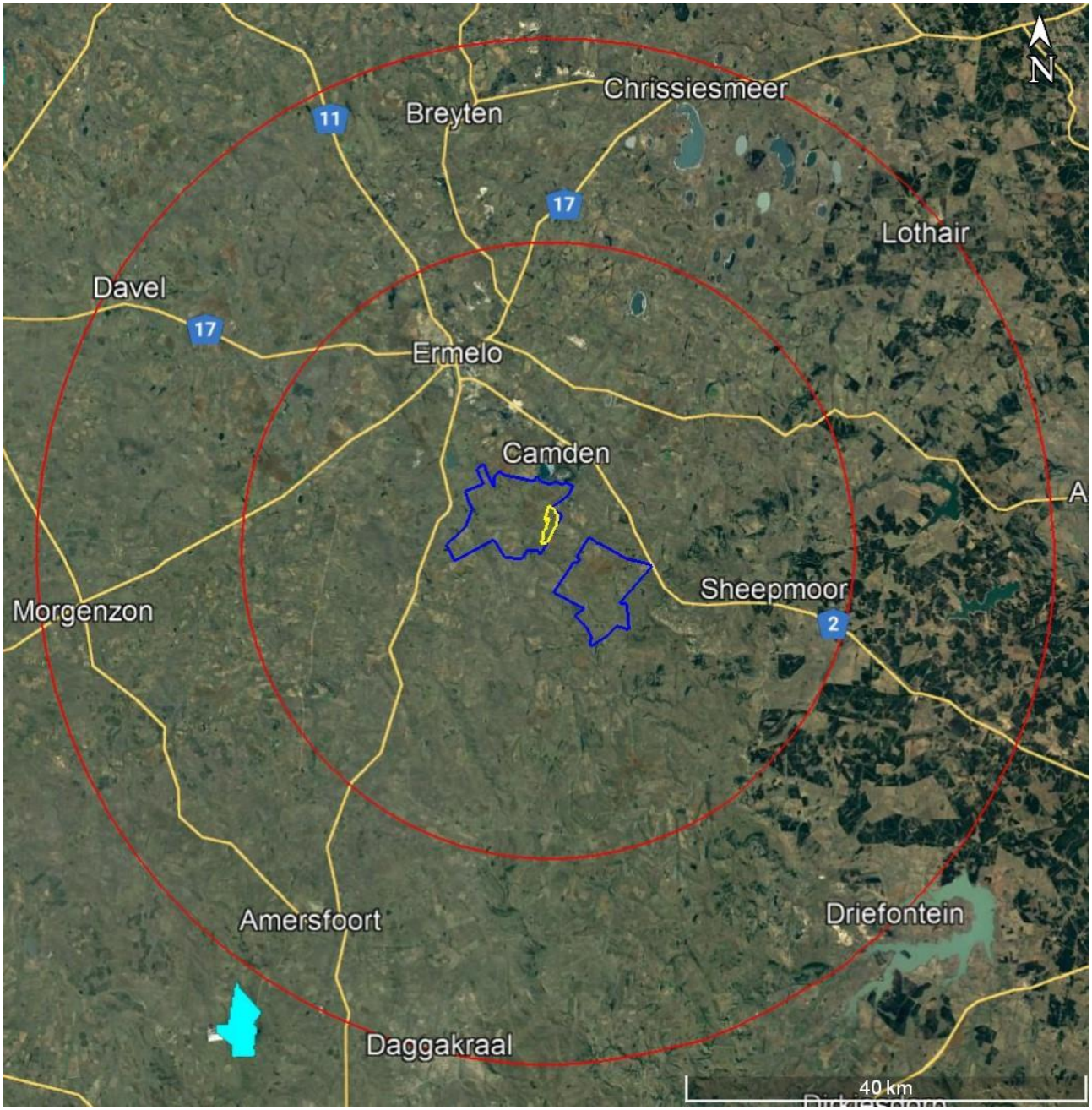

Figure 7. *30 km and 50 km radius around the Camden 1 SEF site. Only three other renewable energy facilities, the associated Camden 1 and 2 WEFs and the Ummbila Emoyeni Wind and Solar Energy Facilities are within 50 km of the site.*

APPENDIX 4: SOIL DATA OF LAND TYPE

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ba51	Hu	900 - 1200	20 - 30	25 - 40	so,hp	26,8
Ba51	Ms / Gs	300 - 450	15 - 30	0 0 0	R,lc	16,5
Ba51	Av	900 > 1200	20 - 30	25 - 40	sp	13,3
Ba51	Lo	900 > 1200	15 - 30	35 - 45	sp	8,8
Ba51	Gf	0 > 1200	20 - 30	25 - 40	0	6,0
Ba51	Sw / Va	350 - 500	30 - 40	35 - 55	vp	6,0
Ba51	Sd	900 > 1200	30 - 35	30 - 45	so	5,8
Ba51	Kd	750 - 1200	15 - 30	40 - 50	gc	5,0
Ba51	Gc	800 - 1200	15 - 30	20 - 35	hp	4,5
Ba51	Bo	0 > 1200	35 - 45	35 - 50	0	3,0
Ba51	Ka / Wo	350 - 600	25 - 40	0 0 0	gc	2,0
Ba51	S	0 0 0	0 0 0	0 0 0	0	1,5
Ba51	Du	0 > 1200	10 - 25	0 0 0	0	1,0
Ca8	Va / Sw	200 - 450	12 - 18	35 - 45	vr	17.9
Ca8	Hu	450 - 900	12 - 18	15 - 25	pr,gc	12.0
Ca8	Hu	450 - 900	12 - 20	25 - 35	pr,gc	11.2
Ca8	Sd	0 > 1200	15 - 25	40 - 55	0	7.5
Ca8	Bv	450 - 900	12 - 15	15 - 25	sp	7.2
Ca8	Bv	450 - 900	12 - 15	25 - 35	sp	7.2
Ca8	Ss	100 - 350	12 - 18	40 - 55	pr	7.0
Ca8	Hu	600 - 1200	10 - 15	10 - 25	ka	6.4
Ca8	R	0 0 0	0 0 0	0 0 0	0	5.8
Ca8	Va	100 - 350	12 - 18	40 - 55	vp	5.5
Ca8	Hu	600 - 1200	12 - 18	25 - 35	ka	4.6
Ca8	Ms /Gs	100 - 250	12 - 18	0 0 0	R,ka	2.6
Ca8	Oa / Ka	600 > 1200	12 - 20	35 - 60	R	1.7
Ca8	Av3 / Pn	450 - 900	12 - 18	15 - 25	sp	1.6

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ca8	Hu	50 - 200	12 - 18	15 - 30	R	1.0
Ca8	Sd	100 - 300	12 - 20	30 - 45	R	0.8

Table of soil data from investigated auger samples on site

Sample number	Soil forms	Depth (mm)	Clay % A horizon	Depth limiting layer
1	Mispah	100	12	Hard weathered bedrock
2	Glenrosa	400	12	Hard weathered bedrock
3	Glenrosa	500	12	Hard weathered bedrock
4	Kroonstad	500	14	G horizon and wetness associated with it
5	Avalon	700	16	Luvic plinthic horizon (sharp transition to high clay)
6	Estcourt	500	14	Dense clay horizon
7	Kroonstad	600	10	G horizon and wetness associated with it
8	Avalon	400	18	Luvic plinthic horizon (sharp transition to high clay)