Appendix 6
Specialist Studies

Appendix 6A

Agricultural and Soils Assessment

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AGRICULTURAL AND SOILS IMPACT ASSESSMENT FOR PROPOSED UMSOBOMVU SOLAR PV ENERGY FACILITIES NEAR NOUPOORT AND MIDDELBURG NORTHERN CAPE AND EASTERN CAPE PROVINCES

EIA REPORT

Report by
Johann Lanz

20 November 2019

Johann Lanz
Professional profile

Education

• M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 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 am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12, and am a member of the Soil Science Society of South Africa.

- **Soil Science Consultant** **Self employed** **2002 - present**
  I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:
- Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: CSIR; SRK Consulting; Aurecon; Mainstream Renewable Power; SiVEST; Savannah Environmental; Subsolar; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Sharples Environmental Services; Haw & Inglis; BioTherm Energy; Tiptrans.
- Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Cederberg Wines; Unit for Technical Assistance - Western Cape Department of Agriculture; Wedderwill Estate; Goedgedacht Olives; Zewenwacht Wine Estate, Lourensford Fruit Company; Kaarsten Boerdery; Thelema Mountain Vineyards; Rudera Wines; Flagstone Wines; Solms Delta Wines; Dornier Wines.
- I have conducted several recent research projects focused on conservation farming, soil health and carbon sequestration.
- I have project managed the development of soil nutrition software for Farmsecure Agri Science.

- **Soil Science Consultant** **Agricultural Consultors International (Tinie du Preez)** **1998 - end 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 make recommendations on 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

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

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

Proposed Construction of the Mooi Plaats, Wonderheuvel and Paarde Valley Solar PV Energy Facilities and Associated Grid Connection Infrastructure, near Noupoort in the Northern and Eastern Cape Provinces.

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 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?	
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:

30/10/2019

Date

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

30/10/2019

Date

Signature of the Commissioner of Oaths

2019 10 30.

Date

SUID-AFRIKAANSE POLISIEDIENS
STATION COMMANDER
WYNBERG KP
30 OCT 2019
STATION COMMANDER
WYNBERG CP
SOUTH AFRICAN POLICE SERVICE

EXECUTIVE SUMMARY

The key findings of this study are:

- The proposed project area is dominated by shallow, loamy sands on underlying rock or less commonly clay. Dominant soil forms are Swartland, Hutton, Mispah, and Valsrivier.
- The major limitations to agriculture are the limited climatic moisture availability (low rainfall), the rugged terrain and the shallow, rocky soils.
- As a result of these limitations, the agricultural use of the study area is limited to low intensity grazing only, except for some isolated patches of irrigation land.
- The proposed project area is classified with land capability evaluation values between 1 (very low) and 7 (low to moderate), with 6 being most predominant.
- The significance of all agricultural impacts is kept low by the limited agricultural potential of the land.
- The only parts of the study area that do not have low sensitivity are the small patches of irrigation. These are considered no-go areas for any footprint of development that will exclude cultivation.
- Two potential negative impacts of the development on agricultural resources and productivity were identified. These are:
  - Loss of agricultural land use; and
  - Soil erosion and degradation.
- One potential positive impact of the development on agricultural resources and productivity was identified as:
  - Increased financial security of farming operations through rental income
- Soil erosion and degradation was assessed as having medium significance before and after mitigation. The other two impacts were assessed as having low significance before and after mitigation.
- The recommended mitigation measures are for implementation of an effective system of storm water run-off control; maintenance of vegetation cover; and to strip, stockpile and re-spread topsoil.
- There is no material difference between the significance of impacts of any of the proposed project alternatives. All proposed alternatives have equal impact.
- Due to the low agricultural potential of the site, and the consequent low to medium, negative agricultural impact, there are no restrictions relating to agriculture which preclude authorisation of the proposed development (including all alternatives) and therefore, from an agricultural impact point of view, the development should be authorised.

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1 INTRODUCTION

Three Solar Photovoltaic (PV) Energy Facilities, with associated grid connection infrastructure, are proposed approximately 36 km north west of Middelburg in the Karoo.

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.

2 PROJECT DESCRIPTION

It is proposed that three (3) Solar Photovoltaic (PV) Energy Facilities, with associated grid connection infrastructure, will be developed, these being:

Mooi Plaats Solar PV Facility, on an application site of approximately 5 303ha, comprising the following farm portions:

Portion 1 of Leuwe Kop No 120
Remainder of Mooi Plaats No 121

Wonderheuvel Solar PV Facility, on an application site of approximately 5 652ha, comprising the following farm portions:

Remainder of Mooi Plaats No 121
Portion 3 of Wonder Heuvel No 140
Portion 5 of Holle Fountain No 133

Paarde Valley Solar PV Facility, on an application site of approximately 3 695ha, comprising the following farm portion:

Portion 2 of Paarde Valley No 62: and
Portion 7 of the Farm Leeuw Hoek No. 61.

SOLAR PV COMPONENTS

Mooi Plaats Solar PV Energy Facility:

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately 400MW and will comprise approximately 1 142 857 PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be

approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Wonderheuvel Solar PV Energy Facility:

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately 480MW and will comprise approximately 1 371 429 PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Paarde Valley Solar PV Energy Facility:

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately 700MW and will comprise approximately 2 000 000 PV modules. The final number of modules as well as their configuration will only be determined in the

detailed design phase.

- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Grid Connection Infrastructure

The proposed grid connection infrastructure will include the following components:

- New on-site substations and collector substations to serve each solar PV energy facility, each occupying an area of up to approximately 4ha.
- A new 132kV overhead power line connecting the on-site substations and/or collector substations to either the Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation, from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage to include both lattice and monopole towers which will be up to 25m in height.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines.

Maps of the three projects are provided in Figures 1 to 3.

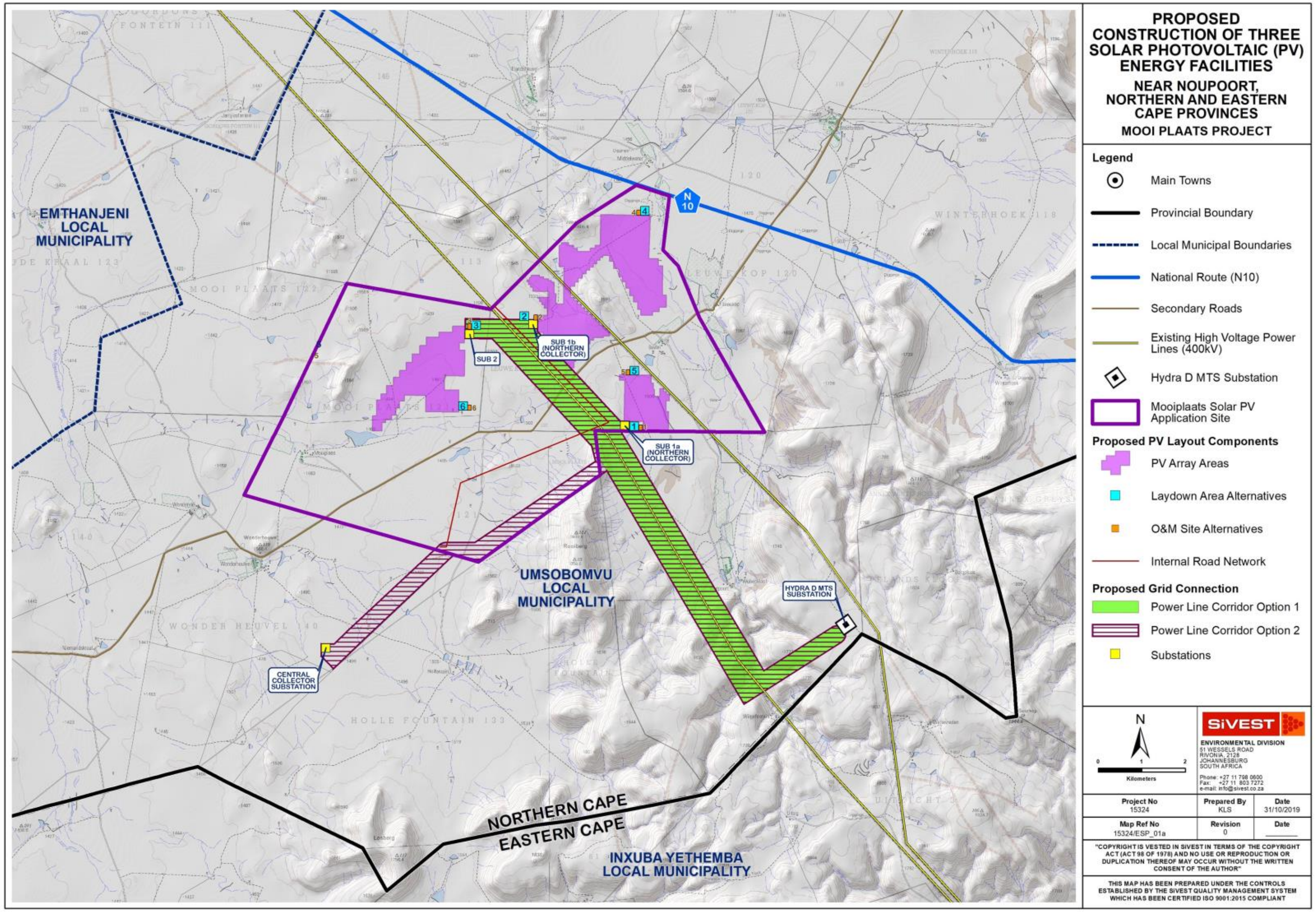

Figure 1. Map of Mooi Plaats project.

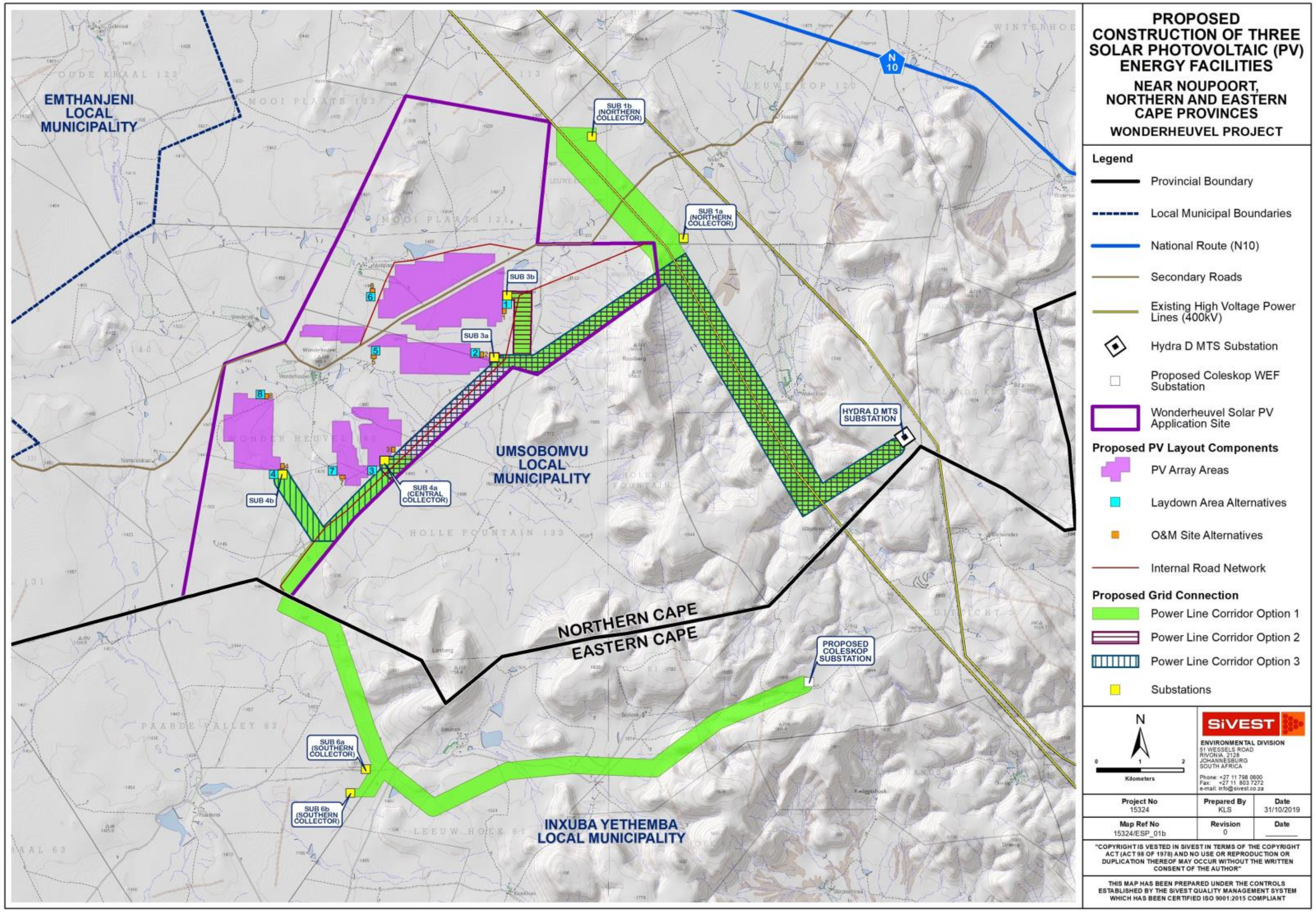

Figure 2. Map of Wonderheuvel project.

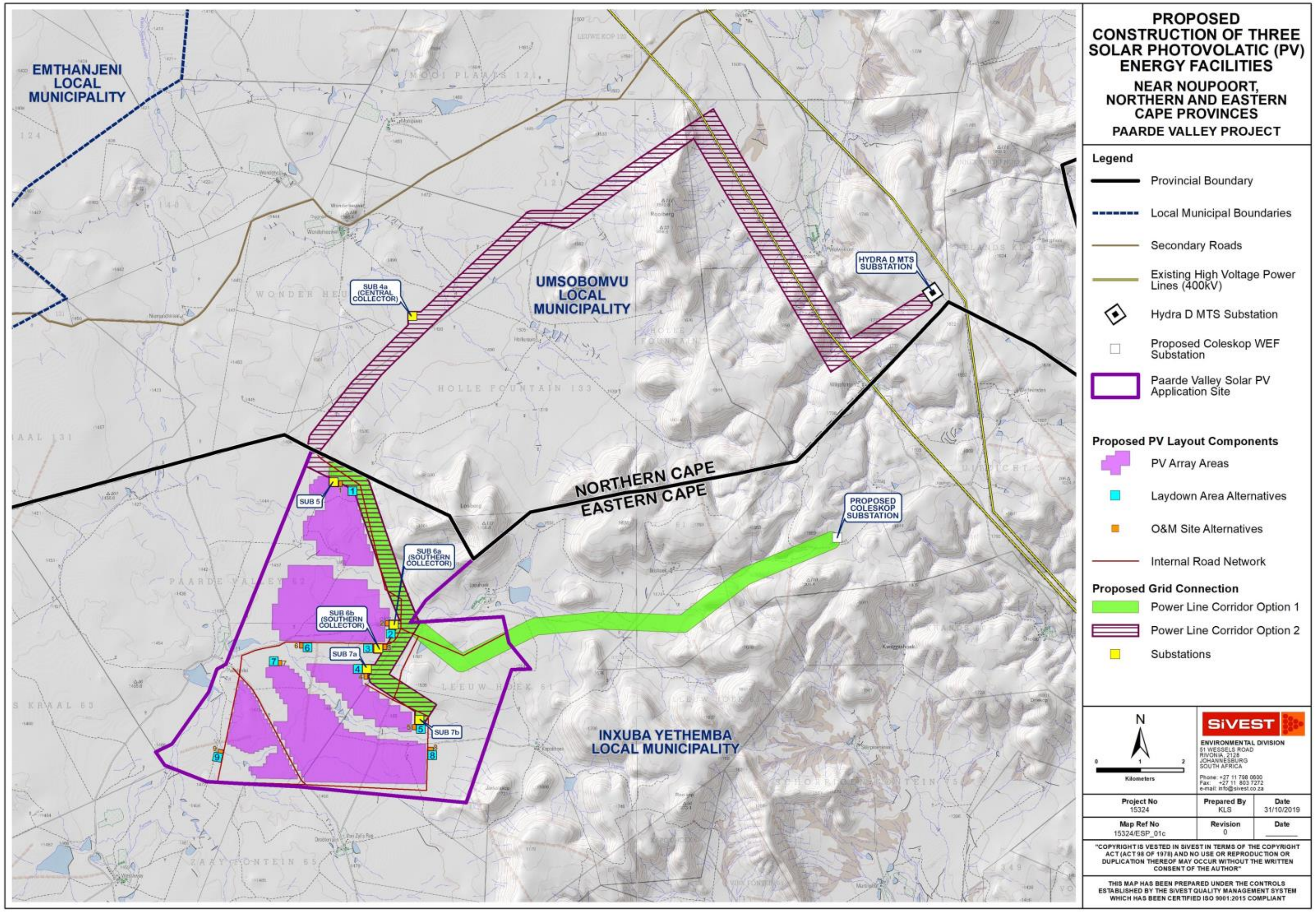

Figure 3. Map of Paarde Valley project.

3 TERMS OF REFERENCE

The following terms of reference apply to this study:

General requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended (see Table 1);
- Adherence to all appropriate best practice guidelines, relevant legislation and authority requirements;
- Provide a thorough overview of all applicable legislation, guidelines
- Cumulative impact identification and assessment as a result of other renewable energy (RE) developments in the area (including; a cumulative environmental impact table(s) and statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered);
- Identification sensitive areas to be avoided (including providing shapefiles/kmls);
- Assessment of the significance of the proposed development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
  - Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
  - Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
  - Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
- Comparative assessment of alternatives;
- Recommend mitigation measures in order to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (e.g. permits, licenses etc.).

Specific requirements:

- Describe the existing environment in terms of soils, geology, land-use and agricultural potential. Significant soils and agricultural features or disturbances should be identified, as well as sensitive features and receptors within the project area. The description must include surrounding agricultural land uses and activities, to convey the local agricultural context.
- Describe and map soil types (soil forms), soil characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers), and degradation and erodibility of soils etc. to the extent necessary to inform this assessment.

- Varying sensitivities of the soils and agricultural potential must be mapped and highlighted.
- The assessment is to be based on existing information, and professional experience and field work conducted by the specialist, as considered necessary and in accordance with relevant legislated requirements.
- Identify and assess the potential impacts of the proposed development on soils and agriculture, including impacts of associated infrastructure, such as the buildings, fencing etc. and provide relevant mitigation measures to include in the environmental management plan.
- Identify any protocols, legal and permit requirements relating to soil and agricultural potential impacts that are relevant to this project and the implications thereof.
- Map sensitivity of the site and clearly show no-go areas i.e. existing irrigated fields/ cultivated lands
- The report needs to fulfill the terms of reference for an agricultural study as set out 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, with an appropriate level of detail for the agricultural suitability and soil variation on site (which may therefore be less than the standardised level of detail stipulated in the above regulations).

Table 1: Compliance with the Appendix 6 of the 2014 EIA Regulations (as Amended)

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	**Addressed in the Specialist Report**
(1) A specialist report prepared in terms of these Regulations must contain- (α) details of- ι. the specialist who prepared the report; and ιι. the expertise of that specialist to compile a specialist report including a curriculum vitae;	page ii
(β) a declaration that the specialist is independent in a form as may be specified by the competent authority;	page iv
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Sections 1 & 3
(cA)an indication of the quality and age of base data used for the specialist report;	Section 4.1
(cB)a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 7.5 & 8.3
(δ) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4.1
(ε) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
(φ) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7.7 & Figure 2
(γ) an identification of any areas to be avoided, including buffers;	Section 7.7

(η) 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 2
(ι) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
(φ) a description of the findings and potential implications of such findings on the impact of the proposed activity <u>or activities;</u>	Section 8
(κ) any mitigation measures for inclusion in the EMPr;	Section 8
(λ) any conditions for inclusion in the environmental authorisation;	Section 9
(μ) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Not applicable
(ν) a reasoned opinion- (ι) whether the proposed activity, <u>activities</u> or portions thereof should be authorised; <u>(iA) regarding the acceptability of the proposed activity or activities and</u> (ii) if the opinion is that the proposed activity, <u>activities</u> 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 9 Section 8
(ο) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
(π) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
(θ) any other information requested by the competent authority.	Not applicable
(2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

4 METHODOLOGY OF STUDY

4.1 Methodology for assessing soils and agricultural potential

The soil investigation applied an appropriate level of detail for the agricultural suitability on site and for the level of impact of the proposed development on agricultural land. A detailed soil survey, as per the requirement in the above DAFF document (see Section 2), is only appropriate for a significant footprint of impact on arable land. It has little relevance to an assessment of agricultural potential in this environment, where the agricultural limitations are overwhelmingly climatic, terrain is rugged, soil conditions are generally poor, and cultivation potential is non-existent. In such an environment, even where soils suitable for cultivation may occur, they cannot be cultivated because of the aridity and terrain constraints. Conducting a soil assessment at the stipulated level of detail would be very time consuming and add no value to the assessment. A field investigation was therefore not considered necessary. The assessment was based on a desktop analysis of existing soil and agricultural potential data and other data for the site, which is considered entirely adequate for a thorough assessment of all the agricultural impacts of the proposed development.

The following sources of information were used:

- Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries. 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 Department of Agriculture, Forestry and Fisheries, Pretoria.
- Rainfall and temperature data was sourced from The World Bank Climate Change Knowledge Portal, dated 2015.
- Grazing capacity data was sourced from Cape Farm Mapper.
- Satellite imagery of the site and surrounds was sourced from Google Earth.

The potential impacts identified in this specialist study were assessed based on the criteria and methodology common to the whole impact assessment. The ratings of impacts were based on the specialist's knowledge and experience of the field conditions of the environment in which the proposed development is located, and of the impact of disturbances on that agricultural environment.

5 ASSUMPTIONS, CONSTRAINTS AND LIMITATIONS OF STUDY

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.

The study makes the assumption that water for irrigation is very limited across the site. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist, and only very limited irrigation water has been exploited in this area.

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix B. SiVEST undertook every effort to obtain the information (including specialist studies, BA / EIA / Scoping and EMPr Reports) for the surrounding developments. However, many of the documents are not currently publicly available to download, and could therefore not be reviewed during this assessment.

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

6 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA), requires that an application for the PV development be approved by the Department of Agriculture, Forestry and Fisheries (DAFF). Despite the name of the Act, it does not apply only to subdivision, and its purpose is to ensure productive use of agriculturally zoned land. Therefore, even if land is not being subdivided or leased, SALA approval is required to develop agriculturally zoned land for non-agricultural purposes.

The power lines require the registration of a servitude for each farm portion crossed. In terms of SALA, the registration of a power line servitude requires written consent of the Minister if the following two conditions apply:

1. if the servitude width exceeds 15 metres; and
2. if Eskom is not the applicant for the servitude.

If one or both of these conditions do not apply, then no agricultural consent is required. Eskom is currently exempt from agricultural consent for power line servitudes.

The Act 70 of 1970 consent is separate from the EIA and needs to be applied for and obtained after the EIA.

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.

7 BASELINE ASSESSMENT OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

This section is organised in sub headings based on DEA's requirements for an agricultural study.

7.1 Climate and water availability

Rainfall for the site is given as a low 378 mm per annum (The World Bank Climate Change Knowledge Portal, 2015). The average monthly distribution of rainfall is shown in Figure 4. Rainfall and resultant moisture availability are insufficient to support viable, rainfed cultivation of crops and also limit the grazing capacity of the veld.

There are some small farm dams across the project area, and limited groundwater exploitation which support small, isolated patches of cultivation.

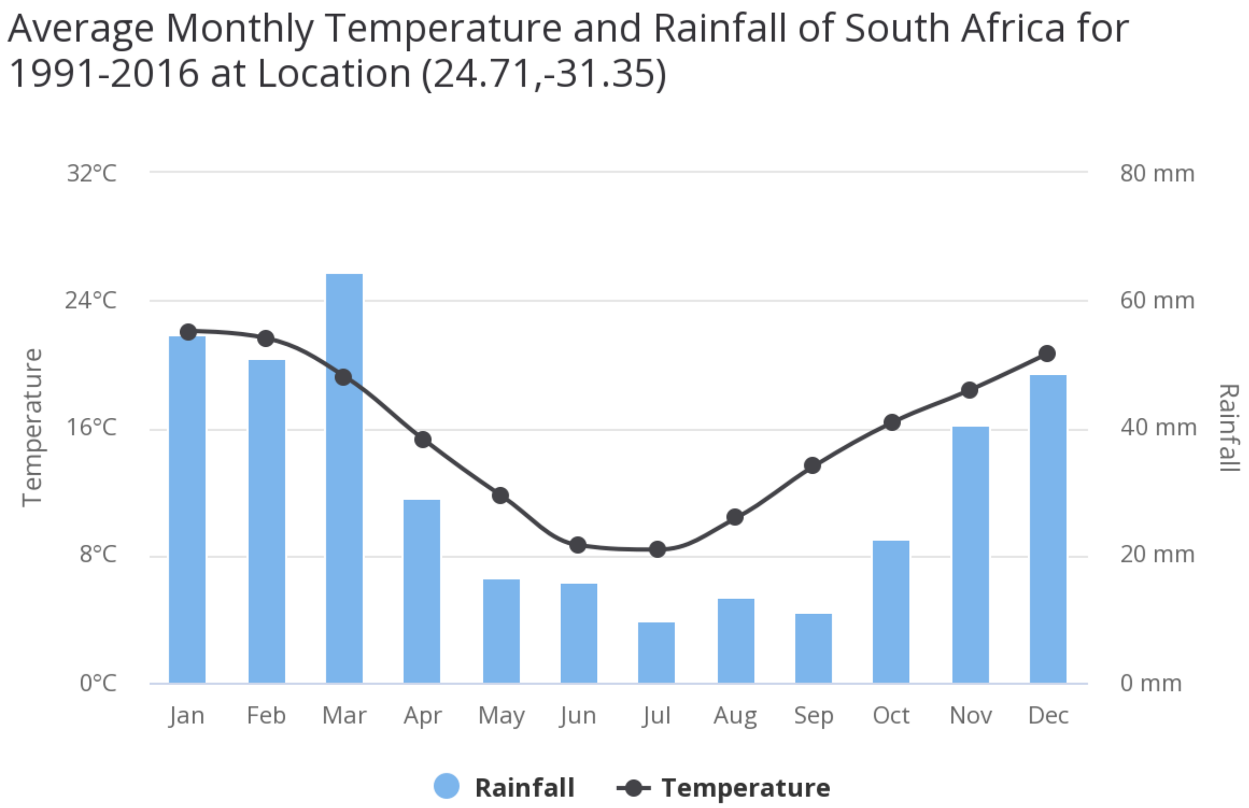

Figure 4. *Average monthly temperature and rainfall for a position approximately in the centre of the development (The World Bank Climate Change Knowledge Portal, 2015).*

7.2 Terrain, topography and drainage

The proposed development is located on plains and broken terrain with small mountains on the escarpment plateau. Altitude varies between approximately 1,440 and 1,700 metres. There is a wide range of slopes across the broken terrain of the project area. There are several non-perennial water courses, typical of arid areas, that drain the project area.

The underlying geology is shale, mudstone and sandstone of the Beaufort Group of the Karoo Supergroup. Dolerite intrusions are common.

7.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The proposed development is located on predominantly two similar land types, namely Da6 and Da77. Only a small proportion of the proposed power line routes crosses another two land types, Ib316 and Fb373, in the mountainous terrain. Soils on these land types are fairly similar and are predominantly shallow, loamy sands on underlying rock or less commonly clay. Dominant soil forms are Swartland, Hutton, Mispah, and Valsrivier. The soils would fall into the Duplex and Lithic soil groups according to the classification of Fey (2010). A summary detailing soil data for the land types is provided in Appendix 1, Table A1.

7.4 Agricultural capability

Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rainfed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability classes are suitable as arable land for the production of cultivated crops, while the lower suitability classes are only suitable as non-arable grazing land, or at the lowest extreme, not even suitable for grazing. In 2017 DAFF released updated and refined land capability mapping across the whole of South Africa. This has greatly improved the accuracy of the land capability rating for any particular piece of land anywhere in the country. The new land capability mapping divides land capability into 15 different categories with 1 being the lowest and 15 being the highest. Values of below 8 are generally not suitable for production of cultivated crops. Detail of this land capability scale is shown in Table 2.

The project area is classified with land capability evaluation values that range from 1 to 7, with 6 being the predominant land capability. The land capability is limited by the very low climatic moisture availability, the rugged terrain, and the shallow, rocky soils.

Table 2: Details of the 2017 Land Capability classification for South Africa.

Land capability evaluation value	Description
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	

11	High
12	High to Very High
13	
14	Very High
15	

Due to the land capability constraints, agricultural land use is restricted to grazing only. The natural grazing capacity is given on Cape Farm Mapper as reasonable, at 16 to 17 hectares per large stock unit.

7.5 Land use and development on and surrounding the site

The area is a sheep farming area. The climate does not support any cultivation, except for small patches of irrigation associated with farm dams. Low intensity natural grazing is the dominant agricultural activity. There are several farmsteads (that is a residential and administrative node of buildings and infrastructure from which a farm is managed) within the study area. There is often agricultural infrastructure, including some irrigation in the proximity of the farmsteads. The only agricultural infrastructure away from the small patches of cultivation, are wind pumps, stock watering points and fencing surrounding grazing camps.

7.6 Possible land use options for the site

The low climatic moisture availability means that natural grazing is the only viable agricultural land use for most of the area, except for the small patches of irrigation.

7.7 Agricultural sensitivity

Agricultural sensitivity is directly related to the capability of the land for agricultural production. This is because a negative impact on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. A general assessment of agricultural sensitivity, in terms of loss of agricultural land in South Africa, considers arable land that can support viable production of cultivated crops, to have high sensitivity. This is because there is a scarcity of such land in South Africa, in terms of how much is required for food security. However, there is not a scarcity in the country of land that is only suitable as grazing land and such land is therefore not considered to have high agricultural sensitivity.

Agricultural sensitivity of a particular development is also a function of the severity of the impact which that type of development poses to agriculture. In the case of PV, fairly large areas of land are excluded from agricultural use, so in terms of that aspect, there is sensitivity. In the case of power lines, the impact is negligible because almost all agricultural activities can continue undisturbed beneath power lines.

The majority of the study area has low agricultural potential and therefore low agricultural sensitivity to development and consequent loss of agricultural land use. The only exception are the small patches of irrigation. These have a higher sensitivity, because of their agricultural value, and should be considered no-go areas for any footprint of development that will exclude cultivation. For power lines, the no-go only applies to centre-pivot irrigated lands. This is because there is a danger of shorting between power lines (at standard height) and the centre pivot irrigation structures. Power lines can however cross centre pivot irrigated lands if the height of the power line is raised. No-go areas require no buffers. No-go areas are shown in Figure 5.

Apart from the cultivated no-go areas, agricultural potential and conditions are very uniform across the rest of the study area and the choice of placement of facility infrastructure therefore has minimal influence on the significance of agricultural impacts.

8 IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE

The focus and defining question of an agricultural impact assessment is to determine to what extent a proposed development will compromise (negative impacts) or enhance (positive impacts) current and/or future agricultural production. The significance of an impact is therefore a direct function of the degree to which that impact will affect current or future agricultural production. If there will be no impact on production, then there is no agricultural impact. Impacts that degrade the agricultural resource base pose a threat to production and therefore are within the scope of an agricultural impact assessment. Lifestyle impacts on the resident farming community, for example visual impacts, do not necessarily impact agricultural production and, if they do not, are not relevant to and within the scope of an agricultural impact assessment. Such impacts are better addressed within the impact assessments of other disciplines included in the EIA process.

For agricultural impacts, the exact nature of the different infrastructure within the facility has very little bearing on the significance of impacts. What is of most relevance is simply the occupation of the land, and whether it is being occupied by a solar array, a road, a building or a substation makes no difference. What is of most relevance therefore is simply the total footprint of the facility.

The ways in which the project can impact on soils, agricultural resources and productivity are:

- Occupation of the land by the total physical footprint of the proposed project including all PV panels, roads and electrical infrastructure.
- Disturbance and changes to the land surface characteristics and soil profile from constructional activities such as levelling and excavations as well as the establishment of hard surfaces. These may lead to erosion and land degradation.

The significance of all potential agricultural impacts is kept low by the low agricultural potential of the land and the consequent low agricultural sensitivity to the loss of this land for agriculture.

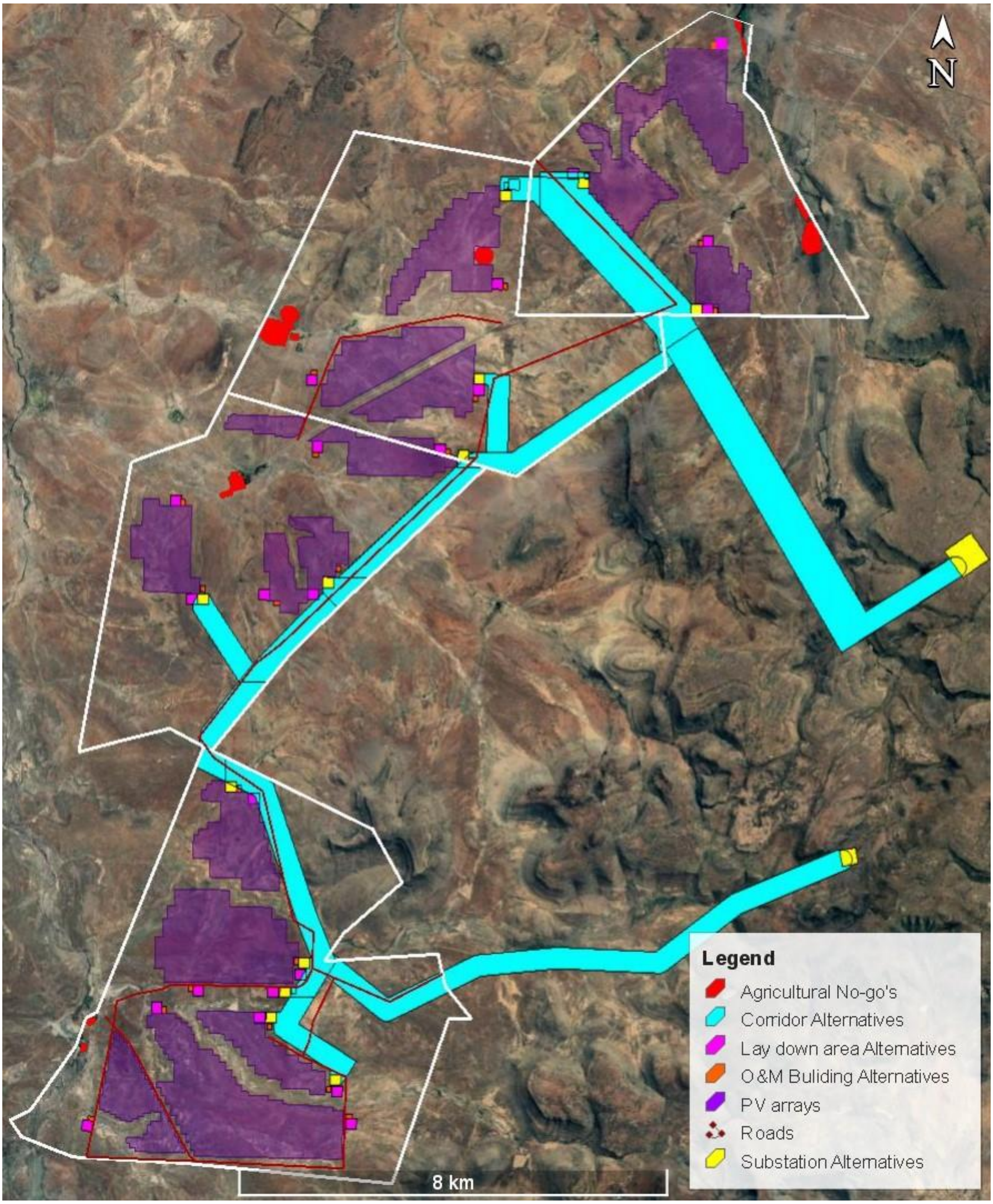

Figure 5. Map of the development area including all proposed transmission line alternatives. Agricultural no-go areas are shown with red outlines.

8.1 Impacts of the solar PV facilities

Because of the similarity of the agricultural environment across all three of the proposed project areas, the impacts are identical for all three solar PV facilities, and are therefore only presented here once.

Three potential agricultural impacts have been identified. Two of these are direct, negative impacts and apply to all three phases of the development (construction, operational and decommissioning). They are:

- Loss of agricultural land use
  Agricultural grazing land directly occupied by the development infrastructure will become unavailable for agricultural use.
- Soil degradation
  Soil degradation can result from erosion and topsoil loss. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related soil profile disturbance. Soil degradation will reduce the ability of the soil to support vegetation growth.

The third impact is a positive, indirect impact and only applies to the operational phase:

- Increased financial security for farming operations
  Reliable income will be generated by the farming enterprises through the lease of the land to the energy facility. This is likely to increase their cash flow and financial security and thereby improve farming operations.

An assessment of these impacts is presented in ***Table 3***, below.

8.2 Impacts of the grid connection infrastructure

Because of the similarity of the agricultural environment across all three of the proposed project areas, the impacts are identical for all three grid connection infrastructures, and are therefore only presented here once.

Grid connection infrastructure has negligible impact on agriculture because all viable agricultural activities in this environment can continue undisturbed below transmission lines and the remaining footprint of the infrastructure (substations etc) occupies an insignificantly small proportion of the available land. Only one agricultural impact has been identified. It is a direct, negative impact that applies to two of the phases of the development (construction and decommissioning):

- Soil degradation
  Soil degradation can result from erosion and topsoil loss. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by

construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related soil profile disturbance. Soil degradation will reduce the ability of the soil to support vegetation growth.

An assessment of this impact is presented in **Table 4**, below.

8.3 Cumulative impact of the solar PV facilities

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. 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 or degradation of agricultural land. The defining question for assessing the cumulative agricultural impact is this:

> What level of loss of agricultural land use is acceptable in the area, and will the loss associated with the Umsombovu PV development, cause that level in the area to be exceeded?

DEA 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 my opinion, result in an over-focus on methodological compliance, while missing the more important task of answering the above defining question more broadly.

The first limitation with DEA's required methodology is that it restricts the cumulative impacts to similar developments, so in this case to renewable energy developments. In order to accurately answer the defining question above, all developments, regardless of their type and similarity, should be taken into account, because all will contribute to exceeding the acceptable level of change.

The second problem with the requirement, is that it restricts surrounding developments to those within an absolutely defined distance, in this case 35km. Again this does not allow for accurately answering the defining question. To achieve this, the distance used for cumulative impact assessment should be discipline dependent. A different distance is likely to apply for agricultural impact than for economic impact or botanical impact. And a different distance should be used in different environments, for example in high potential agricultural environments versus very low potential agricultural environments.

Given the above, this assessment focuses less on methodological compliance and more on effectively addressing the defining question above by considering the cumulative impacts more broadly than is required by DEA compliance. This includes considering a wider area than the 35 km radius, and considering the likelihood of pressure from other types of developments as well.

There are 17 renewable energy projects, with their associated transmission lines, within 35km of the proposed site (that need to be considered in terms of the DEA requirements). These are listed and mapped in Appendix 2.

All of these projects have the same agricultural impacts in a very similar agricultural environment, and in all cases the agricultural impact is assessed as low

Of all the mitigation measures proposed for all of these projects the following have not been included in this report for the reasons given. All others have been included.

Keeping disturbed soil covered by straw, mulch, or erosion control mats. This is not considered viable in the arid environment. Straw would blow away, and there is unlikely to be any viable source of mulch. Vegetation establishment, taking into account any recommendations by the vegetation study, would be the most viable form of soil stabilisation.

In quantifying the cumulative impact, the area of land taken out of agricultural grazing as a result of all of the projects above will amount to a total of approximately 1,700 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 DEA (2015). As a proportion of the area within a 35km radius (approximately 385,000 ha), this amounts to only 0.44% of the surface area. That is well within an acceptable limit in terms of loss of low potential agricultural land, of which there is no scarcity in the country. This is particularly so when considered within the context of the following point:

- In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no cultivation potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are therefore far higher in this region than in regions with higher agricultural potential.

It should also be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore low.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use is assessed as having low significance. In terms of cumulative impact, therefore, the development can be authorised.

8.4 Cumulative impact of the grid connection infrastructures

The discussion of cumulative impacts above applies to the grid connection infrastructure as well. However, because the agricultural impacts of grid connection infrastructure are negligible, the cumulative impacts are even lower than those for the solar PV facilities. This environment could accommodate many more overhead power lines than currently exist or than are proposed, before acceptable levels of land loss and degradation as a result of transmission lines have any likelihood of being exceeded. Acceptable levels of change in terms of other areas of impact, such as visual impact, would be exceeded long before agricultural levels of change came anywhere near to being exceeded.

Table 3: Impact assessment summary for all three solar PV facilities. Because of the similarity of the agricultural environment across all three of the proposed project areas, the impacts are identical for all three solar PV facilities, and are therefore only presented here once.

3 UMSOMBOVU SOLAR PV FACILITIES																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																				
Agricultural land	Loss of agricultural land use due to direct occupation	1	4	2	2	3	2	24	-	Medium	None	1	4	2	2	3	2	24	-	Medium
Soil	Soil degradation and erosion	1	2	2	2	2	2	18	-	Low	Control run-off; maintain vegetation cover; strip, stockpile and re-spread topsoil	1	1	2	2	2	2	16	-	Low

Operational Phase																				
Agricultural land	Loss of agricultural land use due to direct occupation	1	4	2	2	3	2	24	-	Medium	None	1	4	2	2	3	2	24	-	Medium
Soil	Soil degradation and erosion	1	2	2	2	2	2	18	-	Low	Control run-off; maintain vegetation cover; strip, stockpile and re-spread topsoil	1	1	2	2	2	2	16	-	Low
Financial security of farming operations	Increased financial security through rental income	1	4	1	1	3	2	20	+	Low	None	1	4	1	1	3	2	20	+	Low
Decommissioning Phase																				
Agricultural land	Loss of agricultural land use due to direct occupation	1	4	2	2	3	2	24	-	Medium	None	1	4	2	2	3	2	24	-	Medium
Soil	Soil degradation and erosion	1	2	2	2	2	2	18	-	Low	Control run-off; maintain vegetation cover; strip, stockpile and re-spread topsoil	1	1	2	2	2	2	16	-	Low
CumulativeAgricultural land	Regional loss of agricultural land and productivity	2	1	2	2	3	2	20	-	Low	Control run-off; maintain vegetation cover; strip, stockpile and re-spread topsoil	2	1	2	2	3	2	20	-	Low

Table 4: Impact assessment summary for all three grid connection infrastructures.

3 UMSOMBOVU GRID CONNECTON INFRASTRUCTURES																					
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**									
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																					
Soil	Soil degradation and erosion	1	1	2	2	2	1	8	-	Low	Control run-off; maintain vegetation cover; strip, stockpile and re-spread topsoil	1	1	2	2	2	1	8	-	Low
Operational Phase																					
N/A	N/A									N/A	N/A									N/A
Decommissioning Phase																					
Soil	Soil degradation and erosion	1	1	2	2	2	1	8	-	Low	Control run-off; maintain vegetation cover; strip, stockpile and re-spread topsoil	1	1	2	2	2	1	8	-	Low
Cumulative																					
Soil	Soil degradation and	2	1	2	2	2	1	9	-	Low	Control run-off; maintain	2	1	2	2	2	1	9	-	Low

	erosion										vegetation cover; strip, stockpile and re-spread topsoil									

8.5 Assessment of project alternatives

No site location alternatives are considered because these have already been considered in a high-level screening of potential environmental and socio-economic issues, as well as 'fatal flaws' to determine suitable areas for project development.

The following project alternatives have been comparatively assessed (see alternatives table below):

- Laydown Areas and Operation & Maintenance (O&M) Building Site Alternatives. The Applicant wants to construct one (1) Laydown Area and O&M Building per PV array area; and
- Grid Connection Infrastructure Alternatives for each solar PV project.

It should be noted that the locations of the on-site / collector substations will depend on the Grid Connection Infrastructure Alternatives which are chosen as 'preferred' for each project. Grid connection alternatives are described below.

Mooi Plaats Solar PV Grid Connection:

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** - links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b** - links Substation 2 and Substation 1b to the Hydra D MTS.

OPTION 2:

- **Corridor Option 2a** - links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.
- **Corridor Option 2b** - links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

Wonderheuvel Solar PV Grid Connection:

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

OPTION 2:

- **Corridor Option 2a** - links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2b** - Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

OPTION 3:

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central

Collector Substation.

Paarde Valley Solar PV Grid Connection:

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
  - ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  - ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
  - ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  - **ii.** The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

OPTION 2:

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.
  - ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  - ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  - ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  - **ii.** The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

Although it is possible to propose theoretical differences between the significance of the impacts of the above alternatives, there is practically no material difference of any significance between them. Therefore, from an agricultural impact perspective, there are no preferred alternatives, and all the proposed alternatives are acceptable.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact / result in a positive impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 2	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 3	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 4	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 5	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 6	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 2	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 3	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 4	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 5	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 6	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 7	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 8	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 2	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 3	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 4	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 5	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site	No Preference	Low agricultural impacts and the

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Option 6		agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 7	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 8	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Laydown Area and O&M Building Site Option 9	No Preference	Low agricultural impacts and the agricultural uniformity of the site.

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 1b	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2a	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2a	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 1b	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 1c	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 1d	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2a	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2b	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 3	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 1b	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 1c	No Preference	Low agricultural impacts and the agricultural uniformity of the site.

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
Grid Connection Option 1d	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2a	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2b	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2c	No Preference	Low agricultural impacts and the agricultural uniformity of the site.
Grid Connection Option 2d	No Preference	Low agricultural impacts and the agricultural uniformity of the site.

9 CONCLUSIONS

South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of potentially arable land. The assessment has found that the proposed development will only impact agricultural land which is of low agricultural potential and only suitable for low intensity grazing.

Agricultural impacts of the proposed development are assessed as being of low to medium significance. The significance of agricultural impacts is limited by the limited agricultural potential of the proposed development site, which is a function of the climate, terrain and shallow soils. The majority of the study area has low agricultural potential and therefore low agricultural sensitivity to development and consequent loss of agricultural land use. The only exception are small patches of irrigation. These were considered no-go areas for any footprint of development that will exclude cultivation, and have been avoided by the development layout.

This agricultural impact assessment is considered to be comprehensive and no further study is required for agricultural impact.

Due to the low agricultural potential of the site, and the consequent low agricultural impact, there are no restrictions relating to agriculture which preclude authorisation of the proposed development and therefore, from an agricultural impact point of view, the development should be authorised. There is no preference in terms of the proposed power line route alternatives and all alternatives are supported.

There are no conditions resulting from this assessment that need to be included in the Environmental Authorisation, apart from the mitigation measures proposed above.

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APPENDIX 1: SOIL DATA

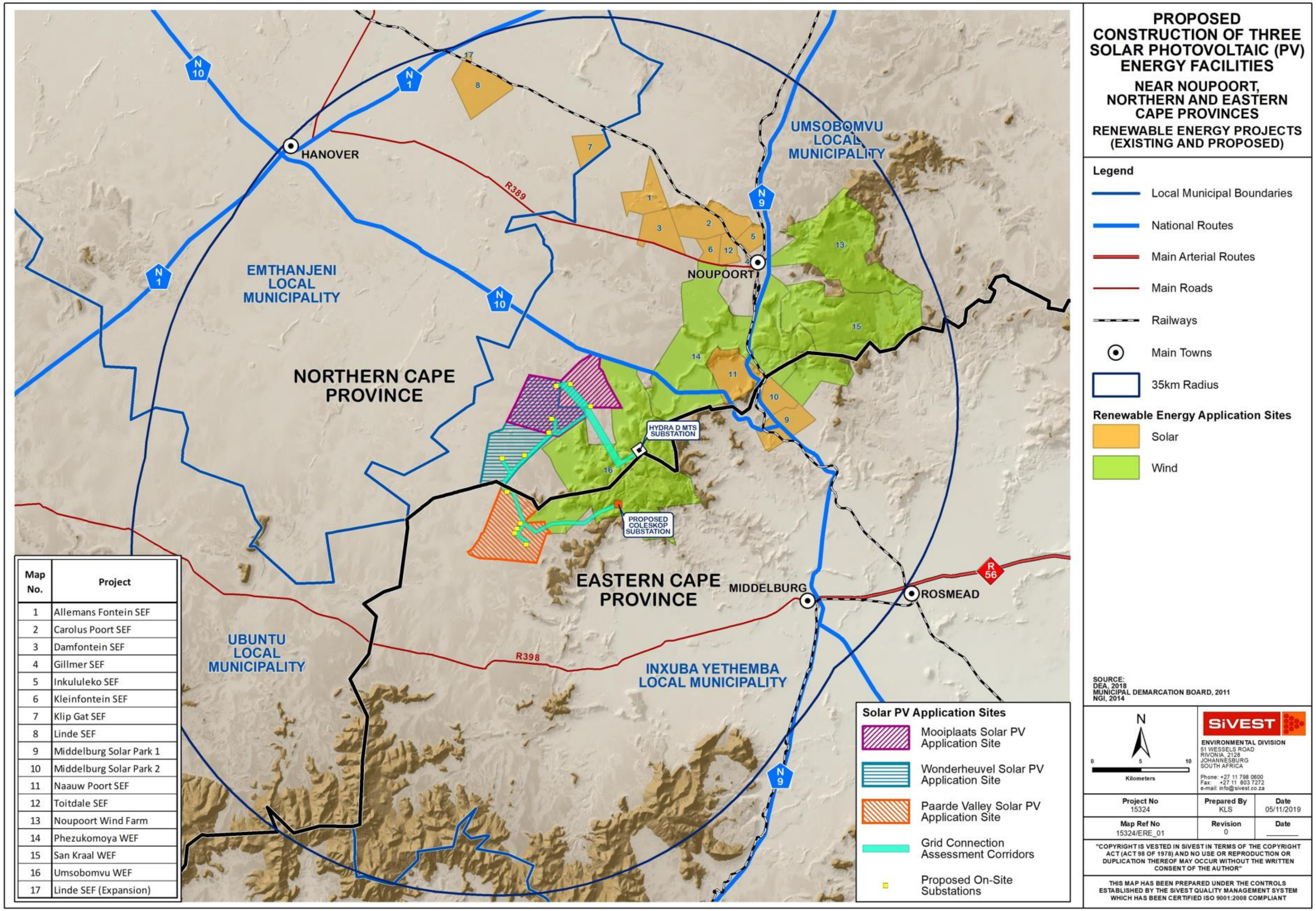
Table A1. Land type soil data for the study area.

Land type	Soil series (forms)	Depth (mm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Da6	Swartland	30 - 300	15 - 30	30 - 45	so	54.2
	Rock outcrop					10.8
	Hutton	100 - 600	10 - 25	10 - 30	R	9.5
	Mispah	50 - 100	10 - 25		R	9.3
	Valsrivier	60 - 400	15 - 30	35 - 45	vr,vp	6.0
	Glenrosa	100 - 200	10 - 25		R	4.0
	Oakleaf	600 > 1200	15 - 25	35 - 40	ne	3.0
	Oakleaf	600 > 1200	15 - 25	15 - 30	ne	3.0
Da77	Swartland	200 - 500	5 - 25	25 - 35	so	18.3
	Hutton	50 - 450	6 - 25	6 - 25	R	17.0
	Swartland	200 - 300	15 - 25	35 - 45	so	16.3
	Valsrivier	200 - 400	15 - 25	35 - 45	vr,vp	12.0
	Mispah	20 - 100	10 - 20		R	11.0
	Oakleaf	400 - 700	15 - 25	15 - 30	ne	5.9
	Rock outcrop					5.8
	Oakleaf	300 - 800	15 - 30	35 - 45	ne	5.3
	Glenrosa	50 - 150	10 - 20	10 - 25	R	5.0
	Sterkspruit	100 - 300	15 - 30	35 - 45	pr	2.3
	Dundee	300 - 800	10 - 30	10 - 30	ne	0.6
	Inhoek	500 - 1200	25 - 35	35 - 45	ne	0.4
	Estcourt	300 - 600	10 - 25	15 - 25	pr	0.4

Depth limiting layers: R = hard rock; so = partially weathered bedrock; lo = partially weathered bedrock (softer); ca = soft carbonate; ka = hardpan carbonate; db = dorbank hardpan; hp = cemented hardpan plinthite (laterite); sp = soft plinthic horizon; pr = dense, prismatic clay layer; vp = dense, structured clay layer; vr = dense, red, structured clay layer; gc = dense clay horizon that is frequently saturated; pd = podzol horizon; U = alluvium.

APPENDIX 2: PROJECTS CONSIDERED IN CUMULATIVE ASSESSMENT

Project	DEA Reference No	Technology	Capacity	Status of Application / Development
Allemans Fontein SEF	14/12/16/3/3/1/730	Solar	20MW	Approved
Carolus Poort SEF	14/12/16/3/3/1/729	Solar	20MW	Approved
Damfontein SEF	14/12/16/3/3/1/728	Solar	20MW	Approved
Gillmer SEF	14/12/16/3/3/1/735	Solar	20MW	Approved
Inkululeko SEF	14/12/16/3/3/1/553	Solar	20MW	Approved
Kleinfontein SEF	12/12/20/2654	Solar	20MW	Approved
Klip Gat SEF	14/12/16/3/3/2/354	Solar	75M	Approved
Linde SEF	12/12/20/2258	Solar	40MW	In Operation
Linde SEF (Expansion)	14/12/16/3/3/1/1122	Solar	75MW	Approved
Middelburg Solar Park 1	12/12/20/2465/2	Solar	75MW	Approved
Middelburg Solar Park 2	12/12/20/2465/1	Solar	75MW	Approved
Naauw Poort SEF	14/12/16/3/3/2/355	Solar	75MW	Approved
Toitdale SEF	12/12/20/2653	Solar	20MW	Approved
Noupoort Wind Farm	12/12/20/2319	Wind	188MW	In Operation
Phezukomoya WEF	14/12/16/3/3/1/1028	Wind	315MW	EIA in Process
San Kraal WEF	14/12/16/3/3/1/1069	Wind	390MW	EIA in Process
Umsobomvu WEF	14/12/16/3/3/2/730	Wind	140MW	Approved


PROPOSED CONSTRUCTION OF THREE SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITIES
NEAR NOUPOORT, NORTHERN AND EASTERN CAPE PROVINCES
RENEWABLE ENERGY PROJECTS (EXISTING AND PROPOSED)
Legend
Local Municipal Boundaries
National Routes
Main Arterial Routes
Main Roads
Railways
Main Towns
35km Radius
Renewable Energy Application Sites
Solar
Wind
SOURCE: DEA, 2018 MUNICIPAL DEMARCATION BOARD, 2011 NGI, 2014
N
0 5 10
Kilometers
SiVEST
ENVIRONMENTAL DIVISION
51 WESSELS ROAD RIVONIA, 2128 JOHANNESBURG SOUTH AFRICA
Phone: +27 11 798 0600 Fax: +27 11 803 7272 e-mail: info@sivest.co.za
Project No 15324
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Revision 0
Date
"COPYRIGHT IS VESTED IN SIVEST IN TERMS OF THE COPYRIGHT ACT (ACT 98 OF 1978) AND NO USE OR REPRODUCTION OR DUPLICATION THEREOF MAY OCCUR WITHOUT THE WRITTEN CONSENT OF THE AUTHOR"
THIS MAP HAS BEEN PREPARED UNDER THE CONTROLS ESTABLISHED BY THE SIVEST QUALITY MANAGEMENT SYSTEM WHICH HAS BEEN CERTIFIED ISO 9001:2008 COMPLIANT
Solar PV Application Sites
Mooiplaats Solar PV Application Site
Wonderheuvel Solar PV Application Site
Paarde Valley Solar PV Application Site
Grid Connection Assessment Corridors
Proposed On-Site Substations
Map No. Project
1 Allemans Fontein SEF
2 Carolus Poort SEF
3 Damfontein SEF
4 Gillmer SEF
5 Inkululeko SEF
6 Kleinfontein SEF
7 Klip Gat SEF
8 Linde SEF
9 Middelburg Solar Park 1
10 Middelburg Solar Park 2
11 Naauw Poort SEF
12 Toitdale SEF
13 Noupoort Wind Farm
14 Phezukomoya WEF
15 San Kraal WEF
16 Umsobomvu WEF
17 Linde SEF (Expansion)
HANOVER
NOUPOORT
MIDDELBURG
ROSMEAD
EMTHANJENI LOCAL MUNICIPALITY
UMSOBOMVU LOCAL MUNICIPALITY
UBUNTU LOCAL MUNICIPALITY
INXUBA YETHEMBA LOCAL MUNICIPALITY
NORTHERN CAPE PROVINCE
EASTERN CAPE PROVINCE
HYDRA D MTS SUBSTATION
PROPOSED COLESKOP SUBSTATION
R389
R398
R 56
N 1
N 9
N 10

Appendix 6B

Avifauna

Appendix 6C

Geotechnical

UMSOBOMVU PV ENERGY FACILITIES
GEOTECHNICAL DESKTOP STUDY

NOVEMBER 2019

REVISION 1 FINAL

Prepared for:

MOOI PLAATS SOLAR POWER (PTY) LTD / WONDERHEUVEL SOLAR POWER (PTY) LTD / PAARDE VALLEY (PTY) LTD

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VERIFICATION PAGE	Form 4.3.1
	Rev 13

TITLE: **UMSOBOMVU PV ENERGY FACILITIES** **GEOTECHNICAL DESKTOP STUDY**		
JGA REF. NO. 4817/07–02	**DATE:** 04/11/2019	**REPORT STATUS** Rev 1 Final

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SYNOPSIS

Revision 1: High-level geotechnical desktop study for the proposed Umsobomvu PV Facility.

KEY WORDS:

Solar Energy, Geotechnical Study, Umsobomvu, Inxuba Yethemba, Northern Cape, Eastern Cape, South Africa

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2015 which has been independently certified by DEKRA Certification

Verification	Capacity	Name	Signature	Date
By Author	Technical Director	C Canahai		29/10/2019
Checked by:	Engineering Geologist	K Naidoo Pr. Sci. Nat		30/10/2019
Authorised by:	Technical Director	C. Canahai Pr. Sci. Nat		04/11/2019

Filename:	W:\Earth Sciences\4817 - Various Small Geotech Projects 2018\07 - Umsobomvu PV Farm Desktop Study\Report Final\Revision 1\4817-07- Umsobomvu PV Farm Rev 1_Final.docx

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations 2014 (as amended)		**Clause**	**Section in Report**
Appendix 6	(1)	A specialist report prepared in terms of these Regulations must contain —	
	(a)	details of –	
		(i) the specialist who prepared the report; and	Verification Page
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Annexure B
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Declaration of interest form
	(c)	An indication of the scope of, and the purpose for which, the report was prepared;	1
	(cA)	An indication of the quality and age of base data used for the specialist report;	11
	(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Tables 2, 3, 4, 5, 6, 7
	(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Non-Applicable
	(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process; inclusive of equipment and modelling used;	5
	(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Figures 6,7, 8
	(g)	An indication of any areas to be avoided, including buffers;	Figures 6, 7, 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;	Figures 5, 6, 7, 8
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	1,11
	(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 or activities;	Figures 6, 7, 8
	(k)	Any mitigation measures for inclusion in the EMPr;	Tables 2, 3, 4, 5, 6, 7
	(l)	Any conditions for inclusion in the environmental authorization;	Tables 2, 3, 4, 5, 6, 7
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Tables 2, 3, 4, 5, 6, 7
	(n)	A reasoned opinion –	
		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	49
		(iA) regarding the acceptability of the proposed activity or activities; and	49
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures	Tables 2, 3, 4, 5, 6, 7

		that should be included in the EMPr, and where applicable, the closure plan;	
	(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	Non-Applicable
	(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None
	(q)	Any other information requested by the authority.	None
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Non-Applicable

UMSOBOMVU PV ENERGY FACILITIES

GEOTECHNICAL DESKTOP STUDY

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UMSOBOMVU PV ENERGY FACILITIES
GEOTECHNICAL DESKTOP STUDY

1 INTRODUCTION

This report presents the high-level, scoping phase, geotechnical desktop study, undertaken for Mooi Plaats (Pty) Ltd, Wonderheuvel (Pty) Ltd and Paarde Valley (Pty) Ltd, via SiVEST Environmental Division, for the proposed construction of Photovoltaic (PV) Energy Facilities. The proposed development crosses the Northern Cape / Eastern Cape provincial border and comprises of three PV Energy facilities with associated grid infrastructure. Further investigation will be needed at the design stage to aid the engineers in their design.

The information provided in this report is based on published geological maps, published geological and geotechnical information, the interpretation of aerial photography and the review of existing environmental study reports. Site verification was not undertaken. This information is provided for planning purposes only and as part of the Environmental Impact Assessment process.

2 PROJECT DESCRIPTION

We understand that the geotechnical desktop study will form part of the Environmental Impact Assessment to be undertaken by the SiVEST Environmental Division. From the information provided by SiVEST, there are three proposed PV facilities (with associated grid infrastructure) namely; Mooi Plaats Solar PV Facility, Wonderheuvel Solar PV Facility and Paarde Valley Solar PV Facility. These facilities are to comprise of:

- ***Mooi Plaats Solar PV Facility***, on an application site of approximately 5 303ha, comprising the following farm portions:
  - Portion 1 of Leuwe Kop No 120
  - Remainder of Mooi Plaats No 121

- ***Wonderheuvel Solar PV Facility***, on an application site of approximately 5 652ha, comprising the following farm portions:
  - Remainder of Mooi Plaats No 121
  - Portion 3 of Wonder Heuvel No 140
  - Portion 5 of Holle Fountain No 133

- ***Paarde Valley Solar PV Facility***, on an application site of approximately 3 695ha, comprising the following farm portion:
  - Portion 2 of Paarde Valley No 62: and
  - Portion 7 of the Farm Leeuw Hoek No. 61.

2.1 SOLAR PV COMPONENTS

2.1.1 Mooi Plaats Solar PV Energy Facility

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **400MW** and will comprise approximately **1 142 857** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.1.2 Wonderheuvel Solar PV Energy Facility:

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **480MW** and will comprise approximately **1 371 429** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.1.3 Paarde Valley Solar PV Energy Facility

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337ha.

- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **700MW** and will comprise approximately **2 000 000** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.2 Grid Connection Infrastructure

The proposed grid connection infrastructure will include the following components:

- New on-site substations and collector substations to serve each solar PV energy facility, each occupying an area of up to approximately 4ha.
- A new 132kV overhead power line connecting the on-site substations and/or collector substations to either the Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation, from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage to include both lattice and monopole towers which will be up to 25m in height.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines. The respective alternatives are as follows:

2.2.1 Mooi Plaats Solar PV Grid Connection

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** - links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b** - links Substation 2 and Substation 1b to the Hydra D MTS.

OPTION 2:

- **Corridor Option 2a** - links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

- **Corridor Option 2b** - links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

2.2.2 Wonderheuvel Solar PV Grid Connection

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.

ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

OPTION 2:

- **Corridor Option 2a** - links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2b** - Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

OPTION 3:

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation.

2.2.3 Paarde Valley Solar PV Grid Connection

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
  - ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  - ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
  - ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

OPTION 2:

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

The EIA phase geotechnical desktop study comprises of an Impact Assessment (from a geotechnical / geological perspective) of each proposed PV facility, a Comparative Assessment of the grid alternatives and a Cumulative Impact Assessment for each proposed PV facility (should other Energy facility / large infrastructure be developed within a 35 km radius) and takes into account other updated / revised issues to include the following:

- a review of the findings in accordance with detailed site layouts, including the PV array areas put forward as a result of the identified sensitive areas;
- a comparative assessment of the layout alternatives provided; and

- addressing any comments or concerns arising from the public participation process.

3 APPOINTMENT

JG Afrika submitted a quotation on the 18th September 2018 to SiVEST and were appointed via email, by SiVEST's Andrea Gibb, on the 11th January 2019.

4 AVAILABLE INFORMATION

SiVEST provided all maps alternatives of all infrastructure proposed in .kml format. The following sources of information were used during the study:

- 1:250 000 scale Geological Map titled 3124 Middleburg published by the Council for Geoscience.
- Engineering Geology of South Africa Volume 4 (Brink, 1985).
- Aerial photography (Google Earth imagery).

5 METHODOLOGY

SiVEST provided the following guidelines / format for assessing the sites and grid infrastructure:

- "Proposed Umsobomvu Solar PV Energy Facilities Comparative Assessment of Alternatives Grid Connection Infrastructure"
- "Updated Environmental Impact Assessment Methodology_Ver1 - 2019 SJ"

Areas with steep slopes and potential talus deposits were identified using available satellite imagery and 20m contour data.

6 SITE LOCATION

Three areas have been identified for the proposed PV facilities namely; Mooi Plaats Solar PV Facility, Wonderheuvel Solar PV Facility and Paarde Valley Solar Facility. These areas lie adjacent to each other, in a north east / south west trending line, and are located approximately 35 km north west of Middelburg and 31 km south west of Noupoort. The entire study area crosses over the Northern Cape / Eastern Cape provincial border. The following location information was provided by SiVEST:

- Mooi Plaats Solar PV Facility, on an application site of approximately 5 303ha, comprising the following farm portions:
  - Portion 1 of Leuwe Kop No 120
  - Remainder of Mooi Plaats No 121

- Wonderheuvel Solar PV Facility, on an application site of approximately 5 652ha, comprising the following farm portions:
  - Remainder of Mooi Plaats No 121
  - Portion 3 of Wonder Heuvel No 140
  - Portion 5 of Holle Fountain No 133

- Paarde Valley Solar PV Facility, on an application site of approximately 2 631ha, comprising the following farm portion:
    - Portion 2 of Paarde Valley No 62

Note that the Remainder of Mooi Plaats No 121 forms part of both the Mooi Plaats Solar PV Facility and Wonderheuvel Solar PV Facility i.e., there is overlap between these sites.

A regional locality map is provided in Figure 1 and locality maps showing the locations of the proposed PV facilities with corresponding corridor options are provided in Figures 2 to 4.

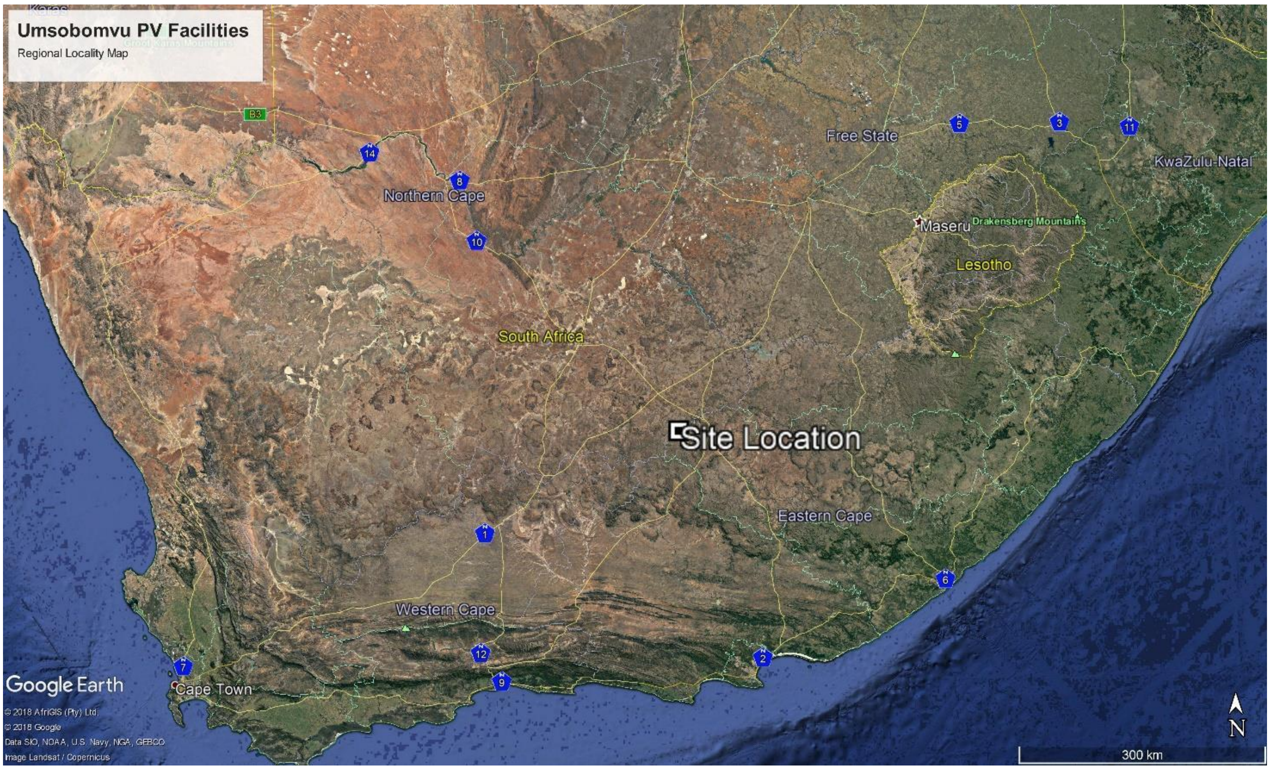

Figure 1 Regional Location Map (Google Earth)

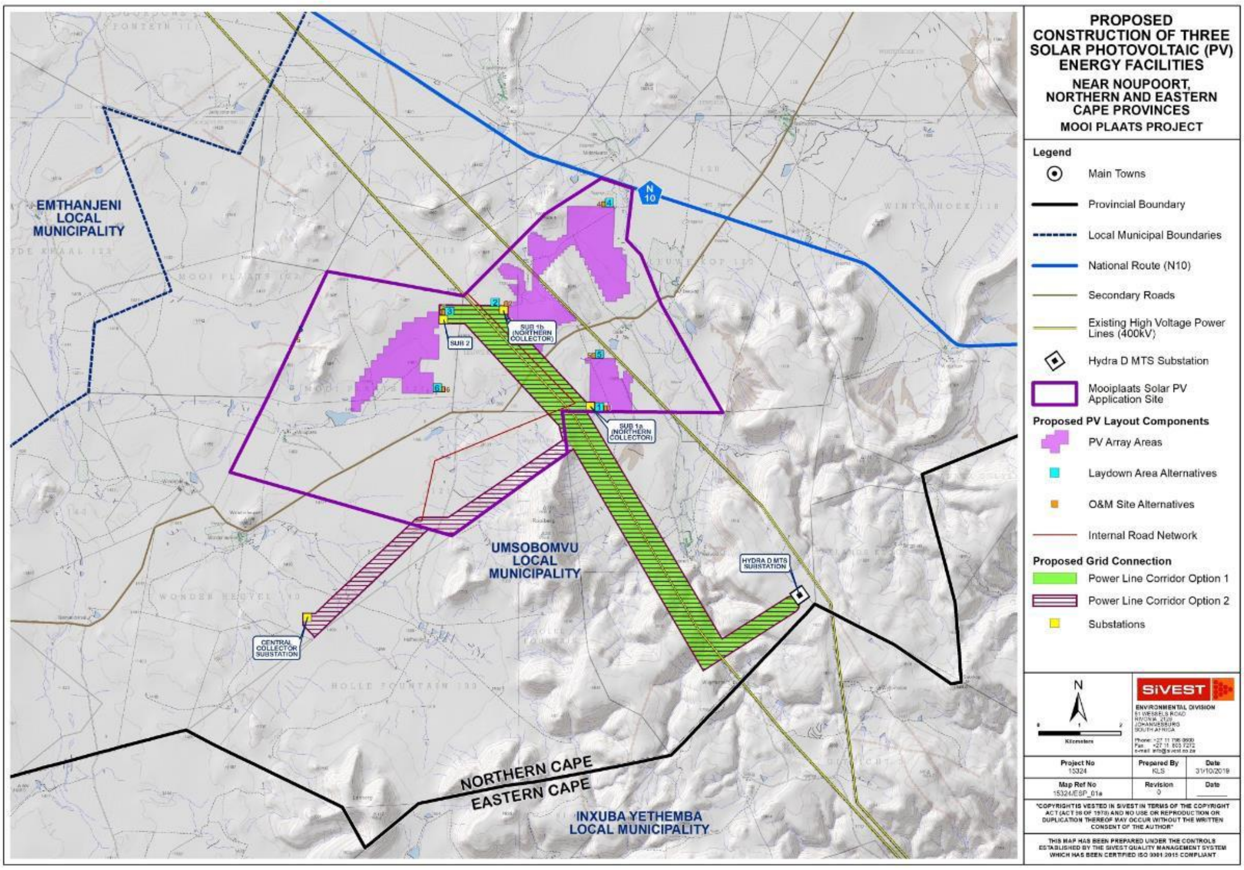

Figure 2 Mooi Plaats PV Facility Locality Map (as provided by SiVEST)

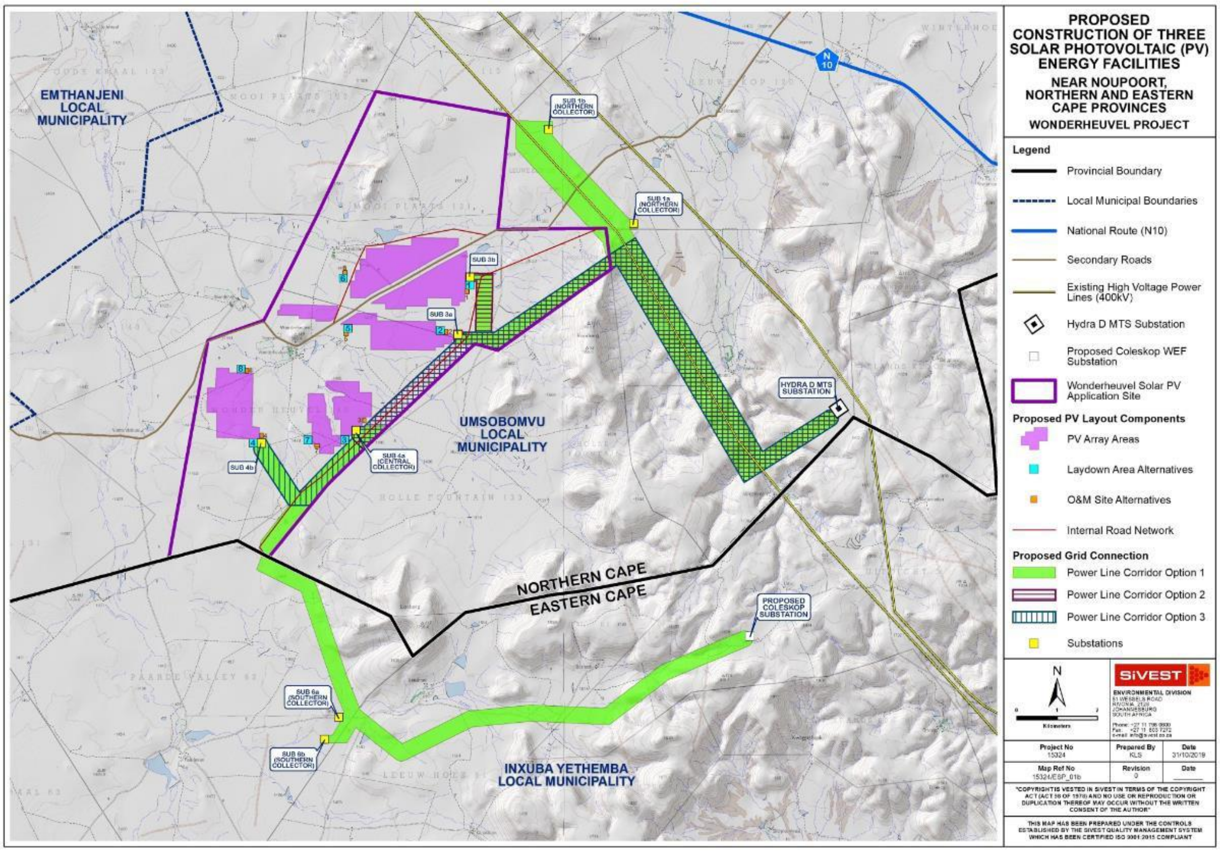

Figure 3 Wonderheuvel PV Facility Locality Map (as provided by SiVEST)

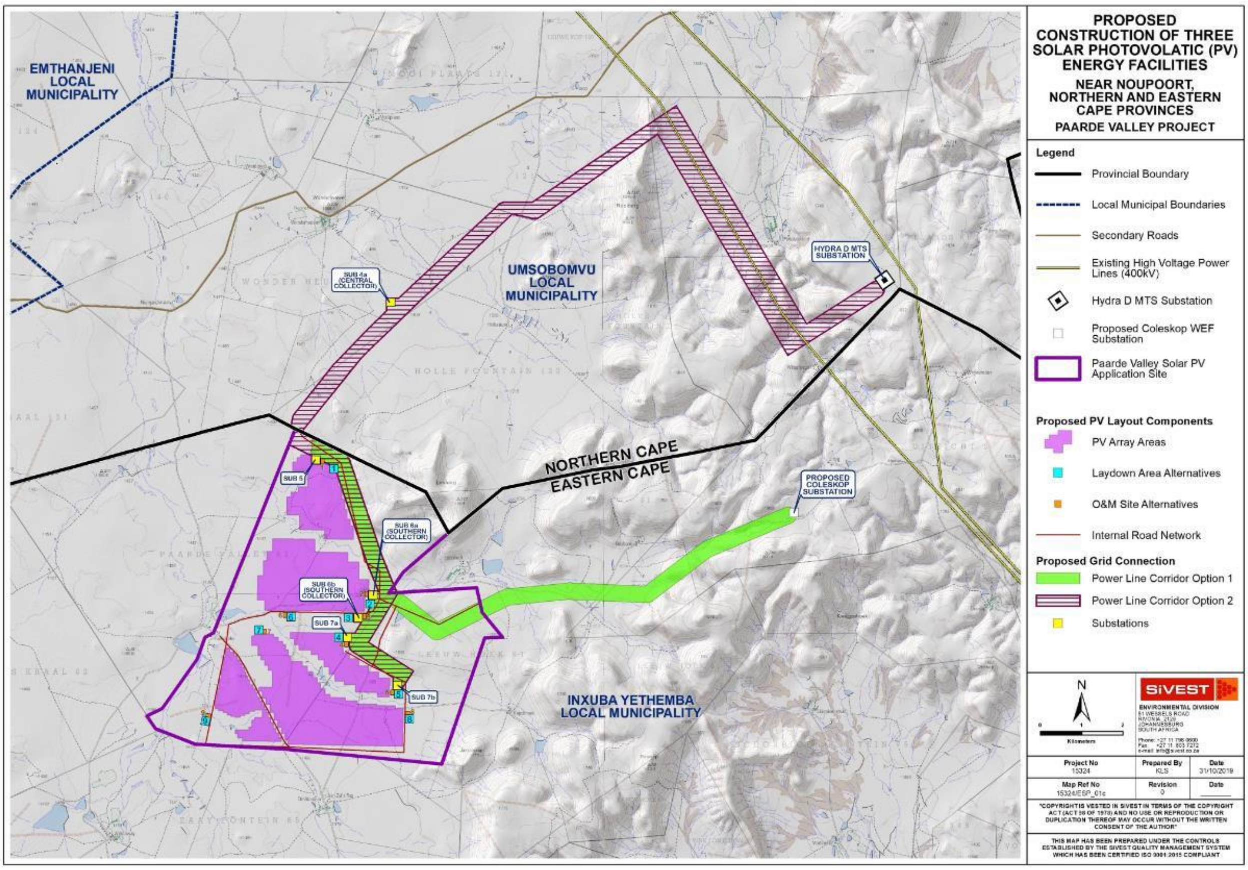

Figure 4 Paarde Valley PV Facility Locality Map (as provided by SiVEST) Site Conditions

6.1 Geology

According to the 1:250 000 series Geological Map 3124 Middelburg, the entire study area is predominantly underlain by sedimentary rock units of the Adelaide Subgroup and the Katberg Formation (which forms part of the Tarkastad Subgroup). The Adelaide Subgroup is overlain by the Tarkastad Subgroup. Together these Subgroups make up the Beaufort Group, which forms part of the Karoo Supergroup. The sedimentary rocks are often intruded by volcanic rocks - dolerite, of the Jurassic age. In addition to the above rock types, the study area is also underlain by scattered quaternary deposits associated with valley lines and lower lying areas.

The geology and stratigraphy of the site is given in Table 1 below.

Table 1 Geology and Stratigraphy of the site

Stratigraphy	**Map Symbol**	**Lithology**
Quaternary		Alluvium, Colluvium
Quaternary	**Qc**	Calcrete
Jurassic	**Jd**	Dolerite
Katberg Formation, Tarkastad Subgroup, Beaufort Group, Karoo Supergroup	**Rk**	Sandstone, Mudrock
Adelaide Subgroup, Beaufort Group, Karoo Supergroup	**Pa**	Mudrock, subordinate sandstone

The geological map of the study area is depicted in Figure 5 overleaf.

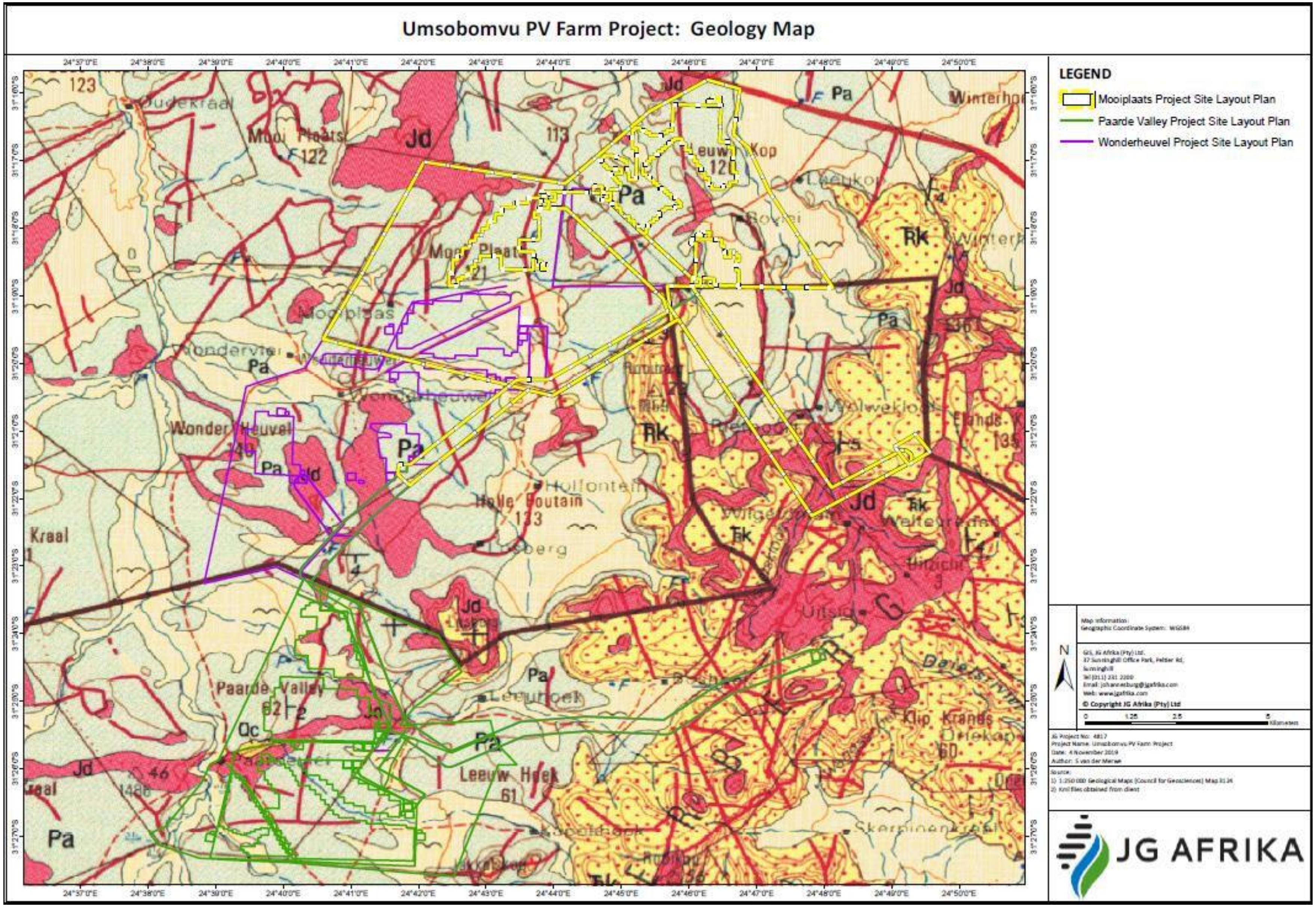

Figure 5 Geology Map

6.2 Topography and Drainage

From satellite imagery, it is observed that all three sites exhibit similar topography. The general topography of area is gentle with localised undulations, hills and occasional koppies. There are scattered hilly/mountainous regions with steep slopes in the study area. Brink (1979) mentions 4 slope elements on concave slopes namely; crest, free face, talus and foot slope. Talus deposits are a type of colluvial deposits that accumulate on talus element of slopes. Numerous rock outcrops and potential talus deposits were identified and highlighted in red in Figures 6 - 8.

Various localised drainage features are to be expected given the undulating nature of the topography. The topographical and drainage features will need to be confirmed by site investigation.

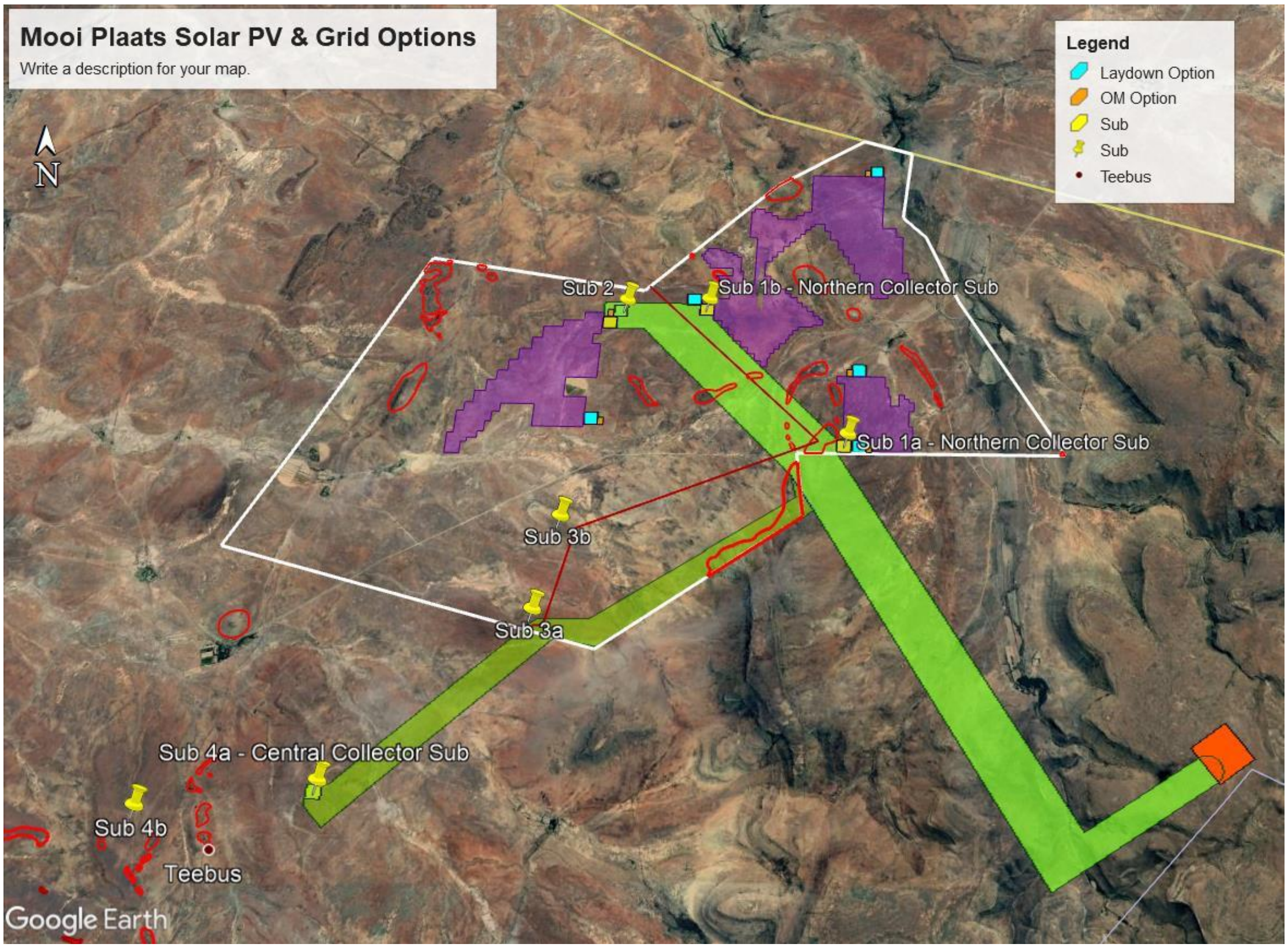

Figure 6 Mooi Plaats PV Facility and Grid Options Rock Outcrops and Talus Slopes (in red)

6.2.1 Mooi Plaats PV Facility

The topography is generally mildly undulating, with a few isolated ridges and koppies. There are numerous scattered rock outcrops. Talus deposits can be anticipated on the slopes of ridges and koppies. A water point/spring (with small reservoir) was identified in the north eastern section of the study area. A prominent drainage feature / river (approximately east-west trending) was identified in the central region of the site. Another drainage feature borders the eastern boundary of the site.

6.2.1.1 Mooi Plaats Grid Option 1

- **Corridor Option 1a -** links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b -** links Substation 2 and Substation 1b to the Hydra D MTS.

The northern section of the corridor has generally mildly undulating topography with a few isolated ridges. Talus deposits can be anticipated on the slopes of ridges and koppies (see red outlined areas).

The southern portion of the corridor traverses a number of drainage features as it moves into a hilly / mountainous region in the south. Thereafter it is making a turn to the north east and crosses a prominent drainage feature before meeting the Hydra D substation.

6.2.1.2 Mooi Plaats Grid Option 2

- **Corridor Option 2a -** links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.
- **Corridor Option 2b -** links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

This Option 2 is longer than Option 1. The northern and southern sections of the Option 2 corridor overlap or runs parallel to a large extent to sections of Option 1. Therefore, in the north, the topography is generally mildly undulating topography with a few isolated ridges. Talus deposits can be anticipated on the slopes of ridges and koppies (see red outlined areas). In the south the corridor traverses several drainage features as it moves into a hilly / mountainous region in the south. Thereafter it is making a turn to the east via central collector substation before meeting the Hydra D substation.

The topography is mildly undulating, except for a ridge roughly in the middle of the section (see red outlines on Figure 6).

6.2.2 Wonderheuvel PV Facility and Grid Infrastructure

The topography is generally mildly undulating with a few localised ridges and koppies scattered across the site. There are a number of scattered outcrops/boulders across the site (especially in the north western corner of the site). A hilly/ mountainous region was identified in the north eastern section of the site. A prominent ridge was also identified in the north western section of the site. Steep slopes and talus may be expected in these areas. Prominent drainage features / rivers were identified in the central and northern region of the site.

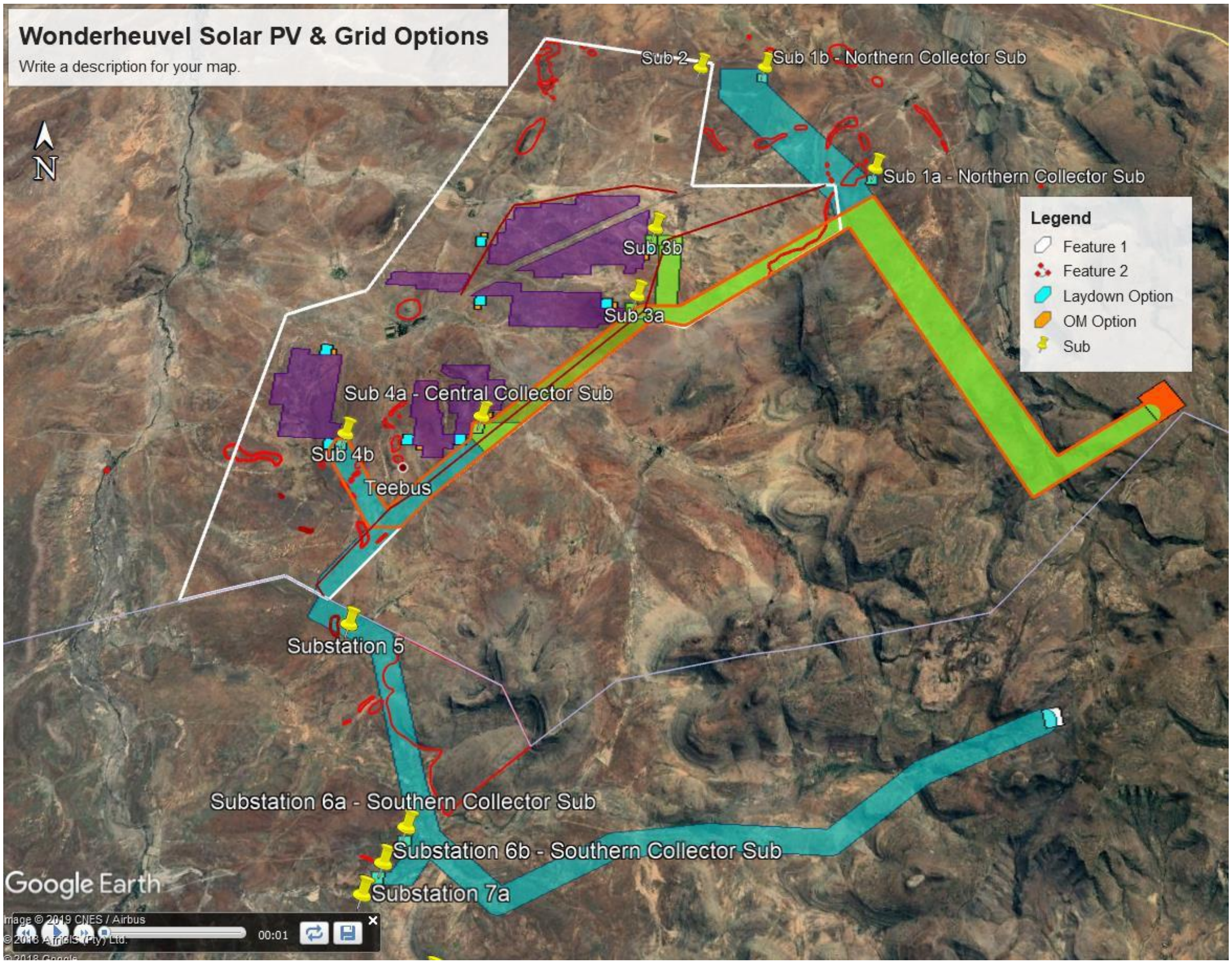

Figure 7 Wonderheuvel PV Facility and Grid Options Rock Outcrops and Talus Slopes (in red)

6.2.2.1 Wonderheuvel Grid Option 1

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - i. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.

ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

All grid Option 1 consists of two limbs a northern and a southern limb, with minor variations. The northern limb has predominantly mildly undulating topography with a few isolated ridges and koppies and drainage valleys especially in the north. Towards the south, the corridor traverses over a prominent drainage feature before it moves into a mountainous/hilly region, towards the Hydra D substation.

The southern limb of the corridor has very similar topography in the west i.e. mildly undulating with a few isolated ridges. Moving east, the corridor tends to follow existing valley lines with steep side slopes before it climbs to the Coleskop Substation. Talus deposits may be expected in this region. The extreme eastern section, close to the Coleskop Substation, traverses a hilly/mountainous region. Steep slopes and talus deposits may be expected.

6.2.2.2 Wonderheuvel Grid Option 2

- **Corridor Option 2a** - links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.
- **Corridor Option 2b** - Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

All corridor Option 2 are shorter and follow similar paths with generally minor variations. The topography is predominantly mildly undulating with a few isolated ridges and koppies and drainage valleys towards the north. Towards the south, the corridor traverses over a prominent drainage feature before it moves into a mountainous/hilly region, towards the Hydra D substation.

6.2.2.3 Wonderheuvel Grid Option 3

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation.

Corridor Option 3 consists of a slightly longer limb than grid Option 2 and follow similar topography as grid Option 2.

6.2.3 Paarde Valley PV Facility and Grid Infrastructure

The topography is generally mildly undulating with a few localised ridges and koppies scattered across the site. There are a number of scattered outcrops/boulders across the site. The north eastern section of the site is situated on a hilly/mountainous zone with steep slopes. There could potentially be talus deposits in this hilly region.

There are a number of drainage features in the southern, central and north eastern regions of the site. A prominent river channel runs parallel to the south western border of the proposed site. The site may be located in or in close proximity to the river flood plains. An approximately east-west trending stream/small river was identified in the northern region of the study area.

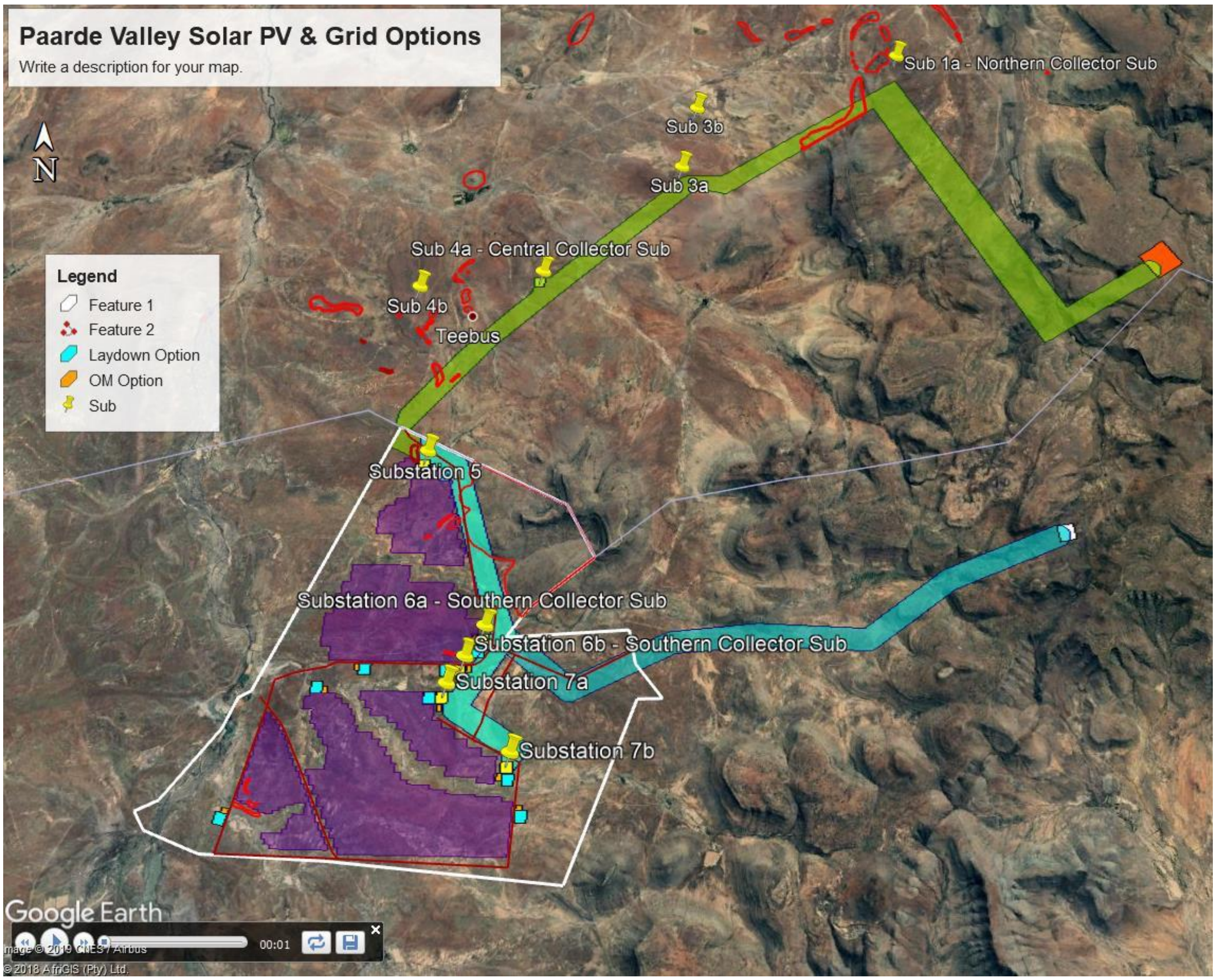

Figure 8 Paarde Valley PV Facility and Grid Options Rock Outcrops and Talus Slopes (in red)

6.2.3.1 Paarde Valley Grid Option 1

a. Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   i. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
   ii. The *southern connection* links **Substation 7a** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

b. Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   i. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
   ii. The *southern connection* links **Substation 7a** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

c. Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   i. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
   ii. The *southern connection* links **Substation 7b** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

d. Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
   i. The *northern connection* links **Substation 5** to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
   ii. The *southern connection* links **Substation 7b** to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

All corridor Options 1 are fairly similar from a geotechnical perspective. The extreme western portion of the Option 1 corridor has mildly undulating topography with a few isolated ridges. Moving east, the corridor traverses and then runs parallel to a stream/ small river. The extreme eastern section, close to the Coleskop Substation, traverses a hilly/mountainous region. Steep upslopes and talus deposits may be expected.

6.2.3.2 Paarde Valley Grid Option 2

a. Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

   iii. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderveuvel PV Project application site.

   iv. The *southern connection* links **Substation 6a and 7a** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

b. Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

   v. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

   vi. The *southern connection* links **Substation 6b and 7b** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

c. Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

   vii. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

   viii. The *southern connection* links **Substation 6a and 7b** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

d. Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

   ix. The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

   x. The *southern connection* links **Substation 6b and 7a** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.

All Corridor Options 2 are fairly similar form a geotechnical perspective although they all seem to be longer than the corridor Options 1. They run in a north easterly direction with predominantly mildly undulating topography with a few isolated ridges and koppies. Boulders and/or a possible rock outcrop were identified in the southern/central region of the corridor. The corridor route traverses a hilly / mountainous region in the northern section with a steep valley, just before the route makes a turn to the south east. Steep slopes and talus deposits may be expected in this mountainous region. The eastern/south eastern portion of the corridor, before it meets the Hydra D substation, has a steep hilly/mountainous topography with incised valleys. Steep slopes and talus deposits may be expected in this region. The grid Option 2 traverses a number of drainage features in the southern, central and northern sections.

6.3 Climate

The climatic regime plays a fundamental role in the development of a soil profile. Weinert (1964) demonstrated that mechanical disintegration is the predominant mode of rock weathering in areas where his climatic "N-value" is greater than 5, while chemical decomposition predominates where the N-value is less than 5. Weinert's climatic N-value for the site ranges between 5 – 10. This implies that mechanical disintegration is the dominant mode of weathering at the site.

6.4 Geotechnical Characteristics and Potential Constraints

From the 1:250 000 Geology map, the following near surface conditions may be encountered on site:

6.4.1 Beaufort Group

The Beaufort Group, which forms part of the Karoo Supergroup, is represented by the Adelaide Subgroup across all six sites. As mentioned above, the Adelaide Formation is comprised of mud stone with subordinate sandstone. The geotechnical characteristics of these rock types are discussed below:

6.4.2 Sandstone

The sandstones of the Karoo Supergroup are closely intercalated with mudrock. The sandstones usually poorly sorted (often containing rock fragments) and have a matrix comprised of clay or iron oxide, and occasionally calcite.

Due to the local climatic conditions, mechanical disintegration is the predominate form of weathering. This typically results in the formation of a relatively thin residual soil mantle overlying the bedrock.

Brink (1983) highlights this variability in the Beaufort Group, where similarly aged thick quartz rich (more resistant to weathering) sandstones are found adjacent to thin, poorly sorted sandstone.

Karoo Sandstone is also noted for have a non-uniform weathering pattern. Dense competent layers are sometimes underlain by less competent layers of lower consistency, therefore, founding conditions in feldspathic sandstones may not always improve with depth (Brink, 1983).

Slope instability may also be encountered in the Karoo sandstones. Brink (1983) notes four main instability types namely; Disintegration of intercalated mudrock, Pore water pressures on intercalated siltstone, Erosion of underlying strata and Block and wedge failures. Slope instability will be assessed during the detailed site investigation however, weathering and erosion of the intercalated mudstone and block/wedge failures are anticipated be the primary instability types.

6.4.3 Mudrock

The mudrocks of the Karoo Supergroup are known to break down upon exposure. The mechanisms of breakdown are still unclear, however changes in temperature, humidity, moisture content and stress relief are believed to be possible causes. Three main responses to the breakdown are highlighted by Brink (1983) namely; very little break down of the rock, disintegration of the rock into pieces of various sizes and shapes and lastly, slaking into silt and clay sized particles.

Brink (1983) also noted moisture content related volumetric changes in the Karoo mudrock. Fresh mudrock samples from the Beaufort group were observed to swell upon exposure to water. This property should be considered when founding any structures in or in close proximity to flood plains.

Slope instability may also be encountered in the Karoo mudrock. Brink (1983) highlight two main types of instability namely: the movement of completely weathered / colluvial material and the sliding of rock on bedding planes. Although these instability events were predominantly noted in Kwa Zulu Natal, care should be taken when working with cuttings and long / deep excavations. As mentioned above, mudrock is closely intercalated with sandstone. Undercutting of more weathering resistant sandstone may also occur, which could cause slope instability.

Due to the dry climate, a deep weathering profile/thick residual soils are not expected on site. Residual mudrock soils are also known to be potentially expansive and laboratory tests will need to be undertaken to confirm this.

6.4.4 Dolerite

The Karoo Supergroup contains many Jurassic aged dolerite intrusions. The magma predominantly intruded into the weaker argillaceous horizons in the form of sills and occasionally dykes (Brink, 1983).

Fresh/solid dolerite typically forms boulder/fractured dolerite during the initial stages of weathering. Due to mechanical breakdown being the predominate form of weathering in this region, further weathering results in the formation of gravel and/or granular dolerite with sandy soils (Brink, 1983).

Founding conditions on residual dolerite are generally non-problematic in areas with a dry climate. Care should be taken in areas with calcrete, as calcrete powder has being noted to increase the Plasticity Index of the residual dolerite (Brink, 1983).

Dolerite boulders will cause difficult excavation conditions due to their size and scattered occurrences. Hard excavation conditions are also expected in areas with shallow bedrock. Additional site clearing may be required to remove boulders from potential development sites. Potentially unstable talus deposits formed from dolerite corestones may be encountered on slopes.

Weathered dolerite may be targeted for use during construction of internal roads etc. The identification of potential borrow pits and the usage of the dolerite for construction material will need to be confirmed during a more comprehensive site investigation with laboratory testing.

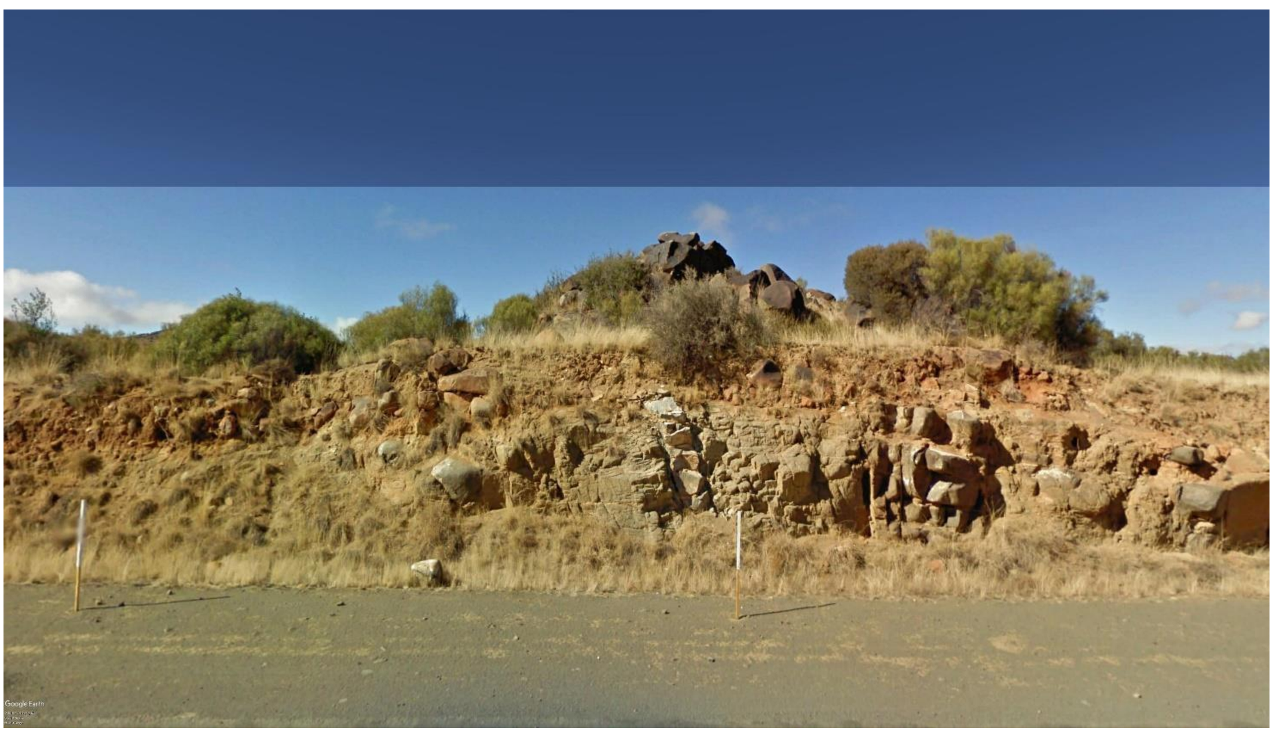

Figure 9 Dolerite weathering profile with corestones and surface boulders (N10 near the Mooi Plaats site – Google Earth)

Figure 10 Dolerite profile with boulders on the surface (N10 near the Mooi Plaats site – Google Earth)

Figure 11 Dolerite Ridge with Boulders on surface (N10 near the Mooi Plaats site– Google Earth)

6.4.5 Quaternary Deposits

6.4.5.1 Alluvium / Colluvium/Talus

Alluvial deposits are created when sediments are transported and deposited by water. Alluvial deposits may be quite thick, variable in composition and be prone to settlement.

Colluvial deposits are created when sediments are transported and deposited by gravity. As mentioned above, talus deposits are a type of colluvial deposits that accumulate on talus element of slopes Talus deposits generally occur where there are steep slopes below a stronger caprock. The caprock on this site is expected to be dolerite and/or sandstone. Talus deposits accumulate at their natural angle of repose and the upper part of talus slopes have a factor of safety that is close to 1.0. Due to weathering and colluvial action, talus deposits are generally poorly sorted, with large/coarse particles occurring with a finer matrix. The finer matrix has less strength than the surrounding unweathered rock fragments/debris, therefore the properties of this matrix influence the stability of the slope. With time, deterioration and weathering of the talus deposits results in instability. In addition to potential slope instability, difficult excavation conditions may be expected due to the large unweathered boulders.

6.4.5.2 Calcrete

According to the geology map, calcrete underlies a small portion of the proposed Paarde Valley PV facility and the associated grid options.

Calcrete is a deposit formed when soils have been cemented and/or replaced by carbonates. Calcretes are either formed by percolating groundwater or by pedogenic methods. Calcrete deposits may have thicknesses of over 30 m, however they are usually not continuous over depths exceeding 1 – 2 m (Brink, 1979).

Caution should be exercised when founding heavy structures on pedocretes (calcrete) as hard calcrete layers may be underlain by less competent material. Calcretes may also be laterally discontinuous over short distances (in occurrence, composition and degree of development/ cementation).

Brink (1979) notes that a collapsible fabric has been suspected in some powder and nodular calcrete and cemented soils. Small scale karst structures and evidence of small sinkholes have also been observed in weathered calcretes.

Hard excavation conditions are expected in well developed, cemented, calcretes.

Calcrete may be used for wearing course and all layers within the road prism for unpaved roads.

7 PRELIMINARY GEOLOGICAL & GEOTECHNICAL IMPACT ASSESSMENT

From a geological / geotechnical perspective, no fatal flaws have been identified that would prevent the construction of the proposed development at this site.

Further intrusive investigation is recommended for detailed design purposes.

7.1 Impact of the Project on the Geological Environment

The impact of the project alternatives on the geological environment will predominantly relate to the impact that the development will have on the soils / rock units beneath the site. Various outcrops/ boulders have been noted across the sites generally associated with ridges. Removal of the boulders (during site clearing) and construction on hilltops and ridge tops, may have a negative (aesthetic / visual) impact on the environment (besides increasing the cost of site preparation in these areas). It is assumed that a visual impact will be undertaken by others.

Both vertebrate and invertebrate fossils have also been found in the Beaufort Group of the Karoo Supergroup. Reptiles, mammal-like reptile (therapsid), amphibian, fish, insect and plant fossils have been discovered (Johnson, 2006). Excavation into the rock and removal of the material will potentially result in damage/destruction of the fossils. The locations of the fossils will have to be determined during an archaeological / palaeontological investigation.

The main potential impact of the project on the geological environment will be the increased ***potential for soil erosion***, caused by the removal of vegetation and the construction activities. Removal of vegetation for terrace preparation and compaction during earthworks will reduce the infiltration of rainwater and therefore increase surface runoff. An increase in runoff will lead to an increase in erosion. Potential impacts of the project on the soils are provided in Sections 7.2 to 7.4 below. The proposed duration of the construction phase was not provided at the time that this report was compiled. For the purpose of the assessment, a construction duration of 1 year was assumed. Please note that the impact rating will change should the construction duration increase. A description of the weighting system and description of terms used is attached in Annexure A.

7.2 Mooi Plaats PV Facility and Grid Infrastructure

The impact of the Mooi Plaats PV facility on the general environment was found to be ***"Low"***. The scoring was based on SiVEST guidelines / format for assessing the sites and grid infrastructure:

- "Updated Environmental Impact Assessment Methodology_Ver1 - 2019 SJ"

Areas with steep slopes associated with slope instability and surface bedrock / boulders associated with ridges, where construction will be difficult, have been outlined in red in Figure 6.

It is our professional opinion that the Mooi Plaats PV Facility project may go ahead, if all mitigation measures given in this report are implemented.

Table 2: MOOI PLAATS SOLAR PV FACILITY & INFRASTRUCTURE IMPACT RATING TABLE

MOOI PLAATS SOLAR PV FACILITY																						
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION										
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		
Construction Phase																						
Soils	Soil disturbance during construction at the PV Facility may destabilise the soil and lead to soil erosion. - Increased soil erosion / runoff due to clearing of vegetation - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	- Use of berms and drainage channels to direct water away from the construction areas where necessary - Minimise earthworks and levelling - Use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible after construction - Correct engineering design of stream and water course crossings - Correct engineering design of any new access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low		
Operational Phase																						
Soils	Increased soil erosion / runoff due to clearing of vegetation and alteration of natural drainage (paved areas) - There may be spillages (petroleum/lubricants) from the vehicles	1	2	1	1	1	1	6	-	Low	- Use existing access roads wherever possible - Correct engineering design of stream and water course crossings - Correct engineering design of access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low		
Decommissioning Phase																						
Soils	Soil disturbance during decommissioning/deconstruction at the PV Facility may destabilise the soil and lead to soil erosion. - Contamination of soil due to chemical spillages from equipment - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	Use of berms and drainage channels to direct water away from the decommissioning/deconstruction areas where necessary - Minimise earthworks and levelling - use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible - Add as much natural vegetation back as possible - Try reinstate natural drainage patterns - Have chemical spill kits on site and remove all spill material when decommissioning any substations. - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low		
Cumulative																						
Soils	No cumulative effect							0			No cumulative effect							0				

Table 3: MOOI PLAATS GRID CONNECTION IMPACT RATING TABLE

MOOI PLAATS GRID CONNECTION INFRASTRUCTURE																			
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																				
Soils	Soil disturbance during construction at the PV Facility may destabilise the soil and lead to soil erosion. - Increased soil erosion / runoff due to clearing of vegetation - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	- Use of berms and drainage channels to direct water away from the construction areas where necessary - Minimise earthworks and levelling - Use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible after construction - Correct engineering design of stream and water course crossings - Correct engineering design of any new access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Operational Phase																				
Soils	Increased soil erosion / runoff due to clearing of vegetation and alteration of natural drainage (paved areas) - There may be spillages (petroleum/lubricants) from the vehicles	1	2	1	1	1	1	6	-	Low	- Use existing access roads wherever possible - Correct engineering design of stream and water course crossings - Correct engineering design of access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Decommissioning Phase																				
Soils	Soil disturbance during decommissioning/deconstruction at the PV Facility may destabilise the soil and lead to soil erosion. - Contamination of soil due to chemical spillages from equipment - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	Use of berms and drainage channels to direct water away from the decommissioning/deconstruction areas where necessary - Minimise earthworks and levelling - use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible - Add as much natural vegetation back as possible - Try reinstate natural drainage patterns - Have chemical spill kits on site and remove all spill material when decommissioning any substations. - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Cumulative																				
Soils	No cumulative effect							0			No cumulative effect							0		

7.3 Wonderheuvel PV Facility and Grid Infrastructure

The impact of the Wonderheuvel PV facility and Grid Infrastructure on the general environment was found to be ***"Low"***. The scoring was based on SiVEST guidelines / format for assessing the sites and grid infrastructure:

- "Updated Environmental Impact Assessment Methodology_Ver1 - 2019 SJ"

Areas with steep slopes associated with slope instability and surface bedrock / boulders associated with ridges, where construction will be difficult, have been outlined in red in Figure 7.

It is our professional opinion that the Wonderheuvel PV Facility and Grid Infrastructure project may go ahead, if all mitigation measures given in this report are implemented.

Table 4: WONDERHEUVEL SOLAR PV FACILITY IMPACT RATING TABLE

Table 4: WONDERHEUVEL SOLAR PV FACILITY & INFRASTRUCTURE IMPACT RATING TABLE																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+	S		E	P	R	L	D	I / M	TOTAL	STATUS (+	S
Construction Phase																				
Soils	Soil disturbance during construction at the PV Facility may destabilise the soil and lead to soil erosion. - Increased soil erosion / runoff due to clearing of vegetation - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	- Use of berms and drainage channels to direct water away from the construction areas where necessary - Minimise earthworks and levelling - Use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible after construction - Correct engineering design of stream and water course crossings - Correct engineering design of any new access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Operational Phase																				
Soils	Increased soil erosion / runoff due to clearing of vegetation and alteration of natural drainage (paved areas) - There may be spillages (petroleum/lubricants) from the vehicles	1	2	1	1	1	1	6	-	Low	- Use existing access roads wherever possible - Correct engineering design of stream and water course crossings - Correct engineering design of access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Decommissioning Phase																				
Soils	Soil disturbance during decommissioning/deconstruction at the PV Facility may destabilise the soil and lead to soil erosion. - Contamination of soil due to chemical spillages from equipment - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	Use of berms and drainage channels to direct water away from the decommissioning/deconstruction areas where necessary - Minimise earthworks and levelling - use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible - Add as much natural vegetation back as possible - Try reinstate natural drainage patterns - Have chemical spill kits on site and remove all spill material when decommissioning any substations. - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Cumulative																				
Soils	No cumulative effect							0			No cumulative effect							0		

Table 5: WONDERHEUVEL GRID CONNECTION IMPACT RATING TABLE

Table 5: WONDERHEUVEL GRID CONNECTION INFRASTRUCTURE IMPACT RATING TABLE																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Soils	Soil disturbance during construction at the PV Facility may destabilise the soil and lead to soil erosion. - Increased soil erosion / runoff due to clearing of vegetation - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	- Use of berms and drainage channels to direct water away from the construction areas where necessary - Minimise earthworks and levelling - Use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible after construction - Correct engineering design of stream and water course crossings - Correct engineering design of any new access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Operational Phase																				
Soils	Increased soil erosion / runoff due to clearing of vegetation and alteration of natural drainage (paved areas) - There may be spillages (petroleum/lubricants) from the vehicles	1	2	1	1	1	1	6	-	Low	- Use existing access roads wherever possible - Correct engineering design of stream and water course crossings - Correct engineering design of access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Decommissioning Phase																				
Soils	Soil disturbance during decommissioning/deconstruction at the PV Facility may destabilise the soil and lead to soil erosion. - Contamination of soil due to chemical spillages from equipment - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	Use of berms and drainage channels to direct water away from the decommissioning/deconstruction areas where necessary - Minimise earthworks and levelling - use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible - Add as much natural vegetation back as possible - Try reinstate natural drainage patterns - Have chemical spill kits on site and remove all spill material when decommissioning any substations. - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Cumulative																				
Soils	No cumulative effect							0			No cumulative effect							0		

7.4 Paarde Valley PV Facility and Grid Infrastructure

The impact of the Paarde Valley PV facility and Grid Infrastructure on the general environment was found to be ***"Low"***. The scoring was based on SiVEST guidelines / format for assessing the sites and grid infrastructure:

- "Updated Environmental Impact Assessment Methodology_Ver1 - 2019 SJ"

Areas with steep slopes associated with slope instability and surface bedrock / boulders associated with ridges, where construction will be difficult, have been outlined in red in Figure 8.

It is our professional opinion that the Paarde Valley PV Facility project may go ahead, if all mitigation measures given in this report are implemented.

The grid options are discussed separately in Section 9.

Table 6: PAARDE VALLEY SOLAR PV FACILITY IMPACT RATING TABLE

Table 6: PAARDE VALLEY SOLAR PV FACILITY & INFRASTRUCTURE IMPACT RATING TABLE																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ O	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ O	S
Construction Phase																				
Soils	Soil disturbance during construction at the PV Facility may destabilise the soil and lead to soil erosion. - Increased soil erosion / runoff due to clearing of vegetation - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	- Use of berms and drainage channels to direct water away from the construction areas where necessary - Minimise earthworks and levelling - Use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible after construction - Correct engineering design of stream and water course crossings - Correct engineering design of any new access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Operational Phase																				
Soils	Increased soil erosion / runoff due to clearing of vegetation and alteration of natural drainage (paved areas) - There may be spillages (petroleum/lubricants) from the vehicles	1	2	1	1	1	1	6	-	Low	- Use existing access roads wherever possible - Correct engineering design of stream and water course crossings - Correct engineering design of access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Decommissioning Phase																				
Soils	Soil disturbance during decommissioning/deconstruction at the PV Facility may destabilise the soil and lead to soil erosion. - Contamination of soil due to chemical spillages from equipment - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	Use of berms and drainage channels to direct water away from the decommissioning/deconstruction areas where necessary - Minimise earthworks and levelling - use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible - Add as much natural vegetation back as possible - Try reinstate natural drainage patterns - Have chemical spill kits on site and remove all spill material when decommissioning any substations. - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Cumulative																				
Soils	No cumulative effect							0			No cumulative effect							0		

Table 7: PAARDE GRID CONNECTION INFRASTRUCTURE IMPACT RATING TABLE

Table 7: PAARDE VALLEY GRID CONNECTION INFRASTRUCTURE																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ O**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ O**	**S**
Construction Phase																				
Soils	Soil disturbance during construction at the PV Facility may destabilise the soil and lead to soil erosion. - Increased soil erosion / runoff due to clearing of vegetation - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	- Use of berms and drainage channels to direct water away from the construction areas where necessary - Minimise earthworks and levelling - Use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible after construction - Correct engineering design of stream and water course crossings - Correct engineering design of any new access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Operational Phase																				
Soils	Increased soil erosion / runoff due to clearing of vegetation and alteration of natural drainage (paved areas) - There may be spillages (petroleum/lubricants) from the vehicles	1	2	1	1	1	1	6	-	Low	- Use existing access roads wherever possible - Correct engineering design of stream and water course crossings - Correct engineering design of access roads - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Implement groundcover measures to prevent erosion such as keeping as much natural vegetation as possible, straw mulch, erosion control mats etc. - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Decommissioning Phase																				
Soils	Soil disturbance during decommissioning/deconstruction at the PV Facility may destabilise the soil and lead to soil erosion. - Contamination of soil due to chemical spillages from equipment - Construction and use of access roads by heavy duty vehicles and construction equipment may destabilise the soil and lead to soil erosion. - There may be spillages (petroleum/lubricants) from the vehicles - There may be siltation of watercourses due to increased runoff and dust	1	4	2	1	1	1	9	-	Low	Use of berms and drainage channels to direct water away from the decommissioning/deconstruction areas where necessary - Minimise earthworks and levelling - use existing access roads wherever possible - Rehabilitate disturbed areas as soon as possible - Add as much natural vegetation back as possible - Try reinstate natural drainage patterns - Have chemical spill kits on site and remove all spill material when decommissioning any substations. - Maintain vehicles and only undertake repairs and maintenance work in designated areas - Contain and control stormwater flow	1	2	1	1	1	1	6	-	Low
Cumulative																				
Soils	No cumulative effect							0			No cumulative effect							0		

8 COMPARATIVE ASSESSMENT OF ALTERNATIVES GRID CONNECTIONS

A comparative assessment of the PV Infrastructure Alternatives as well as alternative grid connections is given in Tables 8 and 9 below.

Construction over mountainous and steep/hilly areas has a higher risk of causing erosion than construction over flatter areas (roads in steep areas are more prone to erosion and require longer routes to be constructed, not just straight roads along the route). Longer routes will have a greater impact on the soils, as there will be a greater area affected by the construction activities, greater distance for vehicles to travel, etc.

Construction on, or in close proximity to mountainous and steep/hilly areas, has a higher risk of slope instability. Loose/unstable talus deposits are expected to be present in these areas. Mitigation measures, to allow construction in these areas, will increase the construction costs.

Therefore, from a geological and geotechnical perspective the following corridor options are preferred:

- Mooi Plaats PV Facility – Option1
- Wonderheuven PV Facility – Options 2 and 3
- Paarde Valley PV Facility – Option 1

Table8: PV Infrastructure Alternatives (Laydown Areas & O&M Buildings); Power Line Corridors and Associated Substations)

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	**Preference**	**Reasons (incl. potential issues)**
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	No preference	The geology is the same at all 6 site options: mudrock and sandstone of Adelaide Formation. Hence there is no preference.
Laydown Area and O&M Building Site Option 2	No preference	
Laydown Area and O&M Building Site Option 3	No preference	

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 4	No preference	
Laydown Area and O&M Building Site Option 5	No preference	
Laydown Area and O&M Building Site Option 6	No preference	
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	Favourable	The geology is comprised of quaternary unconsolidated sands; sands could be of significant thickness and founding conditions could be adverse.
Laydown Area and O&M Building Site Option 2	Favourable	The geology is comprised of quaternary unconsolidated sands; sands could be of significant thickness and founding conditions could be adverse.
Laydown Area and O&M Building Site Option 3	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation
Laydown Area and O&M Building Site Option 4	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation
Laydown Area and O&M Building Site Option 5	Favourable	The geology is comprised of quaternary unconsolidated sands; sands could be of significant thickness and founding conditions could be adverse.
Laydown Area and O&M Building Site Option 6	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation
Laydown Area and O&M Building Site Option 7	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation
Laydown Area and O&M Building Site Option 8	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	Favourable	The geology is comprised of quaternary unconsolidated sands; sands could be of significant thickness and founding conditions could be adverse.

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 2	Favourable	The geology is comprised of Jurassic age dolerite; it appears that this Site Option 2 is close or at a contact with the sedimentary rock of Adelaide Formation. Founding problems may arise.
Laydown Area and O&M Building Site Option 3	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation
Laydown Area and O&M Building Site Option 4	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation
Laydown Area and O&M Building Site Option 5	Favourable	The geology is comprised of quaternary unconsolidated sands; sands could be of significant thickness and founding conditions could be adverse.
Laydown Area and O&M Building Site Option 6	Preferred	The geology is comprised of Jurasic age dolerite
Laydown Area and O&M Building Site Option 7	Preferred	The geology is comprised of Jurasic age dolerite
Laydown Area and O&M Building Site Option 8	Favourable	The geology is comprised of quaternary unconsolidated sands; sands could be of significant thickness and founding conditions could be adverse.
Laydown Area and O&M Building Site Option 9	Preferred	The geology is comprised of mudrock and sandstone of Adelaide Formation

Table 9: Grid Connection Infrastructure Alternatives (Power Line Corridors and Associated Substations)

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	Preferred	Shorter Route Both routes, Option 1a and 1b, underlain by similar bedrock Both routes traverse drainage features/small rivers From an engineering perspective, both options will have similar founding conditions Smaller section of this route traverses near / over mountainous / hilly topography in the north west region of the corridors. Therefore, the corridor Option 1 has less risk of slope instability, possibly less talus deposits, less chance of soil erosion, possibly lower construction cost.
Grid Connection Option 1b	Preferred	Shorter Route Both routes, Option 1a and 1b, underlain by similar bedrock Both routes traverse drainage features/small rivers From an engineering perspective, both options will have similar founding conditions Smaller section of this route traverses near / over mountainous / hilly topography in the north west region of the corridors. Therefore, the corridor Option 1 has less risk of slope instability, possibly less talus deposits, less chance of soil

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		erosion, possibly lower construction cost.
Grid Connection Option 2a	Favourable	Longer Route Both routes, Options 2a and 2b, underlain by similar bedrock Both routes traverse drainage features/small rivers From an engineering perspective, both options will have similar founding conditions Therefore, the corridor option has more risk of slope instability, possibly more talus deposits, higher chance of soil erosion, possibly higher construction cost.
Grid Connection Option 2b	Favourable	Longer Route Both routes, Options 2a and 2b, underlain by similar bedrock Both routes traverse drainage features/small rivers From an engineering perspective, both options will have similar founding conditions Therefore, the corridor option has more risk of slope instability, possibly more talus deposits, higher chance of soil erosion, possibly higher construction cost.
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	Favourable	Two separate grid connection All options (Options 1a, 1b, 1c and 1d) underlain by similar bedrock All routes traverse drainage features / small rivers

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		From an engineering perspective, all options will have similar founding conditions This route traverses more mountainous / hilly topography than corridor Options 2 and 3. Therefore, the corridor Option 1 has more risk of slope instability, possibly more talus deposits, higher chance of soil erosion, possibly higher construction cost.
Grid Connection Option 1b	Favourable	Two separate grid connection All options (Options 1a, 1b, 1c and 1d) underlain by similar bedrock All routes traverse drainage features / small rivers From an engineering perspective, all options will have similar founding conditions This route traverses more mountainous / hilly topography than corridor Options 2 and 3. Therefore, the corridor Option 1 has more risk of slope instability, possibly more talus deposits, higher chance of soil erosion, possibly higher construction cost.
Grid Connection Option 1c	Favourable	Two separate grid connection All options (Options 1a, 1b, 1c and 1d) underlain by similar bedrock All routes traverse drainage features / small rivers From an engineering perspective, all options will have similar founding conditions

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		This route traverses more mountainous / hilly topography than corridor Options 2 and 3. Therefore, the corridor Option 1 has more risk of slope instability, possibly more talus deposits, higher chance of soil erosion, possibly higher construction cost.
Grid Connection Option 1d	Favourable	Two separate grid connection All options (Options 1a, 1b, 1c and 1d) underlain by similar bedrock All routes traverse drainage features / small rivers From an engineering perspective, all options will have similar founding conditions This route traverses more mountainous / hilly topography than corridor Options 2 and 3. Therefore, the corridor Option 1 has more risk of slope instability, possibly more talus deposits, higher chance of soil erosion, possibly higher construction cost.
Grid Connection Option 2a	Preferred	Shorter route; similar impacts for Options 2a and 2b. Both options are underlain by similar bedrock Both routes traverse drainage features / small rivers From an engineering perspective, both options will have similar founding conditions Smaller section of this route traverses near / over more mountainous / hilly topography than corridor Option 1.

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		Therefore, the corridor Option 2 has less risk of slope instability, possibly less talus deposits, less chance of soil erosion, possibly lower construction cost.
Grid Connection Option 2b	Preferred	Shorter route; similar impacts for Options 2a and 2b. Both options are underlain by similar bedrock Both routes traverse drainage features / small rivers From an engineering perspective, both options will have similar founding conditions Smaller section of this route traverses near / over more mountainous / hilly topography than corridor Option 1. Therefore, the corridor Option 2 has less risk of slope instability, possibly less talus deposits, less chance of soil erosion, possibly lower construction cost.
Grid Connection Option 3	Preferred	Slightly longer route than Option 2. Route traverses by similar bedrock as Option 2 It traverses drainage features / small rivers From an engineering perspective, this option will have similar founding conditions Smaller section of this route traverses near / over more mountainous / hilly topography than corridor Option 1. Therefore, the corridor Option 3 has less risk of slope instability, possibly less talus deposits, less chance of soil

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		erosion, possibly lower construction cost.
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	Preferred	Shorter Route Both options, Option 1a and 1b, are underlain by similar bedrock Both routes traverse drainage features / small rivers From an engineering perspective, both options will have similar founding conditions From an engineering perspective, all options will have similar founding conditions
Grid Connection Option 1b	Preferred	Shorter Route Both options, Option 1a and 1b, are underlain by similar bedrock Both routes traverse drainage features / small rivers From an engineering perspective, both options will have similar founding conditions From an engineering perspective, all options will have similar founding conditions
Grid Connection Option 1c	Preferred	Slightly longer route. Both options, Option 1c and 1d, are underlain by similar bedrock Both routes traverse drainage features / small rivers From an engineering perspective, both options will have similar founding conditions From an engineering perspective, all options will have similar founding conditions

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
Grid Connection Option 1d	Preferred	Slightly longer route. Both options, Option 1c and 1d, are underlain by similar bedrock Both routes traverse drainage features / small rivers From an engineering perspective, both options will have similar founding conditions
Grid Connection Option 2a	Favourable	Longer route All options, Option 2a, 2b, 2c and 2d are underlain by similar bedrock all routes traverse drainage features / small rivers From an engineering perspective, all options will have similar founding conditions
Grid Connection Option 2b	Favourable	Longer route All options, Option 2a, 2b, 2c and 2d are underlain by similar bedrock all routes traverse drainage features / small rivers From an engineering perspective, all options will have similar founding conditions
Grid Connection Option 2c	Favourable	Longer route All options, Option 2a, 2b, 2c and 2d are underlain by similar bedrock all routes traverse drainage features / small rivers From an engineering perspective, all options will have similar founding conditions
Grid Connection Option 2d	Favourable	Longer route All options, Option 2a, 2b, 2c and 2d are underlain by similar bedrock

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		all routes traverse drainage features / small rivers From an engineering perspective, all options will have similar founding conditions

9 CONCLUSIONS

The desktop geotechnical assessment did not identify any fatal flaws that, from a geological and geotechnical perspective, would prevent the construction of the proposed Usombomvu PV Energy Facilities.

The potential impacts the project may have on the geology, relate to soils that could be impacted by the construction activities. There may be a potential for soil erosion, due to removal of vegetation and exposure of the soils to the elements, during construction. The impacts were found to be of "***negative low impact***".

Various corridor options were studied for each PV facility. While all options are considered suitable for development, the following options were found to be preferable from a geological and geotechnical perspective:

- Mooi Plaats PV Facility – Grid Option 1
- Wonderheuven PV Facility – Grid Option 2 and 3
- Paarde Valley PV Facility – Grid Option 1

The geological impacts will be similar.

Due the very similar bedrock geology, similar geotechnical conditions are expected across all options.

From a geological and geotechnical perspective, based on the minimal negative impacts on the geology and soils and the recommendations for mitigation measures, it is recommended that the **Usombomvu PV Energy Facilities** project receives the go ahead from the Competent Authority.

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10 REFERENCES

1. Brink, A.B.A. (1983). *Engineering Geology of South Africa Volume 1-4*. Building Publications Pretoria.
2. Johnson, C.R., Anhaeusser, C.R. and Thomas, R.J. (2006). *The Geology of South Africa*. Council for Geoscience.

Annexure A: Impact Assessment Methodology

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

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 total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
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 (P)		
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).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter 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 (L)		
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.

DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects 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 and its effects 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 – 50 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 transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
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 (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		

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. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

Significance = (Extent + probability + reversibility + irreplaceability + duration) 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
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	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".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.

Table 2: Rating of impacts template and example

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Vegetation and protected plant species	Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species.	2	4	2	2	3	3	39	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	4	2	1	3	2	24	-	Low
Operational Phase																				

Fauna	Fauna will be negatively affected by the operation of the wind farm due to the human disturbance, the presence of vehicles on the site and possibly by noise generated by the wind turbines as well.	2	3	2	1	4	3	36	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	4	2	22	-	Low
Decommissioning Phase																				
Fauna	Fauna will be negatively affected by the decommissioning of the wind farm due to the human disturbance, the presence and operation of vehicles and heavy machinery on the site and the noise generated.	2	3	2	1	2	3	30	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	2	2	18	-	Low

Cumulative

Broad-scale ecological processes	Transformation and presence of the facility will contribute to cumulative habitat loss and impacts on broad-scale ecological processes such as fragmentation.	2	4	2	2	3	2	26	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	3	2	1	3	2	22	-	Low

Annexure B: Specialist's Curriculum Vitae

CECILIA CANAHAI

Profession	*Engineering Geologist / Scientist*
Position in Firm	*Technical Director*
Area of Specialisation	*Geotechnical, Environmental, Waste Management*
Qualifications	*Pr.Sci.Nat., MSc (Eng Geol), BSc (Eng Geology)*
Years of Experience	*31 Years*
Years with Firm	*20 Years*

SUMMARY OF EXPERIENCE

Cecilia Canahai gained her first site experience working as a site geologist for oil and gas exploration, in Romania, in 1988. She completed drilling supervision, sampling, gas chromatography, borehole logging and interpretation, report writing and made recommendations for drilling parameters.

Cecilia joined Moore Spence Jones (Pty) Ltd in 1997 as an engineering geologist, where she completed numerous geotechnical investigations for township and industrial development, sports facility developments, private residential properties and pipeline investigations. She has completed slope stability analyses with recommendations for rehabilitation. Other aspects of her experience include dam and tunnel geotechnical investigations. She acquired her first experience as an environmentalist while carrying out groundwater pollution monitoring, at SAPREF.

All projects have included fieldwork, on site testing, site supervision of works, material sampling, interpretation of laboratory results, client liaison, and reporting.

Cecilia joined JG Afrika (Pty) Ltd in 1999 as an environmentalist / engineering geologist.

As an engineering geologist she has worked on various projects, inter alia, geotechnical investigations for rural water supply schemes, housing developments, roads investigations, materials investigations, lateral support design and geotechnical investigations for dams and tunnels.

As an environmental practitioner she has successfully completed numerous Environmental Impact Assessment Scoping and EIA reports, Solid Waste Management, Environmental Management Programme Reports and Closure Reports for various mines/ borrow pits and Environmental Audits. She was also involved in other aspects of the environmental field such as scoping and public participation, impact assessment, mitigation and monitoring and preparation of environmental management plans (EMP).

Cecilia was the Pietermaritzburg Branch Quality System Manager, involved in the maintaining the office' quality standard in terms of ISO 9001 (JG Afrika is ISO 9001 certified) between 2002 and 2007, when work commitments required her to hand over this particular task to someone else.

Cecilia became a shareholder in 2010 and a partner in 2012. Since 2010 her duties are business development and marketing in the fields of engineering geology geotechnical engineering; waste management; environmental science, aquatic health and water resources management, as well as managing various multi- disciplinary projects.

SIKHULISA SONKE

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

Pr.Sci.Nat. - Registered with the South African Council for Natural Scientific Professions - Registration No 400011/00: Environmental Science & Geological Science

SAIEG - Member of the South African Institute for Engineering and Environmental Geologists - Membership No 03/211

IAIA - Member of the International Association of Impact Assessment; Membership No 1686

EDUCATION

1983 – Certificate of Baccalaureate – Pitesti, Romania
1987 – BSc (Hons) (Eng Geol) – University of Bucharest, Romania
1988 – MSc (Eng Geol) – University of Bucharest, Romania

SPECIFIC EXPERIENCE

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)

2010 - 2019
Position – Technical Director

Sicello Bulk Water Main: EIA & EMPR for water main al Sicello

Kumba Iron Ore Biomonitoring Programme for aquatic health

Kriel Power Station – Geotechnical Investigation for ash dam complex stability and stability monitoring for a period of 11 months

New Ash Facility at Tutuka Power Station for Eskom detail design for water return dams and appurtenant structure and infrastructure as part of an ADF team

New Ash Facility at Kusile Power Station for Eskom detail design for water return dams and appurtenant structure and infrastructure as part of an ADF team

Camden New Ash Dam Facility detail design, encompassing geotechnical investigation for the new ADF, water return dams and appurtenant structure and infrastructure

New Ash Facility at Kendal Power Station for Eskom

Hendrina Step-In and Go-Higher Ash Dam Facility detail design, encompassing geotechnical investigation for the extension of the existing ADF

Mathjabeng Solar Park

Atlas Substation EIA for Closure and Risk Assessment and Due Diligence

Gauteng Department of Roads and Transportation: Environmental assessment for 15 Intersection upgrades

Geotechnical Investigation in support of the Feasibility Study for a **5 GW power Solar Park** in the Northern Cape Province of South Africa (presidential project)

Feasibility Study for the potential sources of water for the **Tikwa Wind Farm**

N11 Sections 6 & 7 Borrow Pit Closure

Various **Water Use Licence Applications**

Basic Assessment for the installation of **Fibre Optic Cable between Aliwal North and George**

Baseline study for Eskom WTW and WWTW for readiness for Blue Drop / Green Drop Certification

Basic Assessment for the installation of **Fibre Optic Cable between Johannesburg and Cape Town**

Various Geotechnical Investigations for Rand Water Pipelines

Various **Environmental Basic Assessments** for Rand Water Pipelines

Various **Geotechnical Investigations** for various Eskom towers (3 year Contract)

2009 – 2010
Position –Executive Associate

N4 Rustenburg to Swartruggens: Geotechnical investigation for N4 road rehabilitation

Pikitup OSH Legal Audits

Dumbe Coalline Geotechnical investigation for Transnet (stability of proposed cuttings)

Various **Geotechnical Investigations** for Rand Water Pipelines

Various **Environmental Basic Assessments** for Rand Water Pipelines

Various **Geotechnical Investigations** for various Eskom towers (3 year Contract)

Basic Assessment for the installation of **Fibre Optic Cable** between Pretoria and Rustenburg

Materials recovery facility in **Ekandustria Waste Licence Application** and Basic assessment

2008 – 2009
Position – Associate

Pikitup Environmental Compliance

Rand Water G25 Pipeline Basic Assessment study downgraded to and Environmental Management Plan; Saved the Client R100 000,00 in fees.

Pikitup Garden sites and Depot sites Application for Waste Licences & Basic Assessment studies

Pretoria North Modal Interchange: full Environmental Impact Assessment for intermodal facility

N11 Section 4: Environmental services for obtaining Authorization for road rehabilitation and borrow pits

Various Geotechnical Investigations for Eskom towers (3 year Contract)

N6: Environmental services and Applications for Borrow Pits Closures

N12 Section 12: Environmental Auditing for road construction

2007 – 2008
Position – Associate

N6 Section 8 Closure Documentation for quarry and borrow pits for Road Rehabilitation

Lesotho Lowlands Water Supply Scheme: Geotechnical Investigation

Lusikisiki Police Station Geotechnical Investigation

Toscana Ridge Geotechnical Investigation for Housing development

Phinda Game Reserve: Geotechnical investigation for Housing development

Lusikisiki Police Station: Geotechnical Investigation.

Pretoria North Station Modal Interchange: full Environmental Impact Assessment for various road realignments, modal interchange and railway refurbishment in Pretoria.

N1 Section 14: Full Environmental Impact Assessment for the N1 rehabilitation.

Mt Ayliff & Mt Frere Access Roads – Environmental services for obtaining authorization from DEAET and DME for 12 access roads and associated borrow pits.

N2 Pongola Borrow pits: Application for borrow pits Closure

N2 Section 32: environmental services for obtaining Authorization for road rehabilitation and borrow pits

Umzimkhulu Municipality: Various environmental services for the upgrade of roads in Umzimkhulu

Environmental Management Plan for the rehabilitation of Dorpspruit River, Pietermaritzburg

Kwamashu Police Station Basic Assessment Report

2006 – 2007
Position – Associate

Elliottdale Landfill Site Classification and Permitting

Impendle Housing Development (1500 units): Geotechnical Investigation.

Lesotho Lowlands Bulk Water Supply Scheme: Geotechnical Investigation

Environmental Impact Assessment for various access roads in the Mt Frere and Mt Ayliff areas for the Umzimvubu Municipality.

Bubu Access Road : Geotechnical and materials investigation

Erf 3 Bishopstowe: Geotechnical Investigation for housing development

Willowton Proposed Shopping Centre: Geotechnical Investigation

Black Umfolozi River Bridge: Basic Assessment for environmental authorization

Mtwalume River sand mining Environmental Management Plan

Vulindlela Access Road: Environmental Management Plan for construction

Inhlazuka CWSS Environmental Management Plan for construction

Ladysmith Development: Preliminary Geotechnical & Environmental assessments

Black Umfolozi River Bridge - Basic Assessment Report as per NEMA Regulations 386.

Erf 3 Bishopstowe Geotechnical investigation for housing development

Vulindlela Access Roads – Environmental services for road rehabilitation.

2005 – 2006
Position – Engineering & Environmental Geologist

Closure of Landfill Site Hluhluwe & Identification of new Landfill Site to replace the old Landfill Site

N11 Sections 6 and 7 Borrow Pits and Quarry Permitting: environmental services (EIA & EMPR's) 10 borrow pits and one quarry

N12 Section 12 Borrow Pits & Quarry Permitting: environmental services (EIA & EMPR's) for 8 borrow pits and one quarry

Impendle Community Water Supply Schemes – Environmental services for obtaining authorization from DAEA for the construction of a community pipeline and associated structures.

Masomonco Community Water Supply Scheme - Environmental services for obtaining authorization from DAEA for the construction of a community pipeline and associated structure.

KwaNovuka Community Water Supply Scheme - Environmental services for obtaining authorization from DAEA for the construction of a community pipeline and associated structure.

Umtshezi Municipality Land Use Management System – Broad Environmental Scan

Vryheid Housing Development – Geotechnical Investigation

Illovo River Mining Right – environmental services for a sand mining operation on the Illovo River

Kwa Gqugquma Community Water Supply Scheme - Environmental services for obtaining authorization from DAEA for the construction of a community pipeline and associated structure.

2004 – 2005
Position – Engineering & Environmental Geologist

Georgedale development – environmental services for sand mining

God's Haven Housing Development – Geotechnical Investigation

Kwa Senge Clinic – Geotechnical Investigation

Umdoni Municipality Cemetery – Geotechnical & Environmental Assessments

N6 Borrow Pits and Quarry Permitting: environmental services (EIA & EMPR's) 10 borrow pits and one quarry

Umkomaas River Mining Right – environmental services for sand mining operations on the Umkomaas River

Umkomaas River Footbridge – Geotechnical Investigation

Marburg Prison – Geotechnical Investigation

Enkanyezini Community Water Supply Scheme - Environmental services for obtaining authorization from DAEA for the construction of a community pipeline and associated structures.

Shemula Community Water Supply Scheme - Environmental services for obtaining authorization from DAEA for the construction of a community pipeline and associated structures.

Mtwalume River Mining Permit – environmental services for sand mining operation on the Mtwalume River.

Umzimkulu River Mining Right – environmental services for sand mining operations on the Umzimkulu River

Umvoti River Mining Rights and Permits – environmental services for various sand mining operations on the Umvoti River

N2 Pongola quarry – Geotechnical Investigation

Rugged Glen - Environmental services for upgrading and construction of new structures.

2003 – 2004
Position – Engineering & Environmental Geologist

Kwa Mpande Geotechnical Investigation for school

St Ives Environmental Scoping for tourism development on the Midlands Meander

Ladysmith Petrol Station – Geotechnical Investigation and Scoping report

Kwa Ngwanase Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Kwa Ngwanase Community Water Supply Scheme Environmental Scoping for proposed pipeline and associated structures.

Emkhuzeni & Mhlangana Community Water Supply Schemes – Geotechnical investigation for pipelines and associated structures.

Emkhuzeni & Mhlangana Community Water Supply Schemes Environmental Scoping for proposed pipelines and associated structures.

Inanda Dam Mining Permit – environmental services for a sand mining operation on the Inanda Dam.

Mdloti River Mining Conversion of old right to Mining Right.

Edwin Swales – Environmental Managemnt Plan compilation and Auditing.

Estcourt Prison – Geotechnical Investigation

Kombuzi Environmental Management Programme report for mining

Umhlumayo Community Water Supply Scheme – Geotechnical Investigation

2002 – 2003
Position – Engineering & Environmental Geologist

Dumbe Housing Development – Geotechnical Investigation.

Clouds oh Hope – Children's Home – Geotechnical Investigation

C4 Water Pipeline – Johennesburg – Geotechnical Investigation.

Kombuzi Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Hlahlindlela Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Shemula Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Mt Frere rehabilitation of 3 roads – Geotechnical Investigation

Mbono Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Camperdown Spar - Geotechnical Investigation for failed pavement.

Thokoza Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Nqutu Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Taxi Rank at Lusikisiki – Geotechnical Investigation

Kwa Hlope Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

Mbazwane Community Water Supply Scheme – Geotechnical investigation for pipeline and associated structures.

2001 – 2002
Position – Engineering & Environmental Geologist

Amangwe Community Water supply Scheme Enviornmental Scoping for Pipeline and associated structure

Black Umfolozi River Bridge - Basic Assessment Report as per NEMA Regulations 386.

Mt Ayliff & Mt Frere Access Roads – Environmental services for obtaining authorization from DEAET and DME for access roads and associated borrow pits.

Erf 3 Bishopstowe Geotechnical investigation for housing development

2000 – 2001
Position – Engineering & Environmental Geologist

Black Umfolozi River Bridge - Basic Assessment Report as per NEMA Regulations 386.

Mt Ayliff & Mt Frere Access Roads – Environmental services for obtaining authorization from DEAET and DME for access roads and associated borrow pits.

Erf 3 Bishopstowe Geotechnical investigation for housing development

1999 – 2000
Position – Engineering & Environmental Geologist

Nzinga and Langkloof CWSS: Geotechnical Investigation for pipeline and reservoirs, Environmental Scoping: & Environmental Management Programme reports for mining

Mbazwana CWSS: Geotechnical Investigation for pipeline and reservoirs, & Environmental Scoping

Nhlangano to Sicunusa Road: Geotechnical & Materials Investigation

Edendale Hospital New Wing: Geotechnical Investigation

Spandikroon, Dival & Mhlabathini CWSS: Geotechnical Investigations for pipeline and reservoirs, Environmental Scoping: reports

Tugela Estates CWSS: Geotechnical Investigations for pipeline and reservoirs

Debep Quarry Drilling Investigation for materials for road Construction

N2 Road Rehabilitation at Kei River Geotechnical investigation for road rehabilitation

Moore Spence Jones (Pty) Ltd

1998 – 1999
Position – Engineering & Environmental Geologist

Indian Ocean Fertilizers (Richards Bay): Geotechnical Investigation for new plant

Housing Development at Hammarsdale: Geotechnical investigation for foundations, earthworks, suitability of materials for road construction, etc.

Zimbali Housing Development: Geotechnical investigation for foundations, earthworks, suitability of materials for road construction, etc.

Cato Manor: Stability Investigation of platform cuttings

Mpophomeni Housing Development: Geotechnical investigation for foundations, earthworks, suitability of materials for road construction, etc.

Fleetguard Pmb: Geotechnical investigation for warehouse foundations, earthworks, suitability of materials for road construction, etc.

Stukenberg Water Pipeline: Geotechnical investigation for slope stability, pipeline re-routing and tunnel investigation, etc.

Booth Road Housing Development: Geotechnical investigation for foundations, earthworks, suitability of materials for road construction, etc.

1996 – 1998
Position – Engineering & Environmental Geologist

Gateway Development: Geotechnical Investigation for founding conditions, Assessment of waste, Site stability, etc.

Azalea Housing Development Geotechnical investigation for foundations, earthworks, suitability of materials for road construction, etc.

Matatiele Housing Development Geotechnical investigation for foundations, earthworks, suitability of materials for road construction, etc.

Kwa Dabeka Housing Development Geotechnical investigation for foundations, earthworks, suitability of materials for road construction, etc.

Newlands West: Geotechnical Investigation at cracked houses

AECI: Geotechnical Investigation into the stability of the slimes dams at AECI

SAPREF: Groundwater Pollution monitoring

Craiova Drilling Company Romania

1988 – 1992
Position – Site Geologist

Site geologist - Responsible for Drilling supervision at various oil & gas exploration & exploitation boreholes. Main duties included sample and core analysis and description, data logging and interpretation, down-the-hole logging and on site interpretation, gas chromatography and geo-service logging, compilation of reports and recommendations for drilling parameters.

A major project Mrs Canahai was involved in, was the drilling supervision of a 6000 m deep exploration hole. Responsibilities included liaison with design engineers and contractors, gas chromatography and geo-service logging, compilation of reports and recommendations for drilling parameters.

CONTINUED PROFESSIONAL DEVELOPMENT

Courses

2000 - Integrated Environmental Management Course – (University of KwaZulu Natal)
2001 - Environmental Auditing Course - (University of KwaZulu Natal)
2003 - ISO 9001:2000; Registered Internal and Suppliers Auditors Course - (Wynleigh International)
2003 - Waste Management Course – (University of Pretoria)
2005 SHEQMAN Course – (Advance A.C.T.)

2017 Resource Efficiency Cleaner Production - 2-Day End User Training CSIR Pretoria
2018 Energy Management Systems Implementation - End User Training CSIR Pretoria

Published Papers

1988 - "Mineralogical Study of Devonian Deposits of the Hercinic Orogen, Dobrogea", *MSc Thesis*, University of Bucharest (Engineering Geology), 1988.

PERSONAL DETAILS

Nationality – South African
Date of Birth – 1965-03-30
Domicile – Johannesburg, South Africa

Languages
English – Very Good
Romanian – Excellent

Appendix 6F

Social Impact Assessment

PROPOSED UMSOBOMVU SOLAR PV ENERGY FACILITIES AND ASSOCIATED GRID INFRASTRUCTURE PROJECT EASTERN AND NORTHERN CAPE PROVINCES

SOCIAL IMPACT ASSESSMENT
November 2019

Prepared by:

Dr Neville Bews & Associates
SOCIAL IMPACT ASSESSORS

PO Box 145412
Bracken Gardens
1452

Submitted to:

SiVEST

4 Pencarrow Crescent,
La Lucia Ridge Office Estate,
Umhlanga Rocks,
4320

DETAILS OF PROJECT

Report Title	:	Social Impact Assessment Scoping Report for the Umsobomvu Solar PV Facilities and Associated Grid Infrastructure
Author	:	Dr Neville Bews
DEA Reference Number	:	
Project Developer	:	Mooi Plaats Solar Power (Pty) Ltd / Wonderheuvel Solar Power (Pty) Ltd / Paarde Valley Solar Power (Pty) Ltd
Environmental Consultant	:	**SiVEST Environmental Division**
Review Period	:	16 April, 2019 – 12 November, 2019
Status of Report	:	Second Draft Report

EXECUTIVE SUMMARY

INTRODUCTION

Mooi Plaats Solar Power (Pty) Ltd, Wonderheuvel Solar Power (Pty) Ltd , and Paarde Valley Solar Power (Pty) Ltd has proposed the development of three separate solar photovoltaic facilities with associated grid connection infrastructure to be set up under separate Special Purpose Vehicles (SPV) as follows:

- Wonderheuvel Solar PV Facility under Wonderheuvel Solar Power (Pty) Ltd
- Mooi Plaats Solar PV Facility under Mooi Plaats Solar Power (Pty) Ltd
- Paarde Valley Solar PV Facility under Paarde Valley Solar Power (Pty) Ltd.

In this regard SiVEST Environmental Division has been contracted to undertake the environmental impact assessment of the project and in turn has appointed Dr Neville Bews & Associates to undertake the social impact assessment.

APPROACH TO STUDY

Data was gathered by means of the following techniques.

Collection of data

Data was gathered through:

- The project description prepared by the project proponent.
- Statistics South Africa, Census 2011 and other relevant demographic data generated by Stats SA such as the uarterly Labour Force Survey and Mid-year population estimates.
- Discussions with the project proponents and Environmental Impact Assessment Consultants.
- A literature review of various documents such as the relevant Municipal Integrated Development Plans (IDPs) and other specialist reports and documents.
- A broader literature scan.

Impact assessment technique

The assessment technique used to evaluate the social impacts was provided by SiVEST Environmental Division and is attached in Appendix 1.

PROJECT DESCRIPTION

It is proposed that the following three solar photovoltaic (PV) energy facilities, with associated grid connection infrastructure, be developed on the following farm portions:

- ***Mooi Plaats Solar PV Facility***, on an application site of approximately 5 303 ha, comprising the following farm portions:
  - Portion 1 of Leuwe op No 120
  - Remainder of Mooi Plaats No 121.
- ***Wonderheuvel Solar PV Facility***, on an application site of approximately 5 652 ha, comprising the following farm portions:
  - Remainder of Mooi Plaats No 121
  - Portion 3 of Wonder Heuvel No 140
  - Portion 5 of Holle Fountain No 133.
- ***Paarde Valley Solar PV Facility***, on an application site of approximately 2 631 ha, comprising the following farm portion:
  - Portion 2 of Paarde Valley No 62
  - Portion 7 of the Farm Leeuw Hoek No. 61.

Solar PV Components

Mooi Plaats Solar PV Energy Facility:

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **400 MW** and will comprise approximately **1 142 857** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2 m wide and between 1 m and 4 m in height, depending on the mounting type.
- Internal roads, between 4 m and 10 m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4 ha each.

- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1 ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Wonderheuvel Solar PV Energy Facility:

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864 ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **480 MW** and will comprise approximately **1 371 429** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2 m wide and between 1 m and 4 m in height, depending on the mounting type.
- Internal roads, between 4 m and 10 m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4 ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1 ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Paarde Valley Solar PV Energy Facility:

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337 ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **700 MW** and will comprise approximately **2 000 000** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2 m wide and between 1 m and 4 m in height, depending on the mounting type.

- Internal roads, between 4 m and 10 m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4 ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1 ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Grid Connection Infrastructure

The proposed grid connection infrastructure will include the following components:

- New on-site substations and collector substations to serve each solar PV energy facility, each occupying an area of up to approximately 4 ha.
- A new 132 kV overhead power line connecting the on-site substations and/or collector substations to either the Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation, from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage to include both lattice and monopole towers which will be up to 25 m in height.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor between approximately 400 m and 900 m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines. The respective alternatives are as follows:

***Mooi Plaats Solar PV Grid Connection*:**

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400 m and 900 m wide. The alternatives are as follows:

Option 1:

- **Corridor Option 1a -** links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b -** links Substation 2 and Substation 1b to the Hydra D MTS.

Option 2:

- **Corridor Option 2a -** links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

- **Corridor Option 2b -** links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

Wonderheuvel Solar PV Grid Connection:

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

Option 1:

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.

ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

Option 2:

- **Corridor Option 2a -** links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.
- **Corridor Option 2b -** Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector).

Option 3:

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation.

Paarde Valley Solar PV Grid Connection:

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400 m and 900 m wide. The alternatives are as follows:

Option 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).

ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).

ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).

ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).

ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

Option 2:

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.

ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.

ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.

ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

Location

The project is situated across the Northern and Eastern Cape provinces with Mooi Plaats, and Wonderheuvel falling within the Umsobomvu local and Pixley ka Seme district municipalities in the Northern Cape Province. Paarde Valley falls within the Inxuba Yethemba local and Chris Hani district municipalities in the Eastern Cape Province.

IMPACTS IDENTIFIED

The impacts discussed above are assessed below in respect of the following three photovoltaic facilities and their respective associated grid infrastructure:

- Mooi Plaats Solar PV Facility
- Wonderheuvel Solar PV Facility
- Paarde Valley Solar PV Facility.

From a social perspective it makes far more sense to assess each of the solar PV facilities together with their respective associated grid infrastructure based on the following reasons:

1. The solar PV facilities and associated grid infrastructure are interdependent. If the one was not to exist neither would the other. In this sense each is an integral part of the other and cannot function independently.
2. The focus at a social level is far broader than is the case with certain other specialist studies that may have a narrower, project footprint specific emphasis.
   a. For instance, to consider certain aspects such as job creation; the influx of workers; socio-economic stimulation and the transformation of the sense of place in isolation would deter from the actual impact that may occur when considered on a combined basis and in essence would not make logical sense.
3. Any site specific implications associated with the grid infrastructure alternatives can be specifically addressed and mitigated as well as noted when discussing the motivation for selecting the socially preferred grid connection alternatives.

These impacts are assessed in respect of the following phases of the project:

- Planning and design

- Construction
- Operational
- Decommissioning, and
- The ‘no go” option.

Construction phase

Most of the impacts discussed above apply over the short-term to the construction phase of the project and include:

- Annoyance, dust and noise
- Increase in crime
- Increased risk of HIV infections
- Influx of construction workers and job seekers
- Ha ard exposure
- Disruption of daily living patterns
- Disruptions to social and community infrastructure
- ob creation and skills development
- Socio-economic stimulation.

Operational phase

The social impacts that apply to the operational phase of the project are:

- Transformation of the sense of place and
- Economic
    - ob creation and skills development
    - Socio-economic stimulation

Decommissioning

If the project was to be completely decommissioned the major social impacts likely to be associated with this would be the loss of jobs and revenue stream that stimulated the local economy and flowed into the municipal coffers.

‘No Go’ Alternative

The ‘no go’ option would mean that the social environment is not affected as the status quo would remain. On a negative front it would also mean that all the positive aspects associated with the project would not materialise. Considering that Eskom’s coal fired power stations are a huge contributor to carbon emissions the loss of a chance to supplement the National Grid through renewable energy would be significant at a national, if not at a global level.

Cumulative impacts

In this regard the following cumulative impacts are addressed below:

- Risk of HIV
- Sense of place
- Service supplies and infrastructure, and
- The economic benefit.

No fatal flaws associated with the cumulative impacts are evident at a social level. The findings support the recommendations of the various reports undertaken for the different renewable energy projects in the region that, on an overall basis, the social benefits of renewable energy projects outweigh the negative benefits and that the negative social impacts can be mitigated.

COMPARATIVE ASSESSMENT OF LAYOUT ALTERNATIVES

As no social preference emerged in respect of any of the grid connection option the other specialist reports were perused to establish if there was any preference that would have an influence on the social. Based on this analysis the following preferences were identified and supported on a social basis:

PV infrastructure alternatives (laydown areas and O&M buildings)

MOOI PLAATS SOLAR PV FACILITY	
Laydown Area and O&M Building Site Option 1	Preferred
Laydown Area and O&M Building Site Option 2	Preferred
Laydown Area and O&M Building Site Option 3	Preferred
Laydown Area and O&M Building Site Option 4	Least preferred
Laydown Area and O&M Building Site Option 5	Least preferred
Laydown Area and O&M Building Site Option 6	Least preferred
WONDERHEUVEL SOLAR PV FACILITY	
Laydown Area and O&M Building Site Option 1	Preferred
Laydown Area and O&M Building Site Option 2	Preferred
Laydown Area and O&M Building Site Option 3	Preferred
Laydown Area and O&M Building Site Option 4	Preferred
Laydown Area and O&M Building Site Option 5	Least preferred
Laydown Area and O&M Building Site Option 6	Least preferred
Laydown Area and O&M Building Site Option 7	Least preferred
Laydown Area and O&M Building Site Option 8	Least preferred
PAARDE VALLEY SOLAR PV FACILITY	
Laydown Area and O&M Building Site Option 1	Preferred
Laydown Area and O&M Building Site Option 2	Preferred
Laydown Area and O&M Building Site Option 3	Preferred
Laydown Area and O&M Building Site Option 4	Preferred
Laydown Area and O&M Building Site Option 5	Preferred
Laydown Area and O&M Building Site Option 6	Least preferred
Laydown Area and O&M Building Site Option 7	Least preferred
Laydown Area and O&M Building Site Option 8	Least preferred
Laydown Area and O&M Building Site Option 9	Least preferred

Grid Connection Infrastructure Alternatives (Power Line Corridors and Associated Substations)

MOOI PLAATS SOLAR PV FACILITY	
Grid Connection Option 1a	Preferred
Grid Connection Option 1b	Preferred
Grid Connection Option 2a	Favourable
Grid Connection Option 2b	Favourable
WONDERHEUVEL SOLAR PV FACILITY	
Grid Connection Option 1a	Least preferred
Grid Connection Option 1b	Least preferred
Grid Connection Option 1c	Least preferred
Grid Connection Option 1d	Least preferred
Grid Connection Option 2a	Favourable
Grid Connection Option 2b	Favourable
Grid Connection Option 3	Preferred
PAARDE VALLEY SOLAR PV FACILITY	
Grid Connection Option 1a	Least preferred
Grid Connection Option 1b	Least preferred
Grid Connection Option 1c	Least preferred
Grid Connection Option 1d	Least preferred
Grid Connection Option 2a	Preferred
Grid Connection Option 2b	Preferred
Grid Connection Option 2c	Preferred
Grid Connection Option 2d	Preferred

CONCLUSION AND RECOMMENDATIONS

In assessing the social impact of the Umsobomvu Solar PV Facilities, it was found that in respect of the energy needs of the country and South Africa's need to reduce its carbon emissions that the project fits with national, provincial and municipal policy.

Regarding the social impacts associated with the project it was found that most apply over the short term to the construction phase of the project. Of these impacts all can be mitigated to within acceptable ranges and there are no fatal flaws associated with the construction or operation of the project.

On a cumulative basis it is evident that the cumulative impacts associated with changes to the social environment of the region are more significant than those attached to the project in isolation. On a negative front there are two issues associated with developments in the region that are of most concern. The first of these issues is the change to the sense of place of an area that was once considered a pristine region of South Africa. The second is the potential, through an influx of labour and an increase in transportation to constructions sites, of the risk for the prevalence of HIV to rise in an area that has a relatively low HIV prevalence rate. In this regard it is important that the relevant authorities recognise these issues and find ways of mitigating them to ensure that they do not undermine the benefit that renewable energy projects bring, both to the region as well as to the country as a whole. These issues are beyond a project specific basis and as such will need to be addressed at a higher level.

Impact statement

The project site and surrounding areas are sparsely populated with the agricultural potential of the area being low. Accordingly, the negative social impacts associated with the proposed Mooi Plaats, Wonderheuvel and Paarde Valley solar PV facilities and associated grid connection infrastructure are of low to moderate significance with most occurring over the short term construction phase. The project has a positive element which outweighs the negative in that it will contribute towards the supply of renewable energy into a grid system heavily reliant on coal powered energy generation. In this sense the projects form part of a national effort to reduce South Africa's carbon emissions and thus carries with it a significant social benefit and is thus supported and should proceed.

EIA phase

As the area is sparsely populated and the negative social impacts associated with all three solar PV facilities and associated grid infrastructure of moderate significance it is most unlikely that any further social study will be necessary. This will, however, be dependent on the outcome of the public participation process which may result in a need to update the current report by incorporating the comments recorded and updating the social impacts accordingly.

PRE AND POST MITIGATION COMPARISON OF IMPACTS FOR ALL THREE SOLAR PV FACILITIES AND ASSOCIATED GRID INFRASTRUCTURE

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Construction Phase					
Health & social wellbeing	Annoyance, dust and noise	-16 low	**Health & social wellbeing -27 medium**	-8 low	**Health & social wellbeing -20 low**
	Increase in crime	-33 medium		-22 low	
	Increased risk of HIV infections	-48 high		-32 medium	
	Influx of construction workers and job seekers	-22 low		-20 low	
	Hazard exposure.	-20 low		-18 low	
Quality of the living environment	Disruption of daily living patterns	-20 low	**Quality of the living environment -20 low**	-18 low	**Quality of the living environment-18 low**
	Disruptions to social and community infrastructure	-20 low		-18 low	
Economic	Job creation and skills development	+22 low	**Economic +23 low**	+24 medium	**Economic +25 medium**
	Socio-economic stimulation	+24 medium		+24 medium	
Operational Phase					
Quality of the living environment	Transformation of the sense of place	-51 high	**Quality of the living environment -51 high**	-34 medium	**Quality of the living environment -34 medium**
Economic	Job creation and skills development	+24 medium	**Economic +26 medium**	+24 medium	**Economic +33 medium**
	Socio-economic stimulation	+28 medium		+42 medium	
No Project Alternative					
No project	Status quo will remain	-51 high	**-51 high**	No mitigation measures	
Cumulative Impacts					
Health & social wellbeing	Risk of HIV	-51 high	**Health & social wellbeing -51 high**	-32 medium	**Health & social wellbeing -32 medium**
Quality of the living environment	Transformation of sense of place	-51 high	**Quality of the living environment -36.5 medium**	-34 medium	**Quality of the living environment -27 medium**
	Services, supplies & infrastructure	-22 low		-20 low	
Economic	Job creation, skills development and socio-economic stimulation	+36 medium	**Economic +36 medium**	+48 high	**Economic +48 high**

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LIST OF ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
BID	Background Information Document
DBSA	Development Bank of South Africa
DEA	Department of Environmental Affairs
DM	District Municipality
EIA	Environmental Impact Assessment
GPS	Global Positioning System
HIA	Heritage Impact Assessment
HIV	Human Immunodeficiency Virus
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IRP	Integrated Resource Plan
IRR	Issues Response Report
kV	ilovolt
LM	Local Municipality
MW	Megawatt
NBA	Dr. Neville Bews & Associates
NEMA	National Environmental Management Act (No. 107 of 1998)
NERSA	The National Energy Regulator of South Africa
NGO	Non-Governmental Organisation
NU	Non-urban area
OHS	Occupational Health and Safety
PA	Per Annum (Yearly)
PGDS	Provincial Growth and Development Strategy
PPP	Public Participation Process
PV	Photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Program
SACPVP	South African Council for the Property Valuers Profession
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SDF	Spatial Development Framework
SIA	Social Impact Assessment

SIPs	Strategic Integrated Projects
SMME	Small Medium and Micro Enterprises
SPV	Special Purpose Vehicles
Stats SA	Statistics South Africa
STDs	Sexually Transmitted Diseases
ToR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organi ation
WEF	Wind Energy Facility
WHO	World Health Organisation
WWF	World Wild Fund for Nature

QUALIFICATIONS AND EXPERIENCE OF SPECIALIST

Qualifications:

University of South Africa: B.A. (Honours) – 1984

Henley Management College, United ingdom: The Henley Post-Graduate Certificate in Management – 1997

Rand Afrikaans University: M.A. (cum laude) – 1999

Rand Afrikaans University: D. Litt. et Phil. – 2000

Projects:

The Social Impact Assessment (SIA) for the Gautrain Rapid Rail Link; The impact assessment for the Australian – South African sports development programme; SIA for umba Resources, Sishen South Project; Evaluation of a Centre for Violence Against Women for The United Nations Office on Drugs and Crime; SIAs for the following Exxaro Resources Ltd.'s mines, Leeuwpan Coal Mine Delmas, Glen Douglas Dolomite Mine Henley-on- lip, Grootegeluk Open Cast Coal Mine Lephalale; SIA for the South African National Road Agency Limited (SANRAL) on Gauteng Freeway Improvement Project; SIA for SANRAL on the N2 Wild Coast Toll Highway; Research into research outputs of the University for the University of ohannesburg; SIA for Waterfall Wedge housing and business development in Midrand Gauteng; SIA for the Environmental Management Plan for Sedibeng District Municipality; Social and Labour Plan for the Belfast Project on behalf of Exxaro Resources Ltd; SIA for the Transnet New Multi-Product Pipeline (Commercial Farmers) on behalf of Golder Associates Africa (Pty) Ltd; SIA for the Proposed Vale Moati e Power Plant Project in Mo ambique on behalf of Golder Associates Africa (Pty) Ltd; SIA for Kumba Resources Ltd.'s proposed Dingleton Resettlement Project at Sishen Iron Ore Mine on behalf of Water for Africa (Pty) Ltd; SIA for Gold Fields West Wits Project for EcoPartners; SIA for the Belfast Project for Exxaro Resources Ltd; SIA for Eskom Holdings Ltd.'s Proposed Ubertas 88/11kV Substation on behalf of V3 Engineers (Pty) Ltd; SIA for the Mokolo and Crocodile River (West) Water Augmentation Project for the Department of Water and Sanitation on behalf of Nemai Consulting and the Trans Caledonian Water Authority; Assisted Octagon Consulting with the SIA for Eskom's Nuclear 1 Power Plant on behalf of Arcus GIBB Engineering & Science. SIA for the 150MW Photovoltaic Power Plant and Associated Infrastructure for Italgest Energy (Pty) Ltd, on behalf of alahari Survey Solutions cc. SIA for Eskom Holdings Limited, Transmission Division's Neptune-Poseidon 400kV Power Line on behalf of Nemai Consulting. Ncwabeni Off-Channel Storage Dam for security of water supply in Um umbe, Mpumalanga.

Social Impact assessment for Eskom Holdings Limited, Transmission Division, Forskor-Merensky 275kV 130km Powerline and Associated Substation Works in Limpopo Province. Social impact assessment for the proposed infilling of the Model Yacht Pond at Blue Lagoon, Stiebel Place, Durban.ABC Prieska Solar Project; Proposed 75 MWp Photovoltaic Power Plant and its associated infrastructure on a portion of the remaining extent of ERF 1 Prieska, Northern Cape.Sekoko Wayland Iron Ore, Molemole Local Municipalities in Limpopo Province.Langpan Chrome Mine, Thaba imbi, Limpopo; o ini Nodal Expansion Implementation Project, Mpumalanga, on behalf of Nemai Consulting; SIA for Glen Douglas Dolomite Burning Project, Midvaal Gauteng, on behalf of Afrimat Limited; SIA for Lyttelton Dolomite mine Dolomite Burning Project, Marble Hall Limpopo on behalf of Afrimat Limited; Tubatse Strengthening Phase 1 – Senakangwedi B Integration for Eskom Transmission on behalf of Nsovo Environmental Consulting; Department of Water and Sanitation, South Africa (2014). Environmental Impact Assessment for the M imvubu Water Project: Social Impact Assessment DWS Report No: P WMA 12/T30/00/5314/7. Umkhoma i Water Project Phase 1 – Raw Water Component Smithfield Dam - 14/12/16/3/3/3/94; Water Conveyance Infrastructure - 14/12/16/3/3/3/94/1; Balancing Dam - 14/12/16/3/3/3/94/2. Umkhoma i Water Project Phase 1 – Potable Water Component: 14/12/16/3/3/3/95. Expansion of Railway Loops at Arthursview; Paul; Phokeng and Rooiheuwel Sidings in the Bojanala Platinum District Municipality in the North West Province for Transnet Soc Ltd; Basic Social Impact Assessment for the Cato Ridge Crematorium in wa ulu-Natal Province; SIA for the ennedy Road Housing Project, Ward 25 situated on 316 ennedy Road, Clare Hills (Erf 301, Portion 5); Eskom's Mulalo Main Transmission Substation and Power Line Integration Project, Secunda;

Regularly lecture in the Department of Sociology at the University of ohannesburg and collaborated with Prof.Henk Becker of Utrecht University, the Netherlands, in a joint lecture to present the Social Impact Assessment Masters course via video link between the Netherlands and South Africa. Presented papers on Social Impact Assessments at both national and international seminars. Published on both a national and international level.

Affiliation:

The South African Affiliation of the International Association for Impact Assessment.

Registered on the database for scientific peer review of iSimangaliso GEF project outputs.

DECLARATION OF INDEPENDENCE

I, Neville Bews, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant;
- I regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public, and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study 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:

Name of Specialist: Neville Bews

Date: 12 November 2019

1. INTRODUCTION

Mooi Plaats Solar Power (Pty) Ltd, Wonderheuvel Solar Power (Pty) Ltd and Paarde Valley Solar Power (Pty) Ltd has proposed the development of three separate solar photovoltaic facilities with associated grid connection infrastructure to be set up under separate Special Purpose Vehicles (SPV) as follows:

- Wonderheuvel Solar PV Facility under Wonderheuvel Solar Power (Pty) Ltd
- Mooi Plaats Solar PV Facility under Mooi Plaats Solar Power (Pty) Ltd
- Paarde Valley Solar PV Facility under Paarde Valley Solar Power (Pty) Ltd.

The proposed site for these facilities and associated grid connection infrastructure is located some 32 km northwest of Middleburg in the Eastern Cape Province and approximately 19 km southwest of Noupoort in the Northern Cape Province. In this regard SiVEST Environmental Division has been contracted to undertake the environmental impact assessment of the project and in turn has appointed Dr Neville Bews & Associates to undertake the social impact assessment.

1.1. PURPOSE OF REPORT

The purpose of the report is to identify the social baseline conditions in which the proposed Umsobomvu Project will unfold and to acquire an understanding of the proposed project. Against this background to identify the social impacts associated with the proposed project and suggest mitigation measures to limit the effect of these impacts on the social environment within which the project is placed.

1.2. STRUCTURE OF REPORT

This specialist study is undertaken in compliance with Requirements of Appendix 6 – GN R326 EIA Regulations 2014, as amended on of 7 April 2017. **Table 1** indicates how the requirements of Appendix 6 have been fulfilled in this report.

Table 1: Report content requirements in terms of EIA Regulations

Requirements of Appendix 6 – GN R326 EIA Regulations 2014, as amended on 7 April 2017	Section of Report
1. (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;	Page xviii
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page xx
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1 & 1.2 Page 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section: 1.5.2 Page 5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5, 6, 7 & 8 Pages 40-80
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.4 Page 4
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5-9 Pages 40-80
(g) an identification of any areas to be avoided, including buffers;	N/A
(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;	Figures 1, 2 & 3 Pages 8-10
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.5 Pages 4-5
(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]** or activities;	Sections 6 & 8 Pages 47-65 & 66-79
(k) any mitigation measures for inclusion in the EMPr;	N/A
(l) any conditions for inclusion in the environmental authorisation;	N/A
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Sections 6 & 8 Pages 47-65 & 66-79
(n) a reasoned opinion- (i) **[as to]** whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities 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 10 Page 84
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) any other information requested by the competent authority.	N/A
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

1.3. TERMS OF REFERENCE

To undertake a SIA in respect of the proposed Umsobomvu Project, and accordingly to consider the extent of the proposed project and its likely effect on the social environment within which the project will be placed.

General requirements:

- Adherence to all appropriate best practice guidelines, relevant legislation and authority requirements;
- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Identification sensitive areas to be avoided (if any) including providing shapefiles/kmls;
- Separate assessment and impact significance ratings for each phase of the six (6) proposed PV developments noting the impacts of the Pre-construction, Construction, Operation, Decommissioning Phases (according to SiVEST's impact rating methodology);
- Cumulative impact identification and assessment as a result of other renewable energy (RE) developments in the area (including; a cumulative environmental impact table(s) and statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered);
- Assessment of the significance of the cumulative impacts (according to SiVEST's impact rating methodology);
- Comparative assessment of alternatives to be provided for each of the six (6) phases and grid connection;
- Recommend mitigation measures in order to minimise the impacts of the proposed development and note any specific mitigation measures for a particular phase; and
- Implications of specialist's findings for the proposed development (e.g. permits, licences etc.).

1.4. APPROACH TO STUDY

Data was gathered by means of the following techniques.

1.4.1. COLLECTION OF DATA

Data was gathered through:

- The project description prepared by the project proponent.
- Statistics South Africa, Census 2011 and other relevant demographic data generated by Stats SA such as the uarterly Labour Force Survey and Mid-year population estimates.
- Discussions with the project proponents and Environmental Impact Assessment Consultants.
- A literature review of various documents such as the relevant Municipal Integrated Development Plans (IDPs) and other specialist reports and documents.
- A broader literature scan.

1.4.2. IMPACT ASSESSMENT TECHNIQUE

The assessment technique used to evaluate the social impacts was provided by SiVEST Environmental Division and is attached in Appendix 1.

1.5. ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations apply in respect of this report.

1.5.1. ASSUMPTIONS

It is assumed that the technical information provided by the project proponent and the environmental consultants SiVEST, is credible and accurate at the time of compiling the report.

It is also assumed that the data provided by the various specialists as used in this report are credible and accurate.

1.5.2. LIMITATIONS

The demographic data used in this report was sourced from Statistics South Africa and is based on data gathered during Census 2011. This data is somewhat outdated but where possible is supplemented with the latest Stats SA's survey data such as the Mid-year population estimates and the uarterly Labour Force Survey. The limitation of this is that this survey data is restricted to a provincial level and does not extend to a municipal level.

Some of the information in the documentation available from the district and local municipalities was somewhat outdated but where ever possible that information was aligned with that available from Stats SA.

2. PROJECT DESCRIPTION

It is proposed that three (3) Solar Photovoltaic (PV) Energy Facilities, with associated grid connection infrastructure, will be developed, these being:

- ***Mooi Plaats Solar PV Facility***, on an application site of approximately 5 303 ha, comprising the following farm portions:
  - Portion 1 of Leuwe op No 120
  - Remainder of Mooi Plaats No 121

- ***Wonderheuvel Solar PV Facility***, on an application site of approximately 5 652 ha, comprising the following farm portions:
  - Remainder of Mooi Plaats No 121
  - Portion 3 of Wonder Heuvel No 140
  - Portion 5 of Holle Fountain No 133

- ***Paarde Valley Solar PV Facility***, on an application site of approximately 3 695 ha, comprising the following farm portion:
  - Portion 2 of Paarde Valley No 62: and
  - Portion 7 of the Farm Leeuw Hoek No. 61.

2.1. Solar PV Components

Mooi Plaats Solar PV Energy Facility:

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **400 MW** and will comprise approximately **1 142 857** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2 m wide and between 1 m and 4 m in height, depending on the mounting type.
- Internal roads, between 4 m and 10 m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4 ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1 ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Wonderheuvel Solar PV Energy Facility:

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864 ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **480 MW** and will comprise approximately **1 371 429** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2 m wide and between 1 m and 4 m in height, depending on the mounting type.

- Internal roads, between 4 m and 10 m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4 ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1 ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

Paarde Valley Solar PV Energy Facility:

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337 ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **700 MW** and will comprise approximately **2 000 000** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2 m wide and between 1 m and 4 m in height, depending on the mounting type.
- Internal roads, between 4 m and 10 m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4 ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1 ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.2. GRID CONNECTION INFRASTRUCTURE

The proposed grid connection infrastructure will include the following components:

- New on-site substations and collector substations to serve each solar PV energy facility, each occupying an area of up to approximately 4 ha.

- A new 132 kV overhead power line connecting the on-site substations and/or collector substations to either the Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation, from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage to include both lattice and monopole towers which will be up to 25 m in height.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor between approximately 400 m and 900 m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines. The respective alternatives are as follows:

Mooi Plaats Solar PV Grid Connection:

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400 m and 900 m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a -** links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b -** links Substation 2 and Substation 1b to the Hydra D MTS.

OPTION 2:

- **Corridor Option 2a -** links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.
- **Corridor Option 2b -** links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

Wonderheuvel Solar PV Grid Connection:

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400 m and 900 m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  ii. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

OPTION 2:

- **Corridor Option 2a -** links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2b -** Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

OPTION 3:

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector).

Paarde Valley Solar PV Grid Connection:

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400 m and 900 m wide. The alternatives are as follows:

OPTION 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

OPTION 2:

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

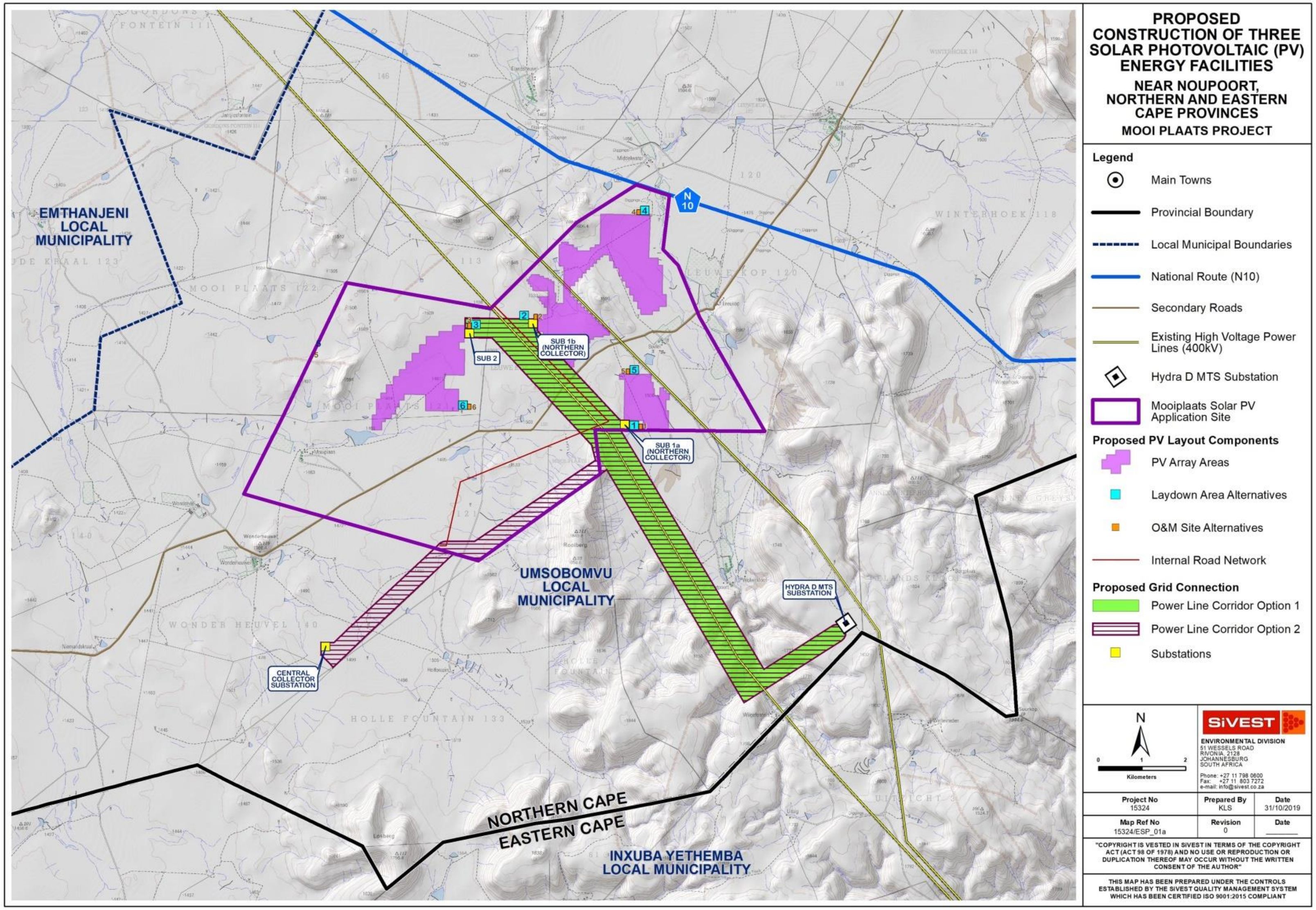
- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

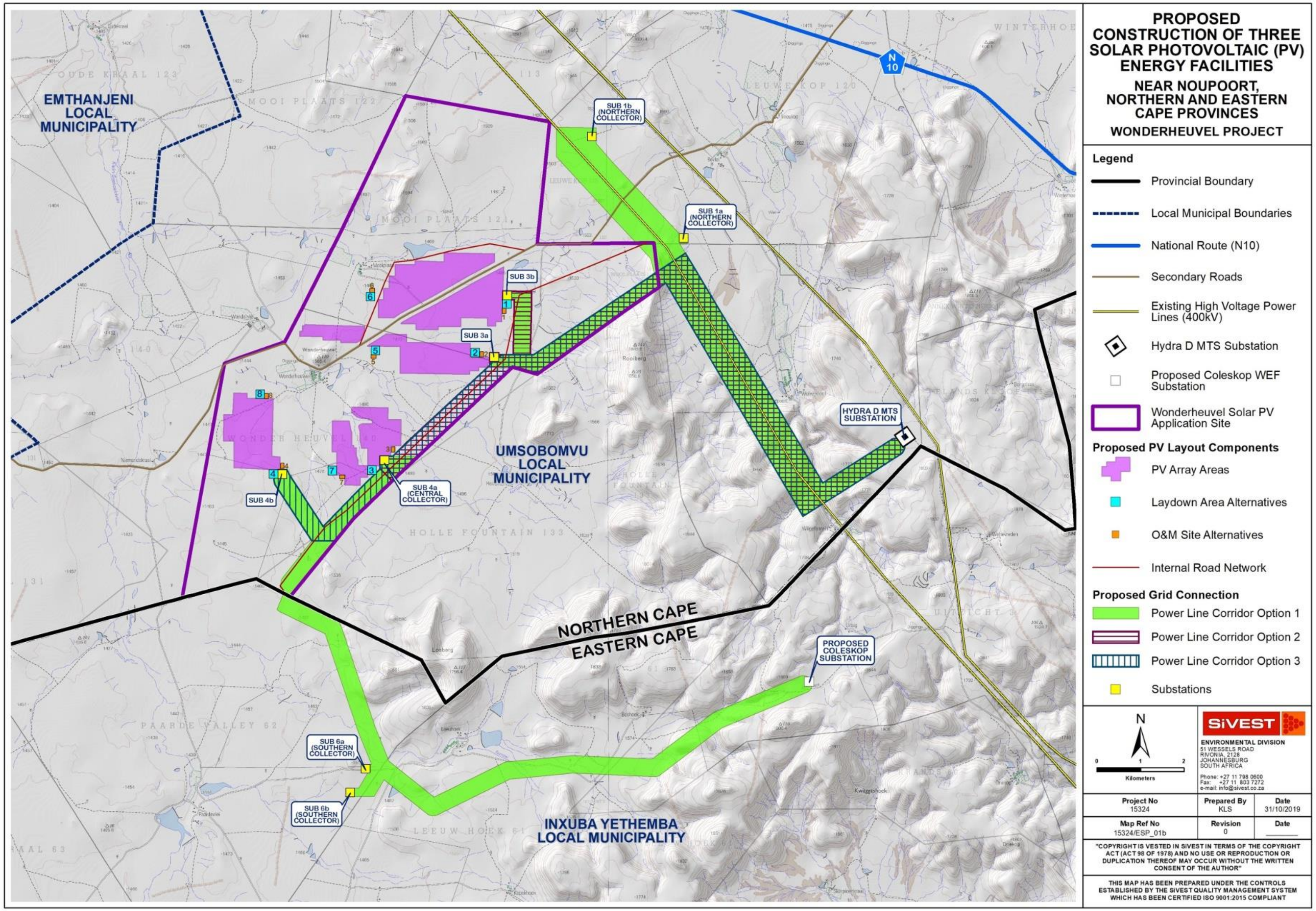
2.3. LOCATION

The project is situated across the Northern and Eastern Cape provinces with Mooi Plaats, illustrated in **Figure 1**, and Wonderheuvel, illustrated in **Figure 2**, falling within the Umsobomvu local and Pixley ka Seme district municipalities in the Northern Cape Province. Paarde Valley falls within the Inxuba Yethemba local and Chris Hani district municipalities in the Eastern Cape Province as illustrated in **Figure 3**.



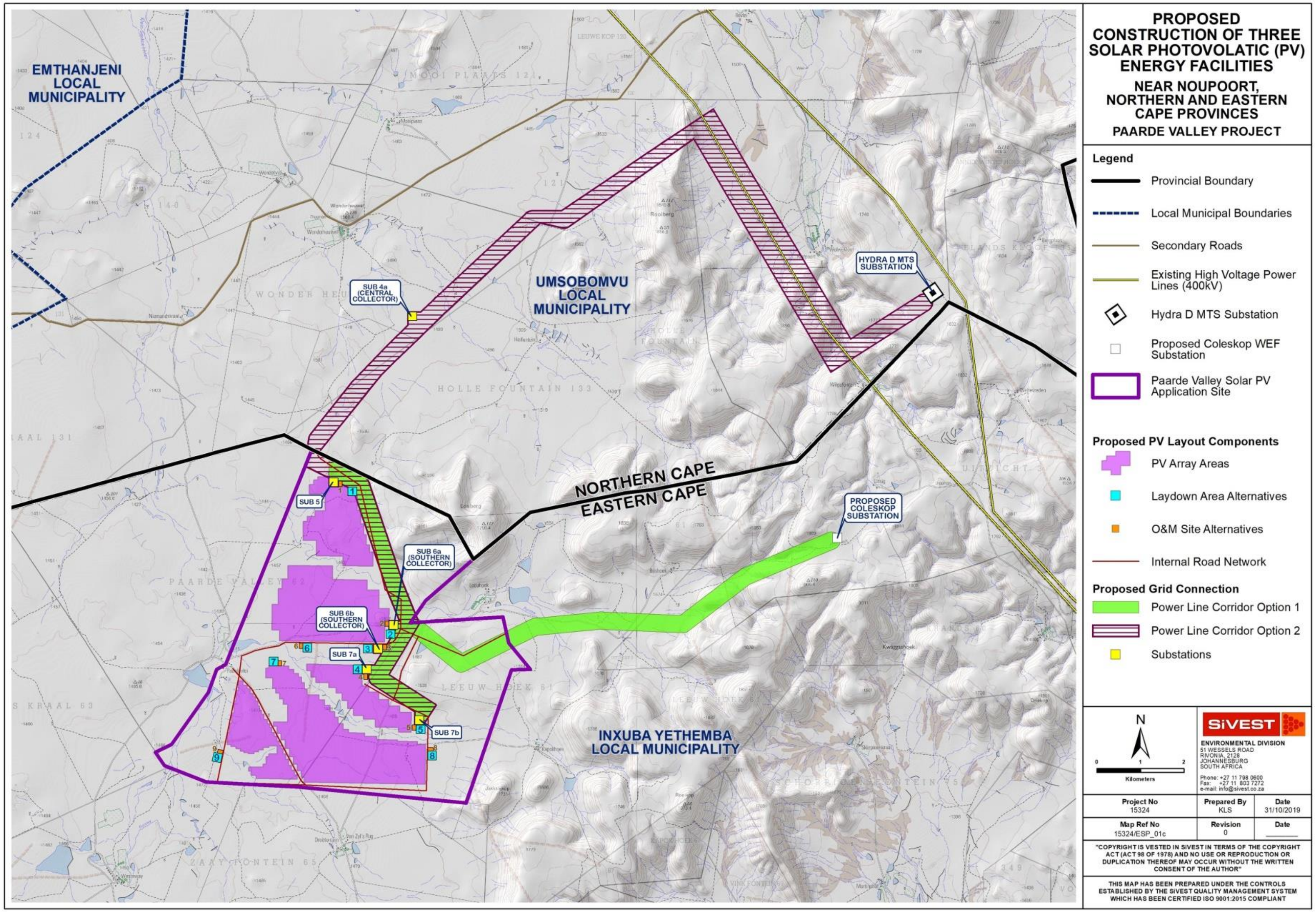
Source: SiVEST Environmental Division

Figure 1: Mooi Plaats Solar PV Facility – Locality map



Source: SiVEST Environmental Division

Figure 2: Wonderheuvel Solar PV Facility – Locality map



Source: SiVEST Environmental Division

Figure 3: Paarde Valley Solar PV Facility – Locality map

2.4. EIA ALTERNATIVES

Laydown area and Operation and Maintenance (O&M) building site alternatives are considered in respect of all three solar photovoltaic (PV) energy facilities. In respect of the grid connection infrastructure two corridor options are considered for each of the three solar photovoltaic (PV) energy facilities and in each case are labelled Option 1 and Option 2. Each of these options is described above under 2.2 Grid connection infrastructure.

2.4.1. NO-GO ALTERNATIVE

It is mandatory to consider the 'no-go' option in the EIA process. The 'no-go' alternative assumes that the site remains in its current state, i.e. there is no construction of any of the solar photovoltaic (PV) energy facilities and associated grid connection infrastructure and that the status quo would proceed.

3. APPLICABLE POLICY AND LEGISLATION

Legislation and policy serve to guide the authorities in undertaking and agreeing on projects that are in the interest of the country as a whole. Consequently, the fit of the project with the relevant national, provincial and municipal legislation and policy is an important consideration. In this respect the following legislation and policy is applicable to the project.

International

- Climate Change Action Plan, 2016-2020, World Bank Group (2016)
- Renewable Energy Vision 2030 – South Africa; World Wildlife Fund for Nature-SA (formerly World Wildlife Fund-SA) (2014)
- REthinking Energy 2017: Accelerating the global energy transformation. International Renewable Energy Agency, (2017)
- Renewable Energy Policies in a Time of Transition. International Renewable Energy Agency (2018)
- Global Warming of 1.5 C. An IPCC special report on the impacts of global warming of 1.5 C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Summary for Policymakers. Subject to copy edit: Intergovernmental Panel on Climate Change (2018).

National

- White Paper on the Energy Policy of the Republic of South Africa (1998)
- White Paper on Renewable Energy (2003)
- A National Climate Change Response Strategy for South Africa (2004)
- National Energy Act (2008)
- Integrated Resource Plan (IRP) for South Africa (2010-2030)
- The Environmental Impact Assessment and Management Strategy for South Africa (2014)
- Government Ga ette Vol. 632; 16 February 2018 No. 41445. Department of Environmental Affairs, No. 114, Page No. 92 (2018)
- New Growth Path Framework (2010)
- The National Development Plan (2011)
- National Infrastructure Plan (2012).

Provincial

- Eastern Cape Provincial Integrated Sustainable Development Planning Framework (PISDPF)
- Eastern Cape Provincial Growth and Development Plan (2004-2014)
- Eastern Cape Strategic Plan (2015-2020)
- Northern Cape Provincial Growth and Development Strategy (2004-2014)
- Northern Cape Province Twenty Year Review (2014)
- Northern Cape Climate Change Response Strategy
- Northern Cape Spatial Development Framework
- Northern Cape Department of Environment & Nature Conservation Annual Report (2016/17)
- Norther Cape Department of Economic Development & Tourism Annual Report (2017)
- Northern Cape State of the Province Address (2018).

District and local

- Chris Hani District Municipality, 2019-2020 Draft Integrated Development Plan Review
- Inxuba Yethemba Local Municipality, 2013/14 Integrated Process Plan Programme
- Pixley ka Seme District Municipality, Integrated Development Plan Draft 2018-2019
- Pixley ka Seme District Municipality, Spatial Development Framework / Land Development Plan 2013 – 2018
- Umsombomvu District Municipality, Integrated Development Plan 2017-2020 1st Review: 2018/19.

3.1. POLICY AND LEGISLATION FIT

Considering the nature and location of the project there is a clear fit with international, national, provincial and local, at both district and municipal levels, policy and legislation. For instance, the World Wild Life Fund for Nature (WWF)

> "…*calls for a more ambitious plan, suggesting that the IRP* Integrated Resource Plan for Electricity *should provide for an 11-19% share of electricity capacity by 2030, depending on the country's growth rate over the next fifteen years*" (Sager, 2014, p. 5).

The issue of climate change is high on the agenda of all levels of government in South Africa with the Department of Environmental Affairs and Tourism indicating that:

> "*The efforts of all stakeholders will be harnessed to achieve the objectives of the Government's White Paper on Renewable Energy (2003) and the Energy Efficiency Strategy, promoting a sustainable development path through coordinated government policy* (Department of Environmental Affairs and Tourism, 2004, p. 23) "

DEAT goes further in specifically listing renewable energy sources, including solar, wind power and biomass, as a tool in promoting mitigation against climate change.

In terms of the capacity determinations of the Minister of Energy, in consultation with the National Energy Regulator (NERSA), it has been established that South Africa required:

> "*14 725 MW of renewable energy (comprising of solar PV: 6 225 MW, wind: 6 360 MW, CSP: 1 200 MW, small hydro: 195 MW, landfill gas: 25 MW, biomass: 210 MW, biogas: 110 MW and the small scale renewable energy programme: 400 MW)*" (Independent Power Producer Office, 2018a, p. 5).

With the Northern Cape contributing 8 652 GWh in respect of solar (Independent Power Producers Procurement Office, 2018b, p. 3) and the Eastern Cape contributing 684 GWh (Independent Power Producers Procurement Office, 2018c, p. 3).

On 16 February 2018 the boundaries of eight Renewable Energy ones (RE s) that are of strategic importance for large scale solar photovoltaic and wind for the country were ga etted (Government Ga ette No. 41445, 2018). Although the project falls outside of these ones it will nevertheless contribute towards the requirement of renewable energy highlighted by the development of these ones.

The Northern Cape Department of Economic Development and Tourism identifies six economic development opportunities, one of which is renewable energy, and states that:

> "*During the financial year* 2017/18 *the intension* (sic) *is to focus on additional opportunities such as, Renewable Energy, a focus area of the 9-Point Plan*" (Northern Cape Province. Department of Economic Development & Tourism, 2017, p. 10 & 15).

The importance of renewable energy facilities within the Northern Cape has been recognised in the province's Twenty Year Review 2014 where it is indicated that:

> "*The New Growth Path that was adopted by national government in 2010 identified the green economy as a new economic sector that will be key to the creation of jobs. The focus of the green economy is on renewable energy and the Northern Cape was identified as the solar hub of the country with a number of solar plants being established across the province*" (Northern Cape Province, 2014, p. 153).

On a municipal level wide support is also evident across the affected municipalities. The IDP of the Chris Hani DM states that:

> " *…we can see that CHDM is now ready to address the scourge of climate change and make it beneficial to the citizens of this region through greening, recycling, and renewable energy initiatives… a*nd the Renewable Energy Sector is listed *As a Special Development Area* as follows *Manufacturing, Industry Mining and Renewable Energy Sectors*" (Chris Hani District Municipality, 2019, p. 171 & 254).

The Pixley ka Seme DM also recognises the potential of renewable energy initiatives and states in its Spatial Development Plan that:

> "*The Pixley Ka Seme District area with its abundance of sunshine and vast tracts of available land has been attracting considerable interest from solar energy investors of late. The high solar index of the area, as indicated by the Solar Index Diagram, provides many opportunities in terms of the development of renewable energy.*
>
> *The growth and development context in the district has also changed radically since 2013 (after it had been stagnant for decades) owing mainly to private and public investments in the area as a hub for renewable energy generation and*

> *astronomy, respectively*" (Pixley a Seme District Municipality, 2014, p. 44 & 52).

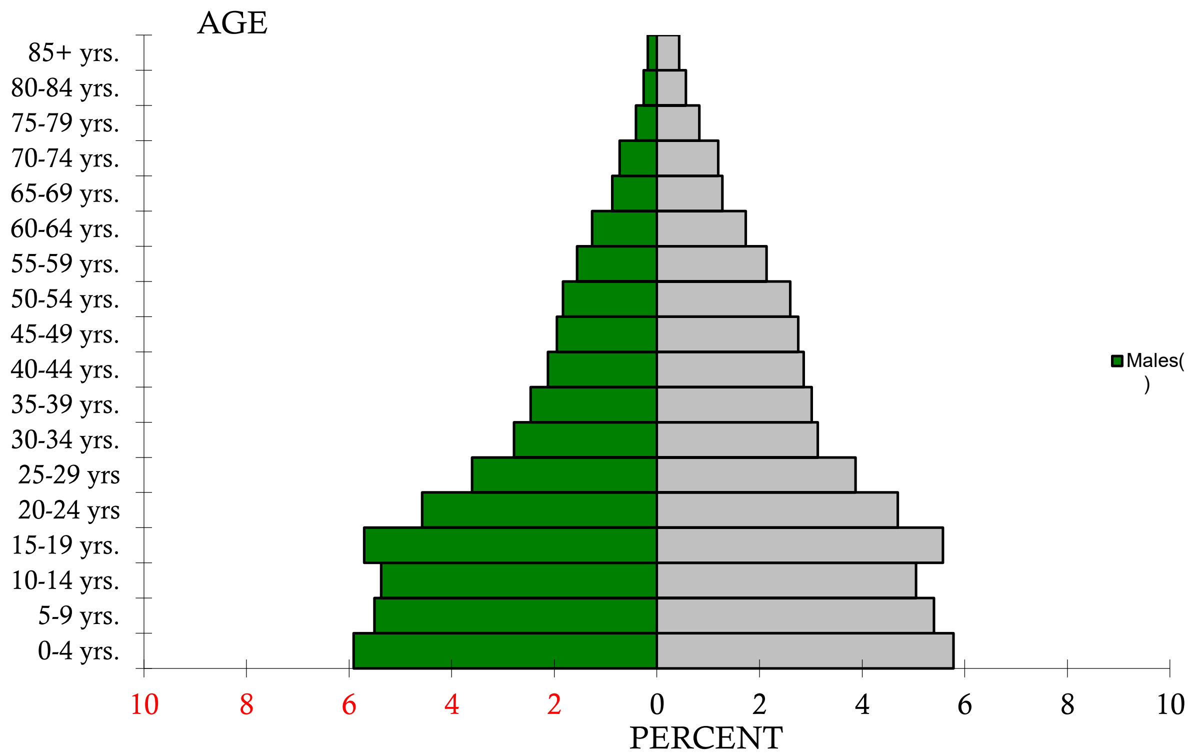
Considering the policy and legislation referred to above it seems that the project largely aligned with this framework. Notwithstanding this, however, the provision that the project conforms to appropriate scale and form, particularly considering the cumulative impacts associated with similar such projects in the area, will need to be considered on a broader basis than can be done as far as this report is concerned. In this regard attention will need to be given to the cumulative impacts at a later point in the report in as far as they relate to the social environment. In the following section a description of the affected environment is provided.

4. Description of the Affected Environment

The Mooi Plaats and Wonderheuvel solar PV facilities fall within the Northern Cape Province while the Paarde Valley Solar PV Facility is located within the Eastern Cape Province. In the Northern Cape the Pixley ka Seme (DC7) district and Umsobomvu (NC072) local municipalities are affected by the project while in the Eastern Cape the project impacts the Chris Hani district (DC13) and Inxuba Yethemba (EC131) local municipalities. The closest towns to the project are Noupoort and Hanover in the Northern Cape and Middelburg in the Eastern Cape, all of which fall within the aroo Region. The demographics pertaining to these areas, as sourced from Statistics South Africa Census 2011, are described below.

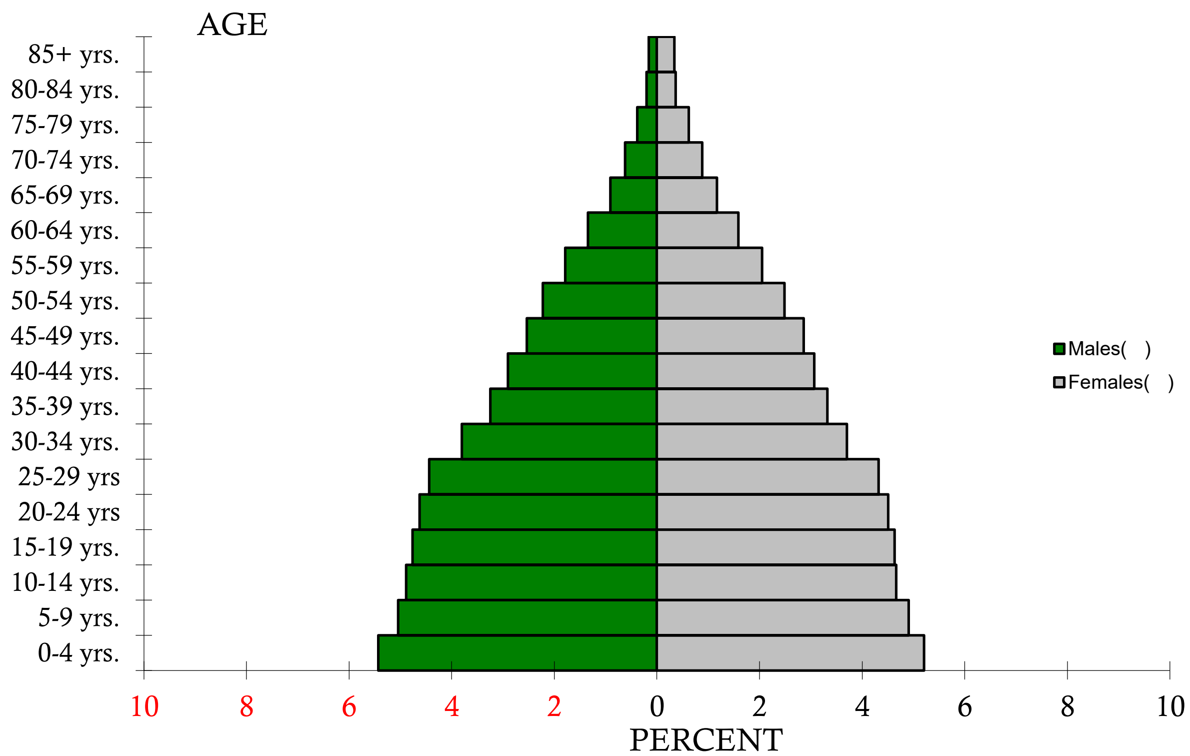
4.1. Provincial

The Eastern Cape Province covers an area of 168 965.98 km and has a population of 6 562 053 people, resulting in a population density of 38.84 people per km according to Census 2011 (Statistics South Africa, 2011). The Northern Cape Province covers an area of 372 889.36 km and, over the same period, had a population of 1 145 861 people giving it a population density of 3.07 people per km . In respect of age structure 33 of the population of the Eastern Cape are below 16 years while 60.2 are between 15 and 64 years of age and 6.7 are above 64 years. The corresponding figures pertaining to the Northern Cape are as follows; below 16 years 30.1 , between 15 and 64 years 64.2 and above 64 years 5.7 . The population pyramids of the Eastern and Northern Cape provinces are illustrated in **Figure 4** and **Figure 5** respectively.



Source: (Statistics South Africa, 2011)

Figure 4: Population pyramid Eastern Cape Province



Source: (Statistics South Africa, 2011)

Figure 5: Population pyramid Northern Cape Province

According to the 2018 Mid-year population estimates (Statistics South Africa, 2018a), with a population of 6 522 700 in 2018, the Eastern Cape accounts for 11.3 of the total population across the country marginally below the Western Cape with an estimated population of 6 621 100 or 11.5 of the total population of South Africa. The Northern Cape Province has the smallest population with an estimated population of 1 225 600 in 2018. As the Mid-year population estimates remain at a provincial level and are not projected to the district and local municipal levels, for comparative purposes, data gathered during Census 2011, will be used where appropriate, notwithstanding it being somewhat outdated.

On this basis and in respect of population groupings at 86.26 , the dominant population group in the Eastern Cape is black African with the dominant population of the Northern Cape, at 50.35 , also being black African people. At 49.7 and 53.8 respectively Afrikaans is the dominant home language spoken across both provinces.

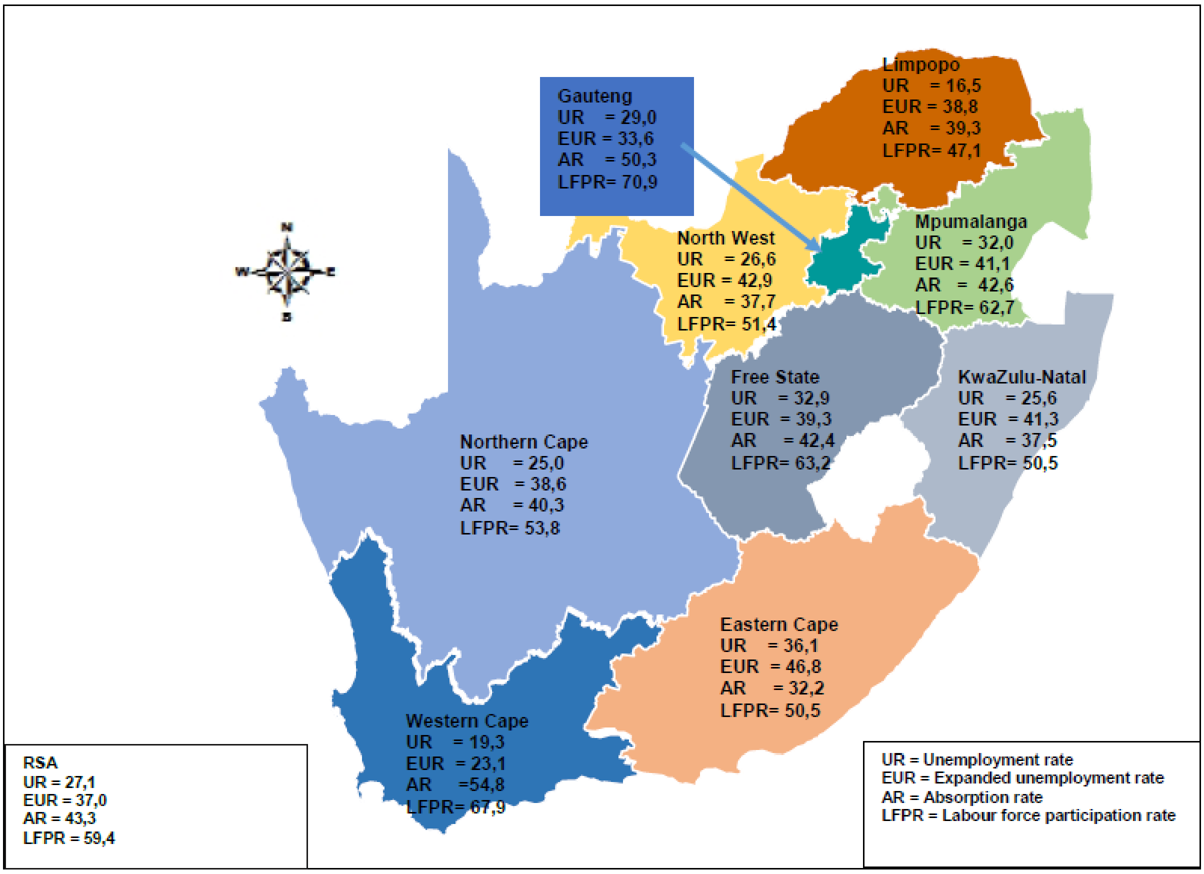
The dependency ratio of the Eastern Cape, which indicates the burden placed on the population of working age, between 15 and 64 years, who support children under 15 years and people over 65 years, is 66.0 while that of the Northern Cape is 55.7. The sex ratio, which measures the proportion of males to females, in the Eastern Cape is 89.0 indicating a higher number of females in the province while that of the Northern Cape is 97.3 also indicating a higher female to male ratio across the province. Between 1996 and 2001 the population growth rate of the Eastern Cape was 0.42 p.a. while between 2001 and 2011 it was 0.44 p.a. The corresponding data for the Northern Cape was -0.40 between 1996 and 2001 and 1.44 between 2001 and 2011.

In 2011 the official unemployment rate in the Eastern Cape was 37.4 with the official unemployment rate amongst the youth, aged between 15 and 34 years, being 47.3 . The corresponding figures for the Northern Cape are 27.4 and 34.5 respectively. In the 4th uarter of 2018 the official unemployment rate in the Eastern Cape had dropped to 36.1 while that in the Northern Cape had dropped to 25 . These figures must, however, be considered with caution as the official unemployment rate is defined by Stats SA as follows;

> "*Unemployed persons are those (aged 15–64 years) who:*
>
> *a) Were not employed in the reference week and;*
>
> *b) Actively looked for work or tried to start a business in the four weeks preceding the survey interview and;*
>
> *c) Were available for work, i.e. would have been able to start work or a business in the reference week or;*

d) Had not actively looked for work in the past four weeks but had a job or business to start at a definite date in the future and were available." (Statistics South Africa, 2018b, p. 17).

Considering this in the 4th uarter of 2018, the expanded unemployment rate in the Eastern Cape was 46.8 while that in the Northern Cape stood at 38.6 . During this period the labour absorption rate in the Eastern Cape was 32.2 while the labour force participation rate was 50.5 . In the Northern Cape the labour force absorption rate was 40.3 and the labour force participation rate was 53.8 . A summary of the labour market indicators illustrated on a comparative basis across South Africa is provided in **Figure 6**.



Source: (Statistics South Africa, 2018b, p. 9)

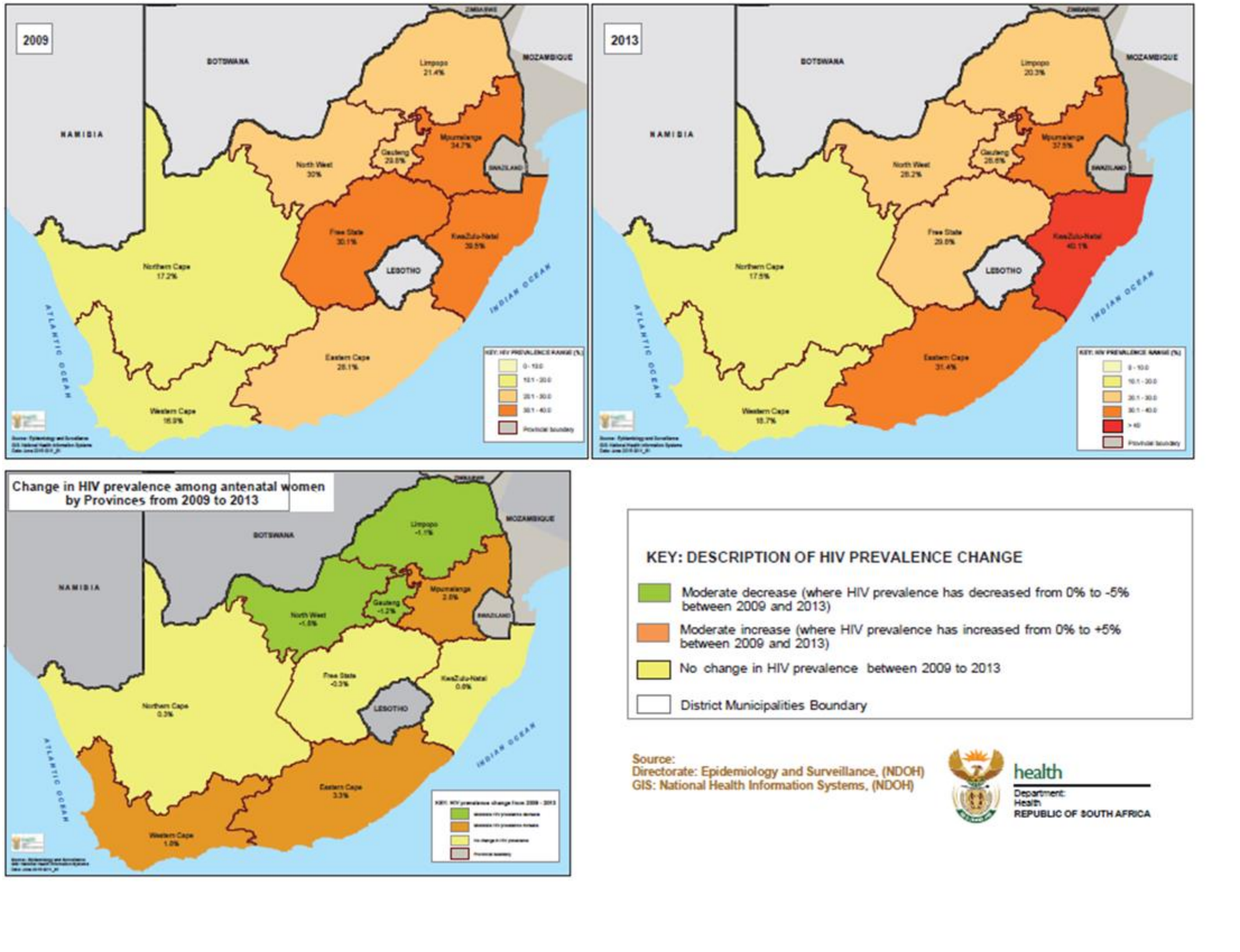
Figure 6: Labour market indicators 4th Quarter 2018

In respect of households, the 2011 Census indicated that there were 1 687 385 households in the Eastern Cape with an average household si e of 3.9 and 301 405 households in the Northern Cape with an average household si e of 3.8. Of the households in the Eastern Cape, 49.6 were female headed, 63.2 lived in formal dwellings and 59.6 either owned or were paying off their dwelling. The corresponding figures for the Northern Cape are 38.8 female headed households with 82.4 living in formal dwellings and 55.1 having either owned or were paying off their dwelling.

Regarding household services in 2011, 40.4 of households in the Eastern Cape and 60.1 in the Northern Cape had flush toilets connected to the sewerage system. In respect of refuse removal 41 of households in the Eastern Cape and 64 in the Northern Cape had their refuse removed on a weekly basis. Piped water was delivered to 32.8 and 45.8 of households in the Eastern and Northern Cape respectively while 75 of households in the Eastern Cape and 85.4 in the Northern Cape used electricity as a means of energy for lighting.

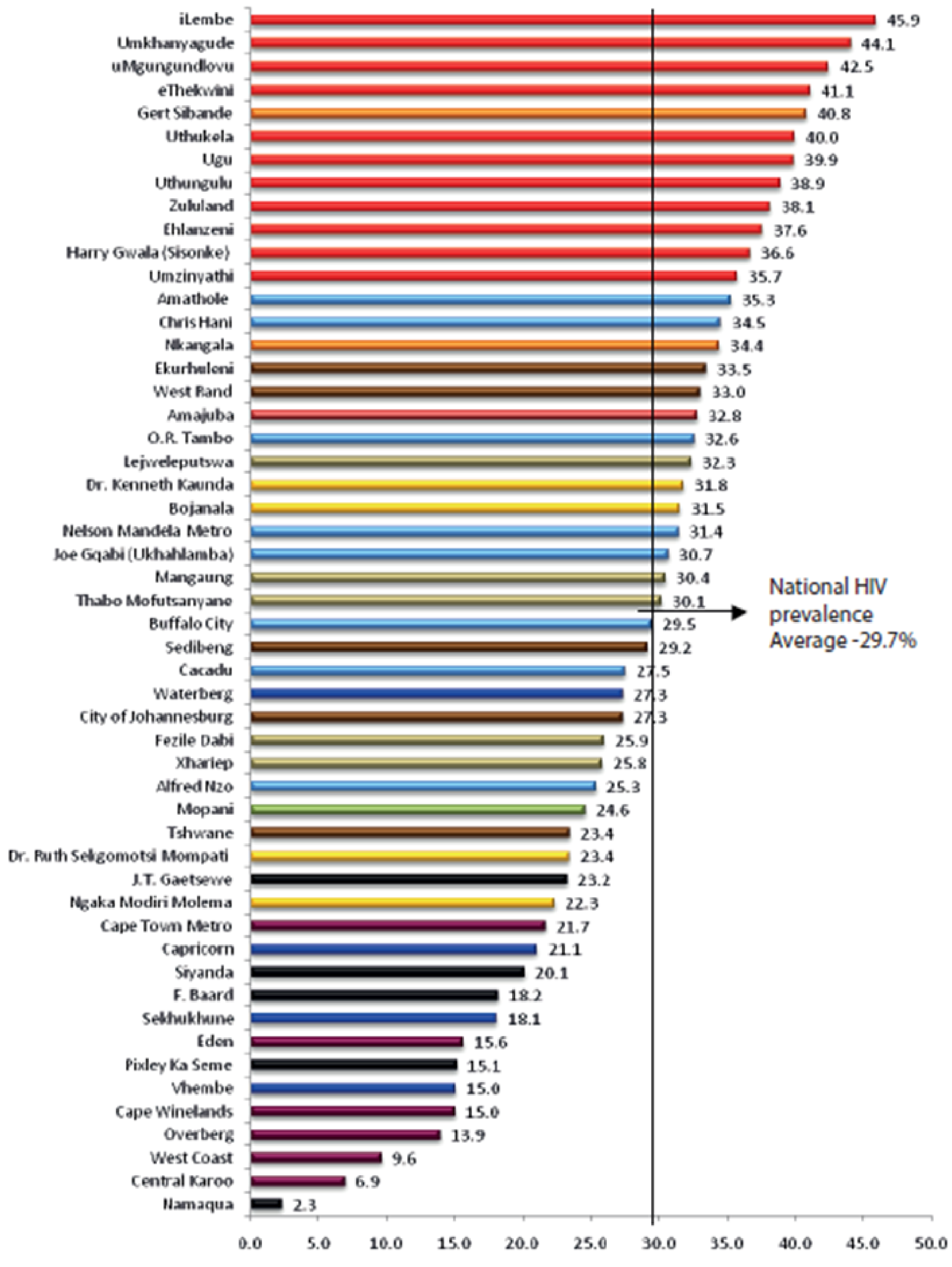
Concerning HIV prevalence amongst prenatal women in both the Eastern and Northern Cape provinces, in 2013 the Northern Cape had the lowest prevalence rate across South Africa at 17.5 followed by the Western Cape at 18.7 while the Eastern Cape had an HIV prevalence rate of 31.4 . At the same point the highest level of HIV prevalence amongst antenatal women was in wa ulu-Natal with a prevalence rate of 40.1 while the national rate was 29.7 . HIV prevalence amongst antenatal women across South Africa is illustrated in **Figure 7**.

The 2013 National Antenatal Sentinel HIV Prevalence Survey extended to the district level which indicated that the Namaqua District Municipality had the lowest level of HIV prevalence across the country at 2.3 followed by the Central aroo District at 6.9 . Of the 52 districts surveyed the Pixley a Seme district had the seventh lowest level of HIV prevalence at 15.0 while the Chris Hani district had a relatively high level at 34.5 . As the project falls within a remote area of the Chris Hani district and Inxuba Yethemba local municipalities it is likely that the level of HIV prevalence will be somewhat low in the vicinity of the project. It is probable that the high HIV levels in the district will be associated with the more densely populated urban areas of Cradock and Middelburg amongst others and is also due to the fact that the Chris Hani district serves as a linking node to all regions in the Eastern Cape. It is well documented that the spread of HIV is associated with transport corridors (Singh & Malaviya, 1994; Ramjee & Gouws, 2002; Djemai, 2018; Strauss, et al., 2018). The prevalence of HIV amongst antenatal women as it occurred across the district municipalities in 2013 is illustrated in **Figure 8**.



Source: (National Department of Health, 2015, p. 27)

Figure 7: HIV prevalence amongst antenatal women – South Africa 2009 – 2013



Source: (National Department of Health, 2015, p. 29)

Figure 8: HIV prevalence across the 52 districts – 2013

Attention is now turned towards the district and local municipalities which are compared together with both the provinces in **Table 2** to **Table 5**.

4.2. MUNICIPAL

The project impacts the two district municipalities of Pixle ka Seme and Chris Hani as well as their respective local municipalities of Umsobomvu and Inxuba Yethemba. On a district level Pixley ka Seme covers the greatest land area and has the lowest population density at 1.80/km^2, while at a local municipal level although the Inxuba Yethemba covers the largest geographical area it also has the largest population resulting in a population density of 5.62/km^2. In respect of population grouping, at 93.35 black African people are the dominant population group across all districts and the Umsobomvu Local Municipality while the coloured population group dominates within the Pixdley ka Seme Local Municipality. isi hosa is the dominant home language spoken across all municipalities except Pixley ka Seme where Afrikaans is the dominant home language. Demographic data pertaining to the district and local municipalities is compared together with that applicable to the Northern and Eastern Cape Provinces in **Table 2**.

The Pixley ka Seme region is primarily a sheep farming area, also renown for stud farms where high-quality race horses are bred. The towns of Colesberg, Norvalspont and Noupoort all fall within the Umsobomvu Local Municipality. The economy of the area revolves around agriculture, the services industry, tourism and hospitality.

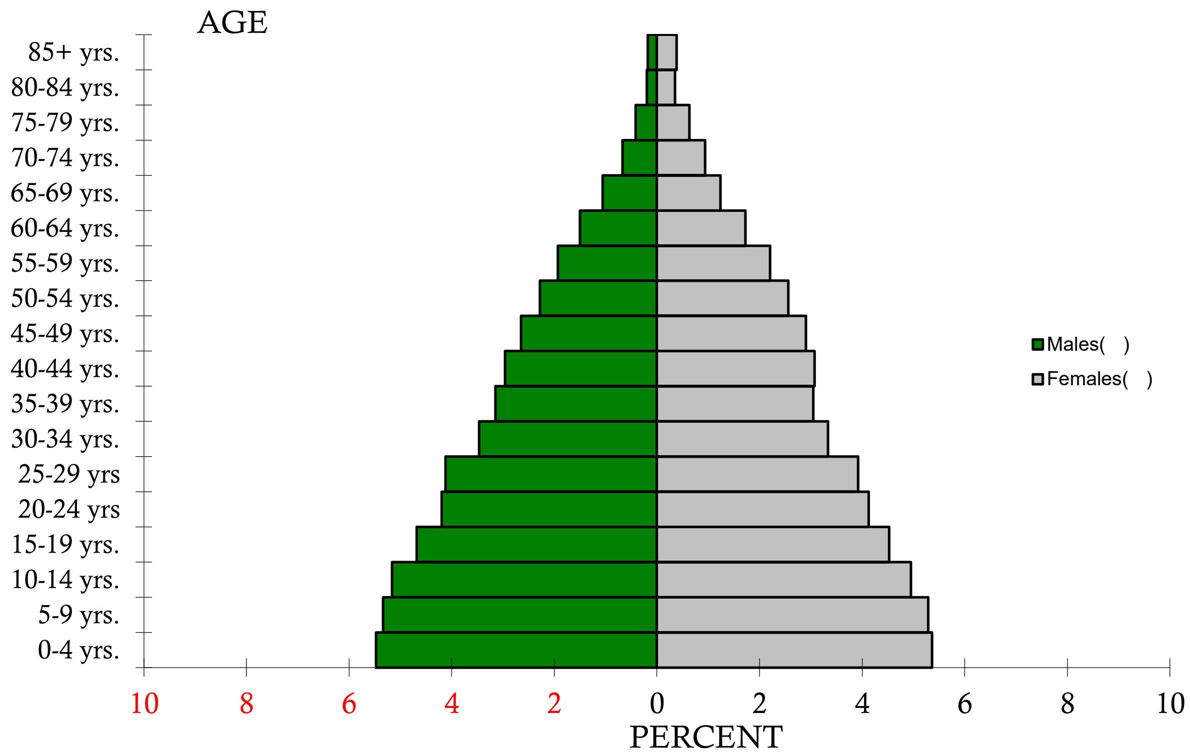
The Inxuba Yethemba Local Municipality incorporates the towns of Cradock and Middelburg and the surrounding rural areas comprise mainly of commercial farms and small settlements. The economic drivers in the area are community and financial services, trade, transportation and agriculture with some tourism with the Mount ebra National Park falling within the area.

Table 2: Geographic and demographic data

	EASTERN CAPE	DC13: Chris Hani	EC131: Inxuba Yethemba	NORTHERN CAPE	DC7: Pixley ka Seme	NC072: Umsobomvu
Geographical Area	168,965.98 km^2	36,143.54 km^2	11,662.69 km^2	372,889.36 km^2	103,409.91 km^2	6,818.53 km^2
Population	6,562,053	795,461	65,560	1,145,861	186,351	28,376
Households	1,687,385	210,852	18,463	301,405	49,193	7,841
Population Density	38.84/km^2	22.01/km^2	5.62/km^2	3.07/km^2	1.80/km^2	4.16/km^2
Household Density	9.99/km^2	5.83/km^2	1.58/km^2	0.81/km^2	0.48/km^2	1.15/km^2
Female	52.92%	52.65%	51.69%	50.69%	50.59%	51.76%
Male	47.08%	47.35%	48.31%	49.31%	49.41%	48.24%
Black African	86.26%	93.35%	56.21%	50.35%	31.45%	62.56%
Coloured	8.26%	4.12%	32.17%	40.31%	59.17%	30.57%
White	4.73%	2.02%	10.51%	7.09%	8.08%	5.66%
Other	0.33%	0.29%	0.82%	1.56%	0.74%	0.66%
Indian/Asian	0.43%	0.22%	0.29%	0.68%	0.56%	0.55%
Home Language	isiXhosa 78.85%	isiXhosa 88.58%	isiXhosa 49.97%	Afrikaans 53.76%	Afrikaans 76.79%	isiXhosa 55.16%
	Afrikaans 10.58%	Afrikaans 6.10%	Afrikaans 44.61%	Setswana 33.08%	isiXhosa 17.48%	Afrikaans 38.58%
	English 5.61%	English 2.62%	English 3.10%	isiXhosa 5.34%	Setswana 1.71%	Sesotho 1.91%
	Sesotho 2.46%	Sign language 0.70%	Other 0.55%	English 3.36%	English 1.63%	English 1.76%

Source: (Statistics South Africa, 2011)

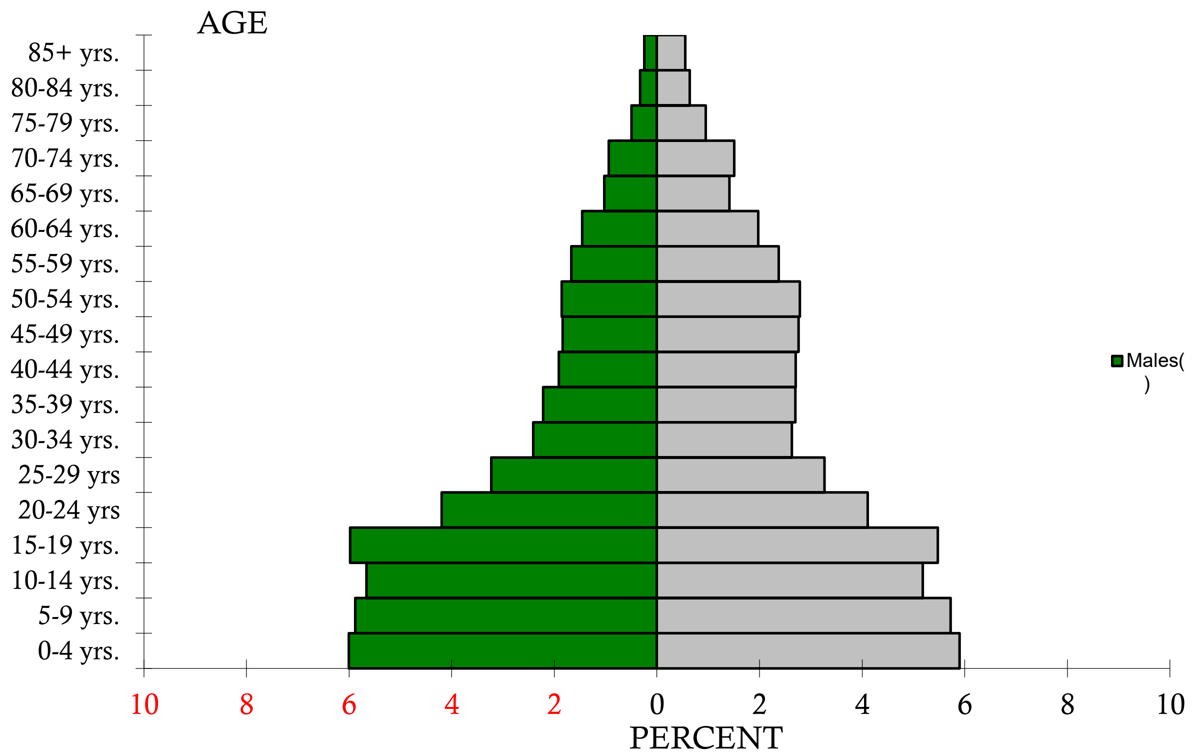
In the Pixley ka Seme district 31.6 of the population, which amounted to 186 351 people in 2011, were under 16 years of age while 62.4 were between 15 and 64 years and 6.1 were over the age of 64. Based on this data the population pyramid of Pixley ka Seme is illustrated in **Figure 9**.



Source: (Statistics South Africa, 2011)

Figure 9: Population pyramid Pixley ka Seme

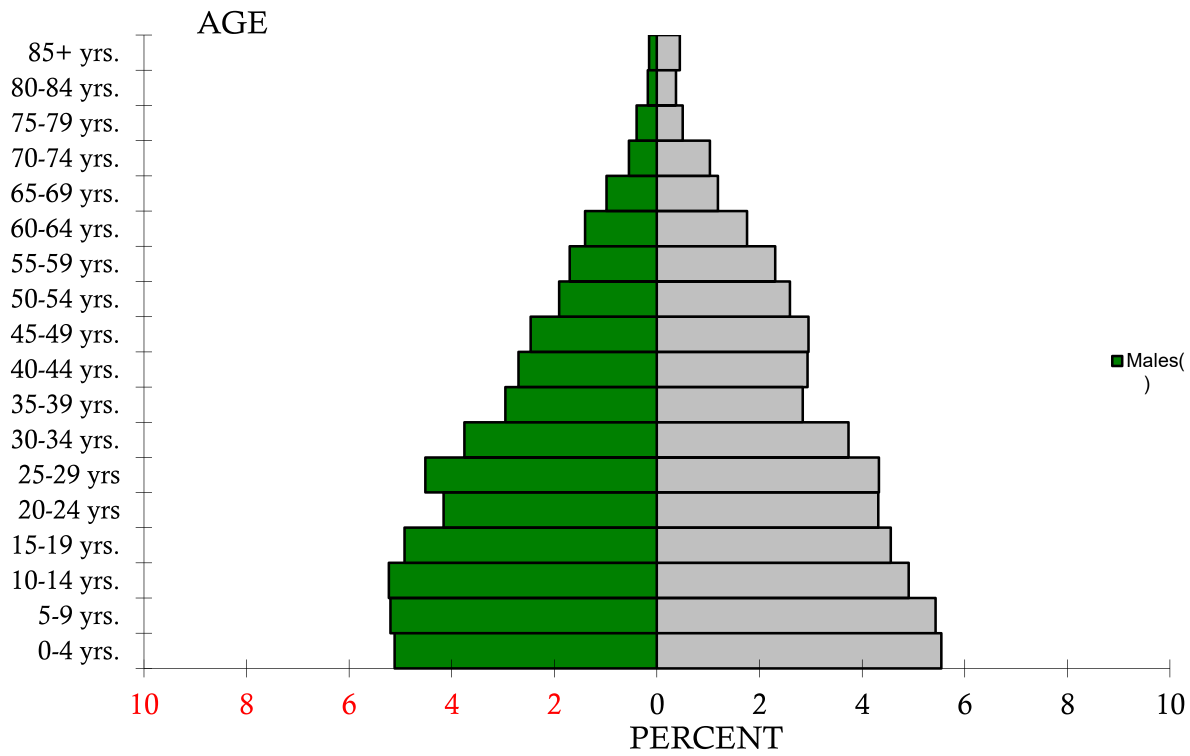
In the Chris Hani district, which had a population of 795 461 people in 2011, 34.4 were under 16 years of age while 67.6 were between 15 and 64 years and 8.1 were over the age of 64. The population pyramid of the Chris Hani district is represented in **Figure 10**.



Source: (Statistics South Africa, 2011)

Figure 10: Population pyramid Chris Hani

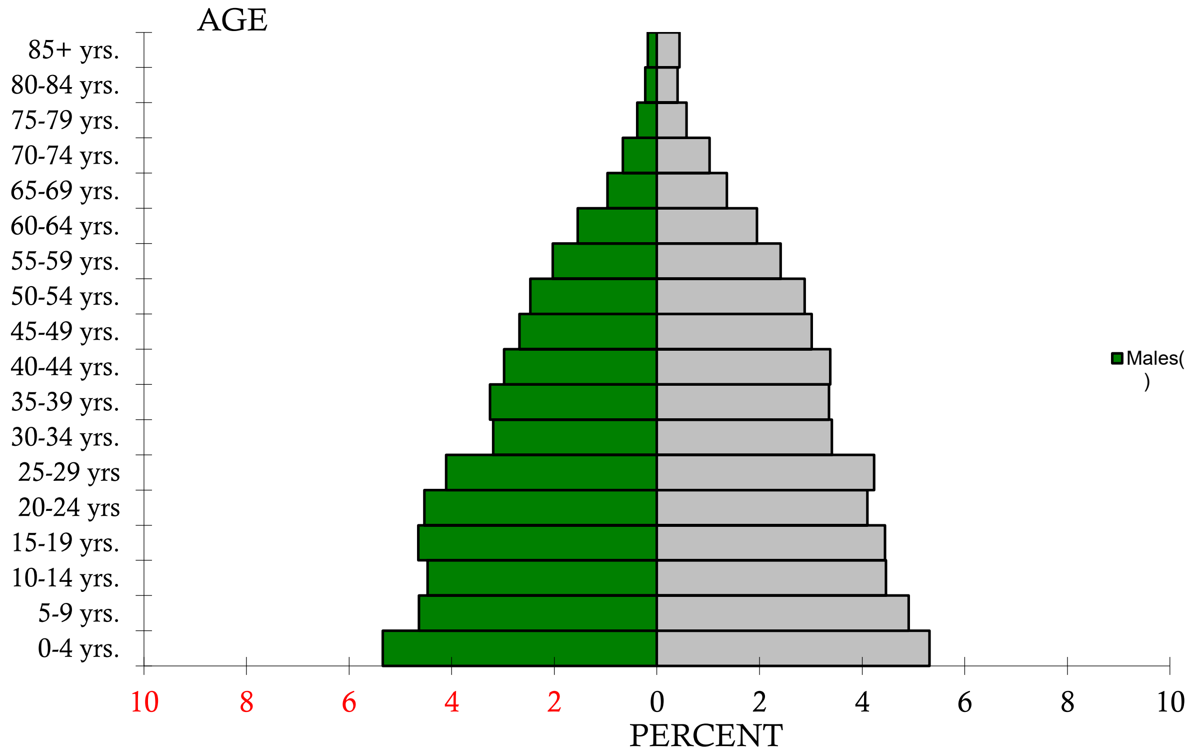
In the Umsobomvu Local Municipality 31.4 of the population of 28 376 people were under 16 years of age, while 62.8 fell between 15 and 64 years and 5.8 were over the age of 64. The population pyramid of the Umsobomvu municipality is represented in **Figure 11**.



Source: (Statistics South Africa, 2011)

Figure 11: Population pyramid Umsobomvu

Of the population of 65 560 people in the Inxuba Yethemba Local Municipality, 29.1 were under 16 years of age in 2011 while 64.6 were between 15 and 64 years and 6.2 were over the age of 64 years. The population pyramid of the Inxuba Yethemba is represented in **Figure 12**.



Source: (Statistics South Africa, 2011)

Figure 12: Population pyramid Inxuba Yethemba

The dependency ratio, which indicates the burden of support for children under 16 years and people over 64 years placed on the working population aged between 15–64 years, is highest in the Chris Hani district at 73.8 and in Ixuba Yethemba at 54.7 . In respect of sex ratio Pixley ka Seme has a higher proportion of males to females in the population at 97.6 while, at 89.9, the Chris Hani has the highest proportion of females to males. Between 2001 and 2011 the Umsobomvu LM had the highest population growth rate at 1.83 while the Chris Hani district had a negative population growth rate at -0.06 . This data is compared across the region in **Table 3**.

Table 3: Age structure, dependency ratio, sex ratio and population growth

Municipality	Age Structure						Dependency Ratio		Sex Ratio		Population Growth (% p.a.)	
	<15		15-64		65+		Per 100 (15-64)		Males per 100 females			
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
EASTERN CAPE	36.6	33.0	57.1	60.2	6.3	6.7	75.0	66.0	86.2	89.0	0.42	0.44
DC13: Chris Hani	38.8	34.4	53.9	57.6	7.3	8.1	85.5	73.8	85.9	89.9	-0.34	-0.06
EC131: Inxuba Yethemba	30.1	29.1	64.0	64.6	5.9	6.2	56.1	54.7	92.7	93.5	0.84	0.83
NORTHERN CAPE	32.1	30.1	62.5	64.2	5.4	5.7	60.1	55.7	93.7	97.3	-0.40	1.44
DC7: Pixley ka Seme	32.6	31.6	61.5	62.4	5.9	6.1	62.7	60.4	94.2	97.6	-1.27	1.12
NC072: Umsobomvu	33.7	31.4	61.0	62.8	5.3	5.8	63.8	59.3	91.8	93.2	-1.41	1.83

Source: (Statistics South Africa, 2011)

The unemployment rate in the area is highest in the Chris Hani district and Umsobomvu local municipalities at 39 and 33 percent respectively. The level of unemployment is lowest in the Inxuba Yethemba Local Municipality at 25.7 . In respect of education, at 10.75 Inxuba Yethemba has the lowest percentage of the population that has no schooling with the Umsobomvu having the highest percentage with no schooling at 16.31 . Surprisingly Umsobomvu has the highest percentage of the population having a matric level of education at 23.2 while the Inxuba Yethemba municipality has the highest percentage of the population with an education level higher than matric at 8.6 . Data pertaining to education as discussed above is compared across the municipalities and at the provincial levels in
Table 4.

In respect of the local municipalities associated with the project, Umsobomvu has the fewest number of households at 7 841 compared to the 18 463 households in the Inxuba Yethemba municipality. The average household si e across both local municipalities is the same at 3.6. There is a slightly higher percentage of female headed households in Umsobomvu at 41.5 compared to 40.9 in Inxuba Yethemba. Most households in the Inxuba Yethemba LM, at 97 , live in formal dwellings. A relatively low number of households across the study region ranging, between 60.3 and 46.7 percent, either own or are paying off their dwellings. Data pertaining to household dynamics across the region is presented in **Table 5**.

Table 4: Labour market and education aged 20 +

Municipality	Labour Market				Education (age 20 +)					
	Unemployment Rate (official)		Youth Unemployment Rate (Official) 15-34 years		No Schooling		Matric		Higher Education	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
EASTERN CAPE	54.3	37.4	64.3	47.3	22.8	10.5	14.3	20.0	6.3	8.5
DC13: Chris Hani	58.8	39.0	69.4	48.5	29.7	13.9	9.4	14.9	5.5	7.0
EC131: Inxuba Yethemba	43.2	25.7	53.7	33.2	16.5	10.7	14.0	20.2	6.0	8.6
NORTHERN CAPE	35.6	27.4	44.1	34.5	19.3	11.3	15.8	22.9	5.9	7.2
DC7: Pix ka Seme	36.4	28.3	44.1	35.4	26.3	14.6	12.5	20.6	5.5	5.9
NC072: Umsobomvu	51.9	33.0	60.6	40.4	26.6	16.3	12.5	23.2	5.2	6.2

Source: (Statistics South Africa, 2011)

Table 5: Household dynamics

Municipality	Household dynamics									
	Households		Average household size		Female headed households		Formal dwellings		Housing owned/paying off	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
EASTERN CAPE	1 481 640	1 687 385	4.2	3.9	50.9	49.6	51.5	63.2	57.1	59.6
DC13: Chris Hani	185 297	210 852	4.2	3.8	53.6	51.6	53.1	61.9	58.3	60.3
EC131: Inxuba Yethemba	16 002	18 463	3.6	3.6	36.9	40.9	97.1	97.0	40.2	46.7
NORTHERN CAPE	245 086	301 405	3.9	3.8	37.7	38.8	81.0	82.4	60.8	55.1
DC7: Pix ka Seme	41 707	49 193	3.9	3.8	33.8	36.9	84.7	86.3	50.2	52.0
NC072: Umsobomvu	5 848	7 841	3.9	3.6	43.1	41.5	81.8	88.2	52.4	52.7

Source: (Statistics South Africa, 2011)

4.3. PROJECT FOOT PRINT

At a project foot print specific level the Mooi Plaats and Woderheuvel facilities fall within the Umsobomvu non-urban (NU) area which is sparsely populated with a population density of 0.38 people per square kilometre. The demographic data in respect of the Umsobomvu NU listed as Sub Place 370003002 according to Census 2011 is as follows:

Geographic area 6 516.10 km
Population 2 452 people
Population density 0.38/km
Households 892
Household density 0.14/km

Gender	People	Percentage
Male	1,267	51.67
Female	1,185	48.33
Population group		
Black African	1,037	42.29
Coloured	993	40.50
White	411	16.76
Indian or Asian	6	0.24
Other	5	0.20
First language		
Afrikaans	1,447	61.65
isi hosa	759	32.34
English	81	3.45
Sesotho	17	0.72
Setswana	16	0.68
Sepedi	15	0.64
Sign language	7	0.30
isi ulu	4	0.17
itsonga	1	0.04

Age group	
Young (0-14)	29,5
Working Age (15-64)	66,1
Elderly (65)	4,4
Young (0-14)	29,5
Dependency ratio	51,4
Sex ratio	107,2
Education	
No schooling aged 20	21,4
Higher education aged 20	12

Matric aged 20	10,5
Households and services	
Average household si e	2,6
Female headed households	11
Formal dwellings	95,7
Housing owned/paying off	16,5
Flush toilet connected to sewerage	34,7
Weekly refuse removal	3,5
Piped water inside dwelling	52,3
Electricity for lighting	86,6

The Paarde Valley facility falls within the Inxuba Yethemba NU, Sub Place 278002001 according to Census 2011. With a population density of 0.89 people per square kilometre the area has a slightly higher population density than Umsobomvu NU. The demographic data in respect of Inxuba Yethemba NU, listed as Sub Place 278002001 in accordance with Census 2011, is as follows:

Geographic area 11,491.97 km
Population 10,208
Population density 0.89/km
Households 2,567
Household density 0.22/km

Gender		
Male	5,466	53.80
Female	4,694	46.21
Population group		
Black African	4,987	48.85
Coloured	3,561	34.88
White	1,389	13.61
Other	262	2.57
Indian or Asian	9	0.09
First language		
Afrikaans	5,405	53.60
isi hosa	4,070	40.36
English	383	3.80
Other	99	0.98
Sesotho	39	0.39
Setswana	32	0.32
Sign language	15	0.15
itsonga	13	0.13

isiNdebele	9	0.09	
isi ulu	9	0.09	
Sepedi	7	0.07	
Tshivenda	2	0.02	
SiSwati	2	0.02	
Not applicable	124		
Age group			
Young (0-14)			28,3
Working Age (15-64)			68,8
Elderly (65)			2,9
Dependency ratio			45,5
Sex ratio			116,2
Education			
No schooling aged 20			10,7
Higher education aged 20			8
Matric aged 20			9,5
Households and services			
Average household si e			3,4
Female headed households			10,5
Formal dwellings			94,9
Housing owned/paying off			12
Flush toilet connected to sewerage			20,2
Weekly refuse removal			5,9
Piped water inside dwelling			37,1
Electricity for lighting			86,1

The closest urban areas to the Umsobomvu Solar PV Facilities are the towns of:

- Noupoort and satellite settlement of wa amuxolo
- Hanover, and
- Middleburg.

Noupoort and Kwazamuxolo

Calculated in a straight line, the project is located about 19 km southwest of the town of Noupoort and the adjoining settlement of wa amuxolo which are situated in the Umsobomvu Local Municipality and Pixley ka Seme District Municipality in the Northern Cape Province. Attaining municipal status in 1942, Noupoort functioned as a traction changeover facility on the Noupoort-Bloemfontein railway line and was commercially dependent on rail activity. A decline in demand for rail services resulted in an economic decline and the degradation of the town. The satellite settlement of wa amuxolo is located alongside Noupoort and the demographics of Noupoort and wa amuxolo are provided separately below:

Noupoort – Main Place 370005 from Census 2001:
Geographic area 9.42 km
Population 4 514 people
Population density 479.3/km
Households 1 036
Household density 110.0/km

Gender	**People**	**Percentage**	
Female	1,803	54.08	
Male	1,531	45.92	
Population group			
Black African	3,289	98.65	
Coloured	26	0.78	
Indian or Asian	13	0.39	
Other	5	0.15	
First language			
isi hosa	3,175	95.23	
Afrikaans	52	1.56	
English	37	1.11	
Sepedi	15	0.45	
Other	12	0.36	
Setswana	11	0.33	
Sign language	10	0.30	
Sesotho	9	0.27	
isi ulu	8	0.24	
isiNdebele	4	0.12	
itsonga	1	0.03	
Age group			
Young (0-14)			34,6
Working Age (15-64)			58,8
Elderly (65)			6,6
Dependency ratio			70,1
Sex ratio			92,7
Education			
No schooling aged 20			12,8
Higher education aged 20			5,5
Matric aged 20			21,4
Households and services			
Average household si e			4,2

Female headed households	39,2
Formal dwellings	95,1
Housing owned/paying off	48,9
Flush toilet connected to sewerage	97,4
Weekly refuse removal	86,9
Piped water inside dwelling	45,1
Electricity for lighting	92,4

Kwazamuxolo – Main Place 370006 from Census 2011:

Geographic area 0.74 km

Population 3 334 people

Population density 4 534.56/km

Households 913

Household density 1 241.77/km

Gender	**People**	**Percentage**
Female	1,803	54.08
Male	1,531	45.92
Population group		
Black African	3,289	98.65
Coloured	26	0.78
Indian or Asian	13	0.39
Other	5	0.15
First language		
isi hosa	3,175	95.23
Afrikaans	52	1.56
English	37	1.11
Sepedi	15	0.45
Other	12	0.36
Setswana	11	0.33
Sign language	10	0.30
Sesotho	9	0.27
isi ulu	8	0.24
isiNdebele	4	0.12
itsonga	1	0.03

Age group	
Young (0-14)	29
Working Age (15-64)	63,3
Elderly (65)	7,7
Dependency ratio	57,9
Sex ratio	84,9
Education	
No schooling aged 20	11,6

Higher education aged 20	2,1
Matric aged 20	19,9
Household services	
Average household si e	3,6
Female headed households	51,6
Formal dwellings	96,3
Housing owned/paying off	60
Flush toilet connected to sewerage	79,5
Weekly refuse removal	98,6
Piped water inside dwelling	35,2
Electricity for lighting	94,2

Hanover

Calculated along a straight line, the project lies some 35 km southwest of Hanover which is situated in the Emthanjeni Local Municipality and Pixley ka Seme District Municipality in the Northern Cape Province. The town was established in 1854 and served as an administrative, educational and religious centre for the surrounding area. Hanover was named after Hanover in Germany and is now situated on the N1, virtually halfway between Cape Town and ohannesburg. Prior to 1884 and due to its central position Hanover also served as a central point for travellers travelling to the various towns and cities across South Africa. However, with the arrival of the railway, this function was to diminish changing the fortunes of the town and its inhabitants. Today the town has a certain tourist attraction with a natural spring, Anglo Boer War history, its central position and location along the N1 and within the aroo. Demographic data pertaining to Hanover is presented below.

Hanover – Main Place 371006 from Census 2011:
Geographic area 80.77 km
Population 4 594 people
Population density 56.88/km
Households 1 083
Household density 13.41/km

Gender	People	Percentage
Female	2,362	51.41
Male	2,232	48.59
Population group		
Black African	2,255	49.09
Coloured	2,133	46.43
White	156	3.40
Other	25	0.54
Indian or Asian	25	0.54

First language		
Afrikaans	2,438	54.91
isi hosa	1,746	39.32
English	68	1.53
Sesotho	61	1.37
Other	35	0.79
Setswana	34	0.77
Sign language	20	0.45
isi ulu	12	0.27
Sepedi	10	0.23
isiNdebele	8	0.18
itsonga	3	0.07
Tshivenda	3	0.07
SiSwati	3	0.07
Not applicable	154	

Age group	
Young (0-14)	34
Working Age (15-64)	60,6
Elderly (65)	5,4
Dependency ratio	65,1
Sex ratio	94,5
Education	
No schooling aged 20	16,8
Higher education aged 20	4,4
Matric aged 20	18,1
Households and services	
Average household si e	3,9
Female headed households	43,7
Formal dwellings	98
Housing owned/paying off	38
Flush toilet connected to sewerage	58,8
Weekly refuse removal	82,3
Piped water inside dwelling	34,2
Electricity for lighting	94,3

Middelburg

The project lies 32 km northwest of Middelburg when calculated along a straight line. Established in 1852 Middelburg falls within the Inxuba Yethemba Local Municipality in the Chris Hani District Municipality of the Eastern Cape Province and serves as an administrative, educational and religious centre for the surrounding areas. Middelburg also has a certain tourist attraction due to its rich Anglo Boer War history, with the Third Manchester Regiment having been stationed just outside the town, and its central position within the Great aroo. Demographic data relating to Middelburg is presented below.

Middelburg – Main Place 370006 from Census 2011:
Geographic area 44.76 km
Population 18 681 people
Population density 417.38/km
Households 5 337
Household density 119.24/km

Gender	**People**	**Percentage**
Female	9,939	53.20
Male	8,742	46.80
Population group		
Black African	9,192	49.21
Coloured	8,197	43.88
White	1,167	6.25
Other	74	0.40
Indian or Asian	50	0.27
First language		
Afrikaans	9,508	52.31
isi hosa	7,921	43.58
English	345	1.90
Sesotho	86	0.47
Setswana	83	0.46
Sign language	78	0.43
Other	53	0.29
isi ulu	34	0.19
Sepedi	23	0.13
isiNdebele	19	0.10
SiSwati	13	0.07
itsonga	7	0.04
Tshivenda	6	0.03
Not applicable	506	

Age group	
Young (0-14)	31,3
Working Age (15-64)	62,2
Elderly (65)	6,5
Dependency ratio	60,7
Sex ratio	88
Education	
No schooling aged 20	10,6

Higher education aged 20	5,9
Matric aged 20	19,5
Households and services	
Average household si e	3,4
Female headed households	44,7
Formal dwellings	95,4
Housing owned/paying off	51,7
Flush toilet connected to sewerage	97
Weekly refuse removal	92,2
Piped water inside dwelling	89,8
Electricity for lighting	96,5

5. IDENTIFICATION OF POTENTIAL IMPACTS

The social impact variables considered across the project are in accordance with Vanclay's list of social impact variables clustered under the following main categories as adapted by Wong (Vanclay, 2002; Wong, 2013) and include;

1. Health and social well-being
2. uality of the living environment (Liveability)
3. Economic
4. Cultural.

These categories are not exclusive and at times tend to overlap as certain processes may have an impact within more than one category.

Under the following section each of the solar photovoltaic (PV) energy facilities and associated grid connection infrastructure is separately considered and assessed in respect of these impacts.

5.1. HEALTH AND SOCIAL WELLBEING

The health and social wellbeing impacts related to the project include.

- Annoyance, dust noise and shadow flicker
- Increase in crime
- Increased risk of HIV infections
- Influx of construction workers and job seekers
- Ha ard exposure.

5.1.1. Annoyance, dust and noise

Annoyance, dust and noise will be more evident during the construction phase of the project, as construction activities will result in disruptions and the generation of dust and noise from construction vehicles and equipment. Site specific activities such as site clearance and the deliveries of materials, equipment, plant and the transportation of the workforce along unsealed access roads will generate the most dust and noise. Dust that accumulates on foliage and grasses that is used for gra ing may result in the foliage and those grasses becoming unpalatable for livestock and/or game. This may in turn have an effect on farming activities within the vicinity of the project site and along the access road over the construction period. This impact will negatively impact sensitive receptors situated within or in close proximity to the project site, and could also potentially impact surrounding land users. The impact of noise and dust on surrounding land users and local farmsteads can be reduced to acceptable levels through the application of appropriate mitigation measures.

Over the operational phase of the project far less disruptions, dust and noise is expected in the vicinity of the project site, however, along the unsealed access road dusts and noise can be generated by traffic travelling to and from the project site. Even at low speeds heavy vehicles could generate noise in what is a remote area, particularly if they need to at times engage low gear ratios.

5.1.2. Increase in crime

The projects fall within the Noupoort Precinct which, according to Crime Stats SA, has a relatively high level of crime with a total of 530 reported crimes in 2018[1]. The surrounding precincts of Hanover and Middelburg also have relatively high levels of reported crime at 428 and 1 474 respectively. It is likely that these crimes are associated with the more densely populated urban areas and that the level of crime in the sparsely populated urban areas would be lower, however, there are no available statistics to confirm this. It is often opportunistic crime, stock theft, the abuse of alcohol and relationship related crimes that are associated with construction activities.

Considering the relative remoteness of the project it is unlikely that the project will lead to any significant increase in crime levels in the area, however, it would be prudent for the developers to ensure that processes are put in place through which any suspected criminal activates associated with the project can be easily communicated and swiftly addressed. The

[1]According to Crime Stats SA as at 28 April 2018 www.crimestatssa.com/precinct.php id 798

construction phase carries with it a higher risk of associated criminal activates than would be associated with the operational phase.

5.1.3. INCREASED RISK OF HIV INFECTIONS

At 17.5 , the Northern Cape Province has the lowest HIV prevalence rate when compared to all other South African provinces. At a district level the Pixley ka Seme DM has the seventh lowest HIV prevalence rate when compared against all district municipalities across the country. In contrast the Eastern Cape Province has the third highest provincial HIV prevalence rate and the Chris Hani DM the 14th highest district level prevalence rate, each with relative HIV prevalence rates of 31.4 and 34.5 percent. These higher prevalence rates are likely to occur within the higher density urban areas and along transport corridors. As all three project sites fall within sparsely populated rural areas the HIV prevalence rate within the immediate vicinity of the projects is likely to be low. Considering this together with the fact that sexually transmitted diseases tend to be spread by construction and transport workers (Singh & Malaviya, 1994; Ramjee & Gouws, 2002; Meintjes, Bowen, & Root, 2007; World Bank Group, 2016; Bowen, Dorrington, Distiller, Lake, & Besesar, 2008; Bowen P. , Govender, Edwards, & Cattell, 2016; ikwasi & Lukwale, 2017; Bowen P. , Govender, Edwards, & Lake, 2018) and the high prevalence of HIV across the Eastern Cape, opens the area to a high risk of HIV infections. This risk is likely to peak during the construction phase of the project as the conduction workforce increases and material and equipment is delivered to site but is likely to subside during the operational phase.

Due to the low HIV prevalence in the area it is important that this issue be given serious attention and that the appropriate mitigation measures are implemented and the situation is closely monitored throughout the construction and operational phases of the project. The risk of the spread of HIV is most prevalent on a cumulative basis and is addressed as such under section 9: Cumulative impacts below.

5.1.4. INFLUX OF CONSTRUCTION WORKERS AND JOB SEEKERS

It is estimated that over the construction period of each of the three solar PV facilities, the construction workforce will average 126 workers peaking at 297 workers. It is likely that 75 of this workforce will be recruited from within local communities. The influx of workers could lead to the disruption of social networks with the formation of temporary relationships and an increase in pregnancy which may place pressures on local family units. Apart from this the arrival of construction workers may result in the formation of a subculture that could manifest in antisocial behaviour which conflicts with the expectations of local communities. This may result in these local communities, who are accustomed to a quiet, rural environment, becoming dissatisfied with the neighbourhood. These disruptions are, however, more likely to occur in the nearby urban areas such as Noupoort, Hanover and to a lesser degree due to the si e of the population, in Middleburg, when workers seek recreational activities.

During the operational phase of the project the workforce will be comprised of 16 workers who will be accommodated off site. Consequently, the risks associated with disruptions to social networks will be minimal over the operation phase of the project.

5.1.5. Hazard exposure

The use of heavy equipment and vehicles and an increase in vehicle traffic within the vicinity of all construction sites will result in an increased risk to the personal safety of people and animals. Of particular concern are increased ha ards faced by pedestrians, cyclists and motorists with emphasis on vulnerable groups such as children and the elderly. Excavation work and trenches also pose a ha ard to the safety of people, particularly children and animals, who may fall into these works and may have difficulty in getting out. However due to the low population numbers within the vicinity of the proposed development this risk is likely to be low and the appropriate mitigation measure, such as fencing, can reduce the impact further. There will also be an increased risk of fires brought about through construction workers lighting fires for cooking and for warmth during cold periods. Nevertheless, with the recommended mitigation measures being successfully put in place this can be controlled.

5.2. Quality of the living environment

The following quality of the living environment impacts are related to the project.

- Disruption of daily living patterns
- Disruptions to social and community infrastructure
- Transformation of the sense of place.

5.2.1. Disruption of daily living patterns

If there are any disruptions to daily living patterns these are likely to be minimal and restricted to the construction phase of the project. This impact will be mainly associated with the site and the main access roads. These disruptions are only likely to be associated with the delivery of materials and machinery to site and the transportation of workers to and from site.

Disruptions of daily living patterns are likely to be negligible during the operation phase of the project as these will be associated with maintenance and repair activities which will be far less frequent and intense than construction activities are likely to be.

5.2.2. DISRUPTION TO SOCIAL AND COMMUNITY INFRASTRUCTURE

An increase in the population of the area as a result of the workforce associated with the project has the potential to place pressure on existing community services supplies and infrastructure such as schools, health care facilities, access to water, electricity and sanitary services. With the workforce associated with the construction phase of each of the solar PV facilities peaking at 297 people, of which 75 are likely to be recruited locally, it is unlikely that in isolation the project will have any significant effect on social and community infrastructure in the area. However, on a cumulative basis, considering the activities taking place and planned for the area, there is likely to be a significant impact in this regard. This impact is dealt with in greater depth under section 8.3: Cumulative Impacts below.

Over the operational phase of the project, with a smaller workforce being recruited locally, it is unlikely that there will be significant disruptions to community and social infrastructure.

5.2.3. TRANSFORMATION OF THE SENSE OF PLACE

Within a social context a sense of place includes a wide range of criteria, all or some of which add meaning to a particular area for individuals and groups. These criteria may include the vista, geography, urban layout, flora and fauna, community, history and fragrance of a place amongst many others and are uniquely interpreted on an individual basis. Some individuals may embrace changes to the sense of place that others may reject and for some it may merely be a change in the demographics of an area that leaves them feeling threatened, vulnerable and insecure. Groups and group membership can help to reinforce the sense of place of an area and can also serve to reinforce fears and suspicions associated with pending changes to the sense of place. A sense of place has much to do with unique individual perceptions attached to the location and is subjective by nature.

One of these criteria is the visual aspect, which was the subject of the Visual Impact Assessment specialist report in which it is indicated that:

> "*The area is not typically valued for its tourism significance and there is limited human habitation resulting in relatively few potentially sensitive receptors in the area. A total of twenty six (26) potentially sensitive receptors were identified in*

> *the combined study area, three (3) of which are considered to be sensitive receptors as they are linked to leisure/nature-based tourism activities in the area. None of the receptors are however expected to experience high levels of visual impact from any of the proposed PV facilities or the grid connection infrastructure. Although the N10 receptor road traverses the study area, motorists travelling along this route are only expected to experience moderate impacts from the proposed Mooi Plaats solar PV facility and from the grid connection infrastructure associated with all three projects*" (SiVEST SA (Pty) Ltd, 2019b, p. 116).

Notwithstanding this, however, the issue regarding the sense of place is likely to remain controversial as a sense of place is personal and subjective with some accepting changes to the landscape in support of renewable energy while others may reject them (Farhar, Hunter, irkland, & Tierney, 2010; Carlisle, ane, Solan, & oe, 2014).

5.3. ECONOMIC

The economic impacts related to the project include.

- ob creation and skills development
- Socio-economic stimulation

5.3.1. JOB CREATION AND SKILLS DEVELOPMENT

The project will lead to the creation of both direct and indirect job which will have a positive economic benefit within the region. In this regard there are 297 jobs associated with the construction phase of each of the solar PV facilities and 16 with the operational phase of each facility. During construction 3 569 person-months are likely to be created of which 2 679 or 75 will be allocated to local communities creating employment opportunities for residents of Middelburg, Noupoort and Hanover. Many of the beneficiaries are likely to be historically disadvantaged members of the community and the project will provide opportunities to develop skills amongst these people. The operational phase will employ approximately 16 people full time for a period of up to 20 years.

5.3.2. SOCIO-ECONOMIC STIMULATION

Apart from these jobs the project is also likely to stimulate the local economy and again this is likely to be most significant at a cumulative level. Nevertheless, there will be a significant economic contribution attached to all three of the solar PV facilities. This contribution will be in the form of disposable salaries and the purchases of services and supplies from the local communities in and around the towns of Noupoort, Hannover and Middleburg estimated at 40 of the total project value yet to be finalised.

Apart from job creation and procurement spend the project will also have broader positive socio-economic impacts as far as socio-economic development contributions are concerned. Although, at the point of writing, the project developer had not as yet put a corporate social responsibility plan in place the intention is to either, fall in line with the REIPPP BID guidelines or put an equivalent plan in place. This will create an opportunity to support the local community over the life span of the operational phase of the project which will stretch over a 20 year period. At a national level the project also has the potential to contribute towards the national grid requirements as part of the Government's vision to source 10.5% of the country's energy through solar power by 2030 (Department of Energy Republic of South Africa, 2018, p. 41).

5.4. CULTURAL IMPACTS

At a social level it is likely that any cultural impacts would be associated with sensitive archaeological and/or heritage sites that may be found. In this regard a Heritage Impact Assessment was undertaken and it was found that:

> "*The projected impact assessment indicates that unmitigated impacts during construction can be MEDIUM to HIGH but reduced to LOW with the implementation of management measures. Impacts during the operational and decommissioning phase is projected to be LOW with the implementation of management measures.*
>
> *These findings provide the basis for the recommendation:*
>
> - *further field truthing through an archaeological walk down and palaeontological study covering the site. The aim of this will be to compile a comprehensive database of heritage sites in the study areas, with the aim of developing a heritage management plan for*

inclusion in the Environmental Management Plan as derived from the EIA (PGS Heritage (Pty) Ltd, 2019, p. 37).

At this point no heritage resources have been identified that could have cultural significance. If these are identified at a later point they can be addressed in the heritage report and as such will not be pursued any further at the social level.

6. IMPACT ASSESSMENT

The impacts discussed above are assessed below in respect of the following three photovoltaic facilities and their respective associated grid infrastructure:

- Mooi Plaats Solar PV Facility
- Wonderheuvel Solar PV Facility
- Paarde Valley Solar PV Facility.

From a social perspective it makes far more sense to assess each of the solar PV facilities together with their respective associated grid infrastructure based on the following reasons:

4. The solar PV facilities and associated grid infrastructure are interdependent. If the one was not to exist neither would the other. In this sense each is an integral part of the other and cannot function independently.
5. The focus at a social level is far broader than is the case with certain other specialist studies that may have a narrower, project footprint specific emphasis.
    a. For instance, to consider certain aspects such as job creation; the influx of workers; socio-economic stimulation and the transformation of the sense of place in isolation would deter from the actual impact that may occur when considered on a combined basis and in essence would not make logical sense.
6. Any site specific implications associated with the grid infrastructure alternatives can be specifically addressed and mitigated as well as noted when discussing the motivation for selecting the socially preferred grid connection alternatives.

These impacts are assessed in respect of the following phases of the project:

- Planning and design
- Construction
- Operational
- Decommissioning, and
- The ‘no go” option.

6.1. PLANNING AND DESIGN PHASE

It is evident that the project fits with legislation and key planning and policy documentation. In this regard renewable energy facilities are supported on a national, provincial and municipal level as indicated under section 3.1: Policy and legislation fit.

However, provincial and municipal documentation also regards tourism as an important resource for the area. In addition to this there have been concerns raised regarding the cumulative effect of the proliferation of renewable energy in the region and the impact that this may have on the sense of place of the area. In this regard see section 8.3: Transformation of sense of place.

6.2. CONSTRUCTION PHASE

Most of the impacts discussed above apply over the short-term to the construction phase of the project and include:

- Annoyance, dust and noise
- Increase in crime
- Increased risk of HIV infections
- Influx of construction workers and job seekers
- Ha ard exposure
- Disruption of daily living patterns
- Disruptions to social and community infrastructure
- ob creation and skills development
- Socio-economic stimulation.

In this respect the construction phase of each of the three solar PV facilities including the associated grid infrastructure is separately assessed with suggested mitigation and optimisation measures being presented in the following tables:

- Mooi Plaats Solar PV Facility and associated grid connection infrastructure – **Table 6**
- Wonderheuvel Solar PV Facility and associated grid connection infrastructure – **Table 7**
- Paarde Valley Solar PV Facility and associated grid connection infrastructure – **Table 8**.

Table 6: Mooi Plaats Solar PV Facility and associated grid connection infrastructure – Construction phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Annoyance, dust and noise	Annoyance, dust and noise generated through construction activities.	1	3	1	2	1	2	16	-	Low	Apply appropriate dust suppressant to gravel roads on a regular basis Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. Ensure all vehicles are roadworthy and drivers are qualified and made aware of the potential noise and dust issues. Appoint a community liaison officer to deal with complaints and grievances from the public.	1	3	1	2	1	1	8	-	Low
Increase in crime	An increase in crime associated with the construction phase of the project.	2	3	2	2	2	3	33	-	Medium	All workers should carry identification cards and wear identifiable clothing. Fence off the construction site and control access to the site. Appoint an independent security company to monitor the site. Appoint a community liaison officer. Encourage local people to report any suspicious activity associated with the construction site to the community liaison officer. A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC contractor and sub-contractors remain responsible and accountable. This will also facilitate the	2	3	2	2	2	2	22	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											identification and implementation of additional mitigation measures if required. Prevent loitering within the vicinity of the construction camp as well as construction sites by recruiting off site via an offsite recruiting office/agent, whatever is most appropriate.									
Increased risk of HIV and AIDS	Increased risk of HIV and AIDS due to the influx of workers, job seekers and deliveries and availability of disposable income.	3	3	3	3	4	3	48	-	High	Ensure that an onsite HIV and AIDS policy is in place and that construction workers are exposed to a health and HIV/AIDS awareness educational programme within the first month of construction. Provide voluntary and free counselling, free testing and condom distribution services to the workforce. Where feasible extend the HIV/AIDS programme into the community with specific focus on schools and youth clubs.	3	3	3	3	4	2	32	-	Medium
Influx of construction workers and job seekers	Influx of construction workers and job seekers resulting in a temporary change in demographics	2	3	2	2	2	2	22	-	Low	Communicate, through Community Leaders and Ward Councillors, the limitation of opportunities created by the project to prevent an influx of job seekers. Develop and implement a local procurement policy which prioritises “locals first” to reduce the movement of people into the area in search of work. Draw up a recruitment policy in conjunction with Community Leaders	2	2	2	2	2	2	20	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											and Ward Councillors and ensure compliance with this policy.									
Ha ard exposure	Exposure to ha ards associated with construction activities and the delivery of heavy machinery and equipment to site.	2	3	2	2	1	2	20	-	Low	Ensure all construction equipment and vehicles are properly maintained at all times. Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly. Ensure that fires lit by construction staff are only ignited in designated areas and that the appropriate safety precautions, such as not lighting fires in strong winds and completely extinguishing fires before leaving them unattended, are strictly adhered to. Make staff aware of the dangers of fire during regular tool box talks. A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC contractor, and sub-contractors remain responsible and accountable and to facilitate the identification and implementation of	2	2	2	2	1	2	18	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											additional mitigation measures if required. Where necessary training should be provided on the implementation of the grievance mechanism to ensure that those who are most likely to be affected by the project are suitably equipped in the mechanism of raising concerns and having these addressed. Compile and implement a Fire Management and Emergency Preparedness Response Plan.									
Disruption of daily living patterns	Disruption of daily living patterns due to construction activities and deliveries of machinery and heavy equipment to site.	2	3	2	2	1	2	20	-	Low	Ensure that, at all times, people have access to their properties as well as to social facilities. All vehicles must be roadworthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. Heavy vehicles should be inspected regularly to ensure their road safety worthiness. The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if damaged due to construction activities.	2	2	2	2	1	2	18	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Disruption of services supplies and infrastructure	Disruptions of community facilities and infrastructure due to construction activities and an influx of workers.	2	3	2	2	1	2	20	-	Low	Regularly monitor the effect that the construction activities is having on public infrastructure and immediately report any damage to infrastructure to the appropriate authority.	2	2	2	2	1	2	18	-	Low
ob creation and skills development	The creation of job opportunities and the development of skills amongst the workforce.	3	3	2	2	1	2	22		Low	Wherever feasible, local residents should be recruited to fill semi and unskilled jobs. Women should be given equal employment opportunities and encouraged to apply for positions. A skills transfer plan should be put in place at an early stage and workers should be given the opportunity to develop skills which they can use to secure jobs elsewhere post-construction. A procurement policy promoting the use of local business should, where possible, be put in place to be applied throughout the construction phase.	3	3	2	2	2	2	24		Medium
Socio-economic development	Potential for positive socio-economic opportunities for the region associated with downstream business opportunities and corporate social responsibility initiatives.	3	3	2	2	2	2	24		Medium	A procurement policy promoting the use of local business should, where possible, be put in place to be applied throughout the construction phase.	3	3	2	2	3	2	26		Medium

Table 7: Wonderheuvel Solar PV Facility and associated grid connection infrastructure – Construction phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Annoyance, dust and noise	Annoyance, dust and noise generated through construction activities.	1	3	1	2	1	2	16	-	Low	Apply appropriate dust suppressant to gravel roads on a regular basis. Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. Ensure all vehicles are roadworthy and drivers are qualified and made aware of the potential noise and dust issues. Appoint a community liaison officer to deal with complaints and grievances from the public.	1	3	1	2	1	1	8	-	Low
Increase in crime	An increase in crime associated with the construction phase of the project.	2	3	2	2	2	3	33	-	Medium	All workers should carry identification cards and wear identifiable clothing. Fence off the construction site and control access to the site. Appoint an independent security company to monitor the site. Appoint a community liaison officer. Encourage local people to report any suspicious activity associated with the construction site to the community liaison officer. A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC contractor and sub-contractors remain responsible and accountable. This will also facilitate the	2	3	2	2	2	2	22	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											identification and implementation of additional mitigation measures if required. Prevent loitering within the vicinity of the construction camp as well as construction sites by recruiting off site via an offsite recruiting office/agent, whatever is most appropriate.									
Increased risk of HIV and AIDS	Increased risk of HIV and AIDS due to the influx of workers, job seekers and deliveries and availability of disposable income.	3	3	3	3	4	3	48	-	High	Ensure that an onsite HIV and AIDS policy is in place and that construction workers are exposed to a health and HIV/AIDS awareness educational programme within the first month of construction. Provide voluntary and free counselling, free testing and condom distribution services to the workforce. Where feasible extend the HIV/AIDS programme into the community with specific focus on schools and youth clubs.	3	3	3	3	4	2	32	-	Medium
Influx of construction workers and job seekers	Influx of construction workers and job seekers resulting in a temporary change in demographics	2	3	2	2	2	2	22	-	Low	Communicate, through Community Leaders and Ward Councillors, the limitation of opportunities created by the project to prevent an influx of job seekers. Develop and implement a local procurement policy which prioritises "locals first" to prevent the movement of people into the area in search of work. Draw up a recruitment policy in conjunction with Community Leaders	2	2	2	2	2	2	20	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											and Ward Councillors and ensure compliance with this policy.									
Ha ard exposure	Exposure to ha ards associated with construction activities and the delivery of heavy machinery and equipment to site.	2	3	2	2	1	2	20	-	Low	Ensure all construction equipment and vehicles are properly maintained at all times. Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly. Ensure that fires lit by construction staff are only ignited in designated areas and that the appropriate safety precautions, such as not lighting fires in strong winds and completely extinguishing fires before leaving them unattended, are strictly adhered to. Make staff aware of the dangers of fire during regular tool box talks. A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC contractor, and sub-contractors remain responsible and accountable and to facilitate the identification and implementation of	2	2	2	2	1	2	18	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											additional mitigation measures if required. Where necessary training should be provided on the implementation of the grievance mechanism to ensure that those who are most likely to be affected by the project are suitably equipped in the mechanism of raising concerns and having these addressed. Compile and implement a Fire Management and Emergency Preparedness Response Plan.									
Disruption of daily living patterns	Disruption of daily living patterns due to construction activities and deliveries of machinery and heavy equipment to site.	2	3	2	2	1	2	20	-	Low	Ensure that, at all times, people have access to their properties as well as to social facilities. All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. Heavy vehicles should be inspected regularly to ensure their road safety worthiness. The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if damaged due to construction activities.	2	2	2	2	1	2	18	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Disruption of services supplies and infrastructure	Disruptions of community facilities and infrastructure due to construction activities and an influx of workers.	2	3	2	2	1	2	20	-	Low	Regularly monitor the effect that the construction activities is having on public infrastructure and immediately report any damage to infrastructure to the appropriate authority.	2	2	2	2	1	2	18	-	Low
ob creation and skills development	The creation of job opportunities and the development of skills amongst the workforce.	3	3	2	2	1	2	22		Low	Wherever feasible, local residents should be recruited to fill semi and unskilled jobs. Women should be given equal employment opportunities and encouraged to apply for positions. A skills transfer plan should be put in place at an early stage and workers should be given the opportunity to develop skills which they can use to secure jobs elsewhere post-construction. A procurement policy promoting the use of local business should, where possible, be put in place to be applied throughout the construction phase.	3	3	2	2	2	2	24		Medium
Socio-economic development	Potential for positive socio-economic opportunities for the region associated with downstream business opportunities and corporate social responsibility initiatives.	3	3	2	2	2	2	24		Medium	A procurement policy promoting the use of local business should, where possible, be put in place to be applied throughout the construction phase.	3	3	2	2	3	2	26		Medium

Table 8: Paarde Valley Solar PV Facility and associated grid connection infrastructure – Construction phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Annoyance, dust and noise	Annoyance, dust and noise generated through construction activities.	1	3	1	2	1	2	16	-	Low	Apply appropriate dust suppressant to gravel roads on a regular basis Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. Ensure all vehicles are roadworthy and drivers are qualified and made aware of the potential noise and dust issues. Appoint a community liaison officer to deal with complaints and grievances from the public.	1	3	1	2	1	1	8	-	Low
Increase in crime	An increase in crime associated with the construction phase of the project.	2	3	2	2	2	3	33	-	Medium	All workers should carry identification cards and wear identifiable clothing. Fence off the construction site and control access to the site. Appoint an independent security company to monitor the site. Appoint a community liaison officer. Encourage local people to report any suspicious activity associated with the construction site to the community liaison officer. A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC contractor and sub-contractors remain responsible and accountable. This will also facilitate the	2	3	2	2	2	2	22	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											identification and implementation of additional mitigation measures if required. Prevent loitering within the vicinity of the construction camp as well as construction sites by recruiting off site via an offsite recruiting office/agent, whatever is most appropriate.									
Increased risk of HIV and AIDS	Increased risk of HIV and AIDS due to the influx of workers, job seekers and deliveries and availability of disposable income.	3	3	3	3	4	3	48	-	High	Ensure that an onsite HIV and AIDS policy is in place and that construction workers are exposed to a health and HIV/AIDS awareness educational programme within the first month of construction. Provide voluntary and free counselling, free testing and condom distribution services to the workforce. Where feasible extend the HIV/AIDS programme into the community with specific focus on schools and youth clubs.	3	3	3	3	4	2	32	-	Medium
Influx of construction workers and job seekers	Influx of construction workers and job seekers resulting in a temporary change in demographics	2	3	2	2	2	2	22	-	Low	Communicate, through Community Leaders and Ward Councillors, the limitation of opportunities created by the project to prevent an influx of job seekers. Develop and implement a local procurement policy which prioritises “locals first” to prevent the movement of people into the area in search of work. Draw up a recruitment policy in conjunction with Community Leaders	2	2	2	2	2	2	20	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											and Ward Councillors and ensure compliance with this policy.									
Ha ard exposure	Exposure to ha ards associated with construction activities and the delivery of heavy machinery and equipment to site.	2	3	2	2	1	2	20	-	Low	Ensure all construction equipment and vehicles are properly maintained at all times. Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly. Ensure that fires lit by construction staff are only ignited in designated areas and that the appropriate safety precautions, such as not lighting fires in strong winds and completely extinguishing fires before leaving them unattended, are strictly adhered to. Make staff aware of the dangers of fire during regular tool box talks. A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC contractor, and sub-contractors remain responsible and accountable and to facilitate the identification and implementation of	2	2	2	2	1	2	18	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											additional mitigation measures if required. Where necessary training should be provided on the implementation of the grievance mechanism to ensure that those who are most likely to be affected by the project are suitably equipped in the mechanism of raising concerns and having these addressed. Compile and implement a Fire Management and Emergency Preparedness Response Plan.									
Disruption of daily living patterns	Disruption of daily living patterns due to construction activities and deliveries of machinery and heavy equipment to site.	2	3	2	2	1	2	20	-	Low	Ensure that, at all times, people have access to their properties as well as to social facilities. All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. Heavy vehicles should be inspected regularly to ensure their road safety worthiness. The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if damaged due to construction activities.	2	2	2	2	1	2	18	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Disruption of services supplies and infrastructure	Disruptions of community facilities and infrastructure due to construction activities and an influx of workers.	2	3	2	2	1	2	20	-	Low	Regularly monitor the effect that the construction activities is having on public infrastructure and immediately report any damage to infrastructure to the appropriate authority.	2	2	2	2	1	2	18	-	Low
ob creation and skills development	The creation of job opportunities and the development of skills amongst the workforce.	3	3	2	2	1	2	22		Low	Wherever feasible, local residents should be recruited to fill semi and unskilled jobs. Women should be given equal employment opportunities and encouraged to apply for positions. A skills transfer plan should be put in place at an early stage and workers should be given the opportunity to develop skills which they can use to secure jobs elsewhere post-construction. A procurement policy promoting the use of local business should, where possible, be put in place to be applied throughout the construction phase.	3	3	2	2	2	2	24		Medium
Socio-economic development	Potential for positive socio-economic opportunities for the region associated with downstream business opportunities.	3	3	2	2	2	2	24		Medium	A procurement policy promoting the use of local business should, where possible, be put in place to be applied throughout the construction phase.	3	3	2	2	3	2	26		Medium

6.3. OPERATIONAL PHASE

The social impacts that apply to the operational phase of the project are:

- Transformation of the sense of place and
- Economic
    - ob creation and skills development
    - Socio-economic stimulation

In this respect the operational phase of each of the three solar PV facilities including the associated grid infrastructure is separately assessed with suggested mitigation and optimisation measures being presented in the following tables:

- Mooi Plaats Solar PV Facility and associated grid connection infrastructure – **Table 9**
- Wonderheuvel Solar PV Facility and associated grid connection infrastructure – **Table 10**
- Paarde Valley Solar PV Facility and associated grid connection infrastructure – **Table 11**.

Table 9: Assessment of the Mooi Plaats Solar PV Facility and associated grid connection infrastructure – Operational phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Transformation of the sense of place	Transformation of the sense of place due to the nature of the project.	2	4	4	3	4	3	51	-	High	Apply the mitigation measures suggested in the Visual Impact Assessment Report. Ensure that all affected landowners and tourist associations are regularly consulted. A Grievance Mechanism should be put in place and all grievances should be dealt with in a transparent manner. The mitigation measures recommended in the Heritage Impact Assessment should be followed.	2	4	4	3	4	2	34	-	Medium
ob creation and skills development	The creation of job opportunities and the development of skills amongst the workforce.	2	3	2	2	3	2	24		Medium	Implement a training and skills development programme for locals. Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme.	2	3	2	2	3	2	24		Medium
Socio-economic stimulation	Potential for positive socio-economic opportunities for the region associated with downstream business opportunities and corporate social responsibility initiatives.	3	3	2	3	3	2	28		Medium	Ensure that the procurement policy supports local enterprises. Establish a social responsibility programme either in line with the REIPPP BID guidelines or equivalent. Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme. Ensure that any trusts or funds are strictly managed in respect of outcomes and funds.	3	3	2	3	3	3	42		Medium

Table 10: Assessment of the Wonderheuvel Solar PV Facility and associated grid connection infrastructure – Operational phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Transformation of the sense of place	Transformation of the sense of place due to the nature of the project.	2	4	4	3	4	3	51	-	High	Apply the mitigation measures suggested in the Visual Impact Assessment Report. Ensure that all affected landowners and tourist associations are regularly consulted. A Grievance Mechanism should be put in place and all grievances should be dealt with in a transparent manner. The mitigation measures recommended in the Heritage Impact Assessment should be followed.	2	4	4	3	4	2	34	-	Medium
ob creation and skills development	The creation of job opportunities and the development of skills amongst the workforce.	2	3	2	2	3	2	24		Medium	Implement a training and skills development programme for locals. Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme.	2	3	2	2	3	2	24		Medium
Socio-economic stimulation	Potential for positive socio-economic opportunities for the region associated with downstream business opportunities and corporate social responsibility initiatives.	3	3	2	3	3	2	28		Medium	Ensure that the procurement policy supports local enterprises. Establish a social responsibility programme either in line with the REIPPP BID guidelines or equivalent. Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme. Ensure that any trusts or funds are strictly managed in respect of outcomes and funds.	3	3	2	3	3	3	42		Medium

Table 11: Assessment of the Paarde Valley Solar PV Facility and associated grid connection infrastructure – Operational phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Transformation of the sense of place	Transformation of the sense of place due to the nature of the project.	2	4	4	3	4	3	51	-	High	Apply the mitigation measures suggested in the Visual Impact Assessment Report. Ensure that all affected landowners and tourist associations are regularly consulted. A Grievance Mechanism should be put in place and all grievances should be dealt with in a transparent manner. The mitigation measures recommended in the Heritage Impact Assessment should be followed.	2	4	4	3	4	2	34	-	Medium
ob creation and skills development	The creation of job opportunities and the development of skills amongst the workforce.	2	3	2	2	3	2	24		Medium	Implement a training and skills development programme for locals. Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme.	2	3	2	2	3	2	24		Medium
Socio-economic stimulation	Potential for positive socio-economic opportunities for the region associated with downstream business opportunities and corporate social responsibility initiatives.	3	3	2	3	3	2	28		Medium	Ensure that the procurement policy supports local enterprises. Establish a social responsibility programme either in line with the REIPPP BID guidelines or equivalent. Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme. Ensure that any trusts or funds are strictly managed in respect of outcomes and funds.	3	3	2	3	3	3	42		Medium

6.4. DECOMMISSIONING PHASE

If the project was to be completely decommissioned the major social impacts likely to be associated with this would be the loss of jobs and revenue stream that stimulated the local economy and flowed into the municipal coffers. It is estimated that the project has a lifespan of approximately 20 years and there is the possibility that after this period the solar facility could be replaced with more up-to-date technology that would extend the life of the facilities. Although the loss of a job is significant and can be devastating on an individual and family level, the total number of jobs under threat could be insignificant as the operational staff complement is estimated at a total of 48 across all three facilities and many of these employees will be skilled and could find alternative employment.

Decommissioning will result in a limited number of jobs being created over a short period of time as components are dismantled and the site is cleared. Although positive, this will be a rather insignificant benefit considering the si e of the facilities and the time period attached to decommissioning.

Considering the time period to decommissioning, the uncertainty of what would exactly occur, and the significance of the impact in isolation it would be rather meaningless to attach assessment criteria to decommissioning at this point. However, prior to decommissioning the following mitigation measures are suggested.

Decommissioning mitigation measures

- Ensure that a retrenchment package is in place.
- Ensure that staff have been trained in a manner that would provide them with saleable skills within the job market.
- Ensure that the site is cleared responsibly and left in a safe condition.

7. ASSESSMENT OF 'NO GO' ALTERNATIVE

The 'no go' option would mean that the social environment is not affected as the status quo would remain. On a negative front it would also mean that all the positive aspects associated with the project would not materialise. Consequently, there would be no job creation, no revenue streams into the local economy and municipal coffers and a lost opportunity to enhance the national grid with a renewable source of energy. Considering that Eskom's coal fired power stations are a huge contributor to carbon emissions the loss of a chance to supplement the National Grid through renewable energy would be significant at a national, if not at a global level. The Intergovernmental Panel on Climate Change (6 October 2018, p. 15) has warned that that Co^2 emissions need to be reduce by 45 from 2010 levels by 2030 and to ero by 2050 which basically means that coal must go. The no-project alternative is assed in **Table 12** with regard to all three solar PV facilities and associated infrastructure. The no go alternative is identical in respect of each of the solar PV facilities and to avoid unnecessary repetition is present in one table.

Table 12: No go alterative in respect of all three solar PV facilities

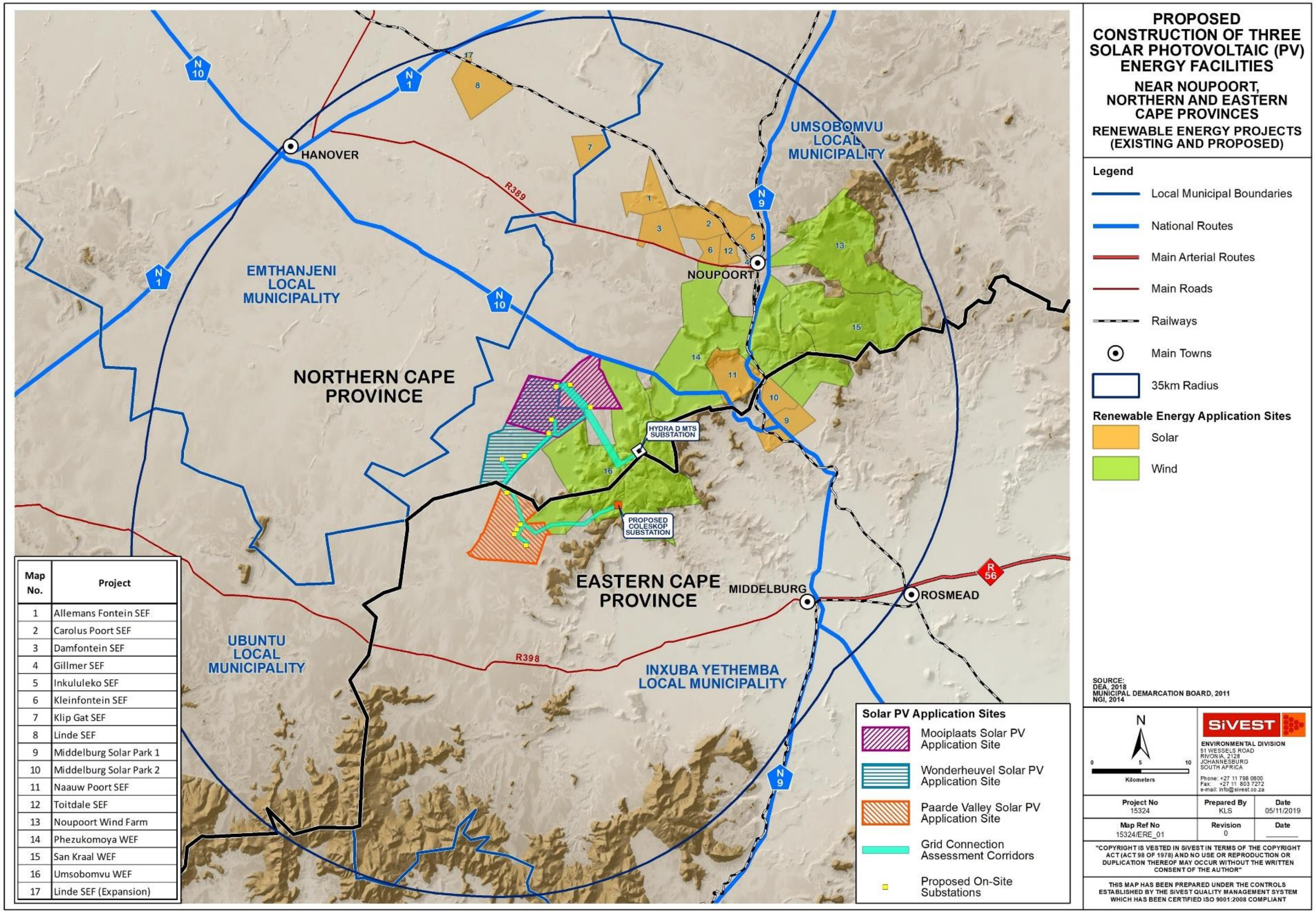
Environmental Significance	
Environmental Parameter	No project
Issue/Impact/Environmental Effect/Nature	Status quo
Extent	4
Probability	4
Reversibility	3
Loss of resources	3
Duration	3
Intensity/magnitude	3
Total	51
Status (+ or -)	-
Status	High

8. Cumulative Impacts

Renewable energy facilities require specific climatic conditions that provide high levels of solar radiation and wind energy. This has resulted in a tendency for these facilities to be clustered in specific areas, such as the aroo, that provide these ideal conditions. Consequently, this grouping of facilities in specific areas has in turn led to cumulative impacts. In this regard the following projects, illustrated in the map in **Figure 13,** have been identified within a 35 km radius of the proposed Umsobomvu Solar PV Energy Facility:

- Allemans Fontein SEF
- Carolus Poort SEF
- Damfontein SEF
- Gillmer SEF
- Inkululeko SEF
- leinfontein SEF
- lip Gat SEF
- Linde SEF
- Middelburg Solar Park 1

- Middelburg Solar Park 2
- Naauw Poort SEF
- Toitdale SEF
- Noupoort Wind Farm
- Phe ukomoya WEF
- San raal WEF
- Umsobomvu WEF, and
- Linde SEF (Expansion).



Source: SiVEST Environmental Division

Figure 13: Proposed renewable energy developments ~35 km radius from site

8.1. REVIEW OF SPECIALIST REPORTS FOR REFS IN THE AREA

The following more specific social issues have been raised in the specialist reports pertaining to the various renewable energy initiatives identified above.

- **Positive impacts**
  - ob creation; Impacts associated with the construction phase are generally short-term
  - Establishment of local community trust
  - Establishment of renewable energy infrastructure
- **Negative impacts**
  - Sense of place
  - Influx of construction workers
  - Impact on family and community relations – STDs and HIV
  - Risk of stock theft, poaching and damage to farm infrastructure
  - Risk of veld fires
  - Impact of heavy vehicles, damage to roads, safety, noise and dust
  - Loss of agricultural land
  - Impact on tourism
- **Indirect impacts**
  - After construction locals may not find future employment
  - Skills and development – increased employability
- **Cumulative impacts**
  - Development of additional renewable energy facilities – increased potential for job creation
  - Impact on family and community relations – STDs and HIV
  - Sense of place
  - Pressure on municipal and social services
- **No-Go option**
  - Loss of renewable energy infrastructure
  - High carbon emissions
  - Unsustainable way to produce electricity
  - Overall social impact
  - Predominantly low significance (positive impact)
  - In respect of climate change – a positive social benefit for society as a whole.

The details of the reports from which these impacts have been sourced are provided in **Table 13**.

Table 13: List of EIA reports for projects within a 35 km radius

Date	Title of report	DEA Ref number	Consultant responsible for report	Page numbers
July 2011	Establishment of Photovoltaic (Solar Power) Farms in the Northern Cape	12/12/20/2258	Sustainable Development Projects cc	4-5, 37-39, 51
February 2012	Environmental Basic Impact Assessment Process Draft Basic Assessment Report, Proposed Toitdale Solar Energy Facility Northern Cape Province	12/12/20/2653	Savannah Environmental (Pty) Ltd	47, 58, 61-62
March 2012	Social Impact Assessment Aced Middleburg Photovoltaic Solar Energy Facility Eastern Cape Province	Specialist report	Tony Barbour Environmental Consulting and Research	Entire report
March 2012	Environmental Basic Impact Assessment Process Draft Basic Assessment Report, Proposed Middelburg Solar Park 1 Eastern Cape Province	12/12/20/2465/2	Savannah Environmental (Pty) Ltd	54-63, 71-73
13 April 2012	Mainstream Renewable Power South Africa Noupoort (Pty) Ltd. Proposed Construction of a Wind Farm near Noupoort, Northern Cape Province, South Africa. Final Environmental Impact Report	12/12/20/2319	SiVEST Environmental Division	156-177, 221-228, 232-234
May 2012	Environmental Basic Impact Assessment Process Draft Basic Assessment Report, Proposed Tollie Solar Energy Installation on a site near Noupoort, Northern Cape Province	14/12/16/3/3/1/528	Savannah Environmental (Pty) Ltd	54-59, 65-68
September 2012	Environmental Impact Assessment Process Final Basic Assessment Report, Proposed Klip Gat Solar Energy Facility (75MW) near Noupoort, Northern Cape Province	14/12/16/3/3/2/354	Savannah Environmental (Pty) Ltd	61-62, 71-72, 79
September 2012	Environmental Impact Assessment Process Final Basic Assessment Report, Proposed Naauw Poort Solar Energy Facility (75MW) near Noupoort, Northern Cape Province	14/12/16/3/3/2/355	Savannah Environmental (Pty) Ltd	84-86, 95-96, 101, 101-111
November 2012	Social Impact Assessment Klipgat Solar Energy Facility Northern Cape Province (Draft Report)	Specialist report	Tony Barbour Environmental Consulting and Research	Entire report
December 2012	Environmental Impact Assessment Process Final Basic Assessment Report, Proposed Damfontein Solar Energy Facility near Noupoort, Northern Cape Province	14/12/16/3/3/1/728	Savannah Environmental (Pty) Ltd	70-72 & 79-81
January 2013	Environmental Impact Assessment Process Final Basic assessment Report, Allemans Fontein Solar Energy Facility near Noupoort, Northern Cape Province	14/12/16/3/3/1/730	Savannah Environmental (Pty) Ltd	66-67 & 80-81

Date	Report title	DEA Ref number	Responsible consultant	Page numbers
January 2013	Environmental Impact Assessment Process Final Basic Assessment Report, Proposed Carolus Poort Solar Energy Facility near Noupoort, Northern Cape Province	14/12/16/3/3/1/729	Savannah Environmental (Pty) Ltd	73-74
January 2013	Environmental Impact Assessment Process Final Basic Assessment Report, Proposed Gillmer Solar Energy Facility near Noupoort, Northern Cape Province	14/12/16/3/3/1/735	Savannah Environmental (Pty) Ltd	74-75 & 78-79, 82-83
January 2013	Environmental Impact Assessment Process Final Basic Assessment Report, Proposed Inkululeko Solar Energy Facility near Noupoort, Northern Cape Province	14/12/16/3/3/1/553	Savannah Environmental (Pty) Ltd	63, 66 & 68
January 2013	Environmental Impact Assessment Process Final Basic Assessment Report, Proposed Kleinfontein Solar Energy Facility near Noupoort, Northern Cape Province	12/12/20/3//2654	Savannah Environmental (Pty) Ltd	45-46, 59, 61
April 2016	Proposed Umsobomvu Wind Energy Facility, Northern Cape & Eastern Cape Provinces	14/12/16/3/3/2/730	Savannah Environmental (Pty) Ltd	117-121, 127, 147
December 2017	Social Impact Assessment Phezukomoya Wind Energy Facility Northern Cape and Eastern Cape Province	Specialist report	Tony Barbour Environmental Consultant and Researcher	Entire report
December 2017	Social Impact Assessment San Kraal Wind Energy Facility Northern and Eastern Cape Province	Specialist report	Tony Barbour Environmental Consultant and Researcher	Entire report
March 2018	Environmental Impact Assessment Report for the Proposed 315 MW Phezukomoya Wind Energy Facility and Grid Connection, Northern and Eastern Cape Provinces	14/12/16/3/3/2/1028	Arcus Consultancy Services South Africa (Pty) Limited	ix, 329-338, 350
March 2018	Environmental Impact Assessment Report for the Proposed 390 MW San Kraal Wind Energy Facility and Grid Connection, Northern and Eastern Cape Provinces	14/12/16/3/3/2/1029	Arcus Consultancy Services South Africa (Pty) Limited	vii-viii, 328-337, 350

Recommendation

Recommendations of the reports reviewed indicate that, on an overall basis, the social benefits of renewable energy projects in the area outweigh the negative benefits and that the negative social impacts can be mitigated.

In this regard the following cumulative impacts are addressed below:

- Risk of HIV
- Sense of place
- Service supplies and infrastructure, and
- The economic benefit.

8.2. RISK OF HIV INFECTIONS[2]

With an HIV prevalence rate of 17.5 , the Northern Cape Province has the lowest HIV prevalence rate of all provinces across South African with the Eastern Cape having the third highest rate at 31.4 . At a district level the Pixley ka Seme District Municipality has the 5th lowest HIV prevalence rate across all district municipalities in South Africa at 15.1 . In comparison, the Chris Hani district has the 14th highest HIV prevalence rate across all district municipalities with a rate of 34.5 . It is most likely that this higher prevalence rates in the Chris Hani district will be associated with more densely populated urban areas and along transport routes, considering that the Chris Hani district serves as a linking node to all regions in the Eastern Cape.

With most projects falling within what is a sparsely populated region of the Northern Cape and along the sparsely populated Northern and Eastern Cape boarder, it is likely that HIV prevalence rates will be low within the immediate vicinity of these projects. Consequently, it is important to consider the risk of the spread of HIV associated with these projects, particularly where the workforce is recruited from areas that are likely to have relatively high levels of HIV such as Middelburg and other urban areas further afield. This is important as it is well documented on both an international and local basis that the construction industry carries with it a high risk of HIV (Meintjes, Bowen, & Root, 2007; Bowen, Dorrington, Distiller, Lake, & Besesar, 2008; Wasie, et al., 2015; Bowen P. , Govender, Edwards, & Cattell, 2016; ikwasi & Lukwale, 2017; Bowen P. , Govender, Edwards, & Lake, 2018) which can be spread amongst the local communities, particularly through an increase in prostitution that follows the

[2] HIV prevalence rates are at 2013 figures based on The 2013 National Antenatal Sentinel HIV Prevalence Survey, South Africa.

availability of disposable income. It is also well documented, on both an international and local level, that HIV is also spread by truck drivers (Singh & Malaviya, 1994; Ramjee & Gouws, 2002; Strauss, et al., 2018) and there is likely to be an increase in truck drivers in the area as equipment and material is delivered to the various construction sites.

These issues, associated with the area being extremely poor and the associated disposable income that will follow the construction workers and truck drivers to the area, will heighten the risk of the spread of HIV infections across what is a rather remote region. In this regard The World Bank (2009, pp. 367-368) had indicated a strong link between infrastructure projects and health as:

> "*Transport, mobility, and gender inequality increase the spread of HIV and AIDS, which along with other infectious diseases, follow transport and construction workers on transport networks and other infrastructure into rural areas, causing serious economic impacts.*"

8.3. TRANSFORMATION OF SENSE OF PLACE

There is also a concern amongst various interest groups that the proliferation of renewable energy facilities in the aroo will have a significant and negative cumulative social impact on the area's isolated, tranquil and pristine environment[3]. In this regard issues such as the aesthetic appearance associated with highly visible solar parks and wind farms; the noise from turbine blades; the loss of bird and bat life and its effect on tourism; as well as the disruption of social networks have all been cited amongst these concerns.

This is, however, a complex issue as there are varying opinions in respect of the aesthetic appearance of renewable energy facilities with some regarding them in a far more positive light than others (Firestone, Bidwell, Gardner, & napp, 2018; Schneider, Mudra, & o umpl kov , 2018). In a study of public attitudes towards onshore windfarms in south-west Scotland it was found that many regarded the visual impact of these developments in a positive light. It must, however, be noted that this was linked with community ownership having a positive impact on public attitudes towards windfarm developments in Scotland (Warren & McFadyen, 2010). A further and important consideration in this regard is of an ethical nature

[3] Amongst others see for instance:
1. Heritage South Africa's Karoo News Group http://heritagesa.org/wp/2222-2/
2. Alternative sources of energy for South Africa in various shades of green (Smit, 2011)
3. Social media sites such as the Facebook aroo Energy Debate https://www.facebook.com/The_arooEnergyDebate/
4. Why the aroo. (Research Chair in the Sociology of Land, Environment and Sustainable Development. Department of Sociology and Social Anthropology, Stellenbosch University, 2016).

associated with community acceptance and energy justice and raises the question of the incorporation of public acceptance, particularly that of the underrepresented, into energy policy (Roddisa, Carvera, Dallimerb, Normana, & iva, 2018, pp. 362-363).

8.4. Services, supplies and infrastructure

With the increase in renewable energy facilities in the area it is quite likely that the local authorities, currently hard pressed to deliver services, will find it difficult to keep up with these developments. The influx of construction workers is likely to place pressure on accommodation and the need for both services and supplies. Noupoort, Hanover and Middelburg, being within a 35 km radius of these projects, are likely to bear the brunt of the demand for accommodation, services and supplies. On this basis market demands could inflate costs which may have a negative effect on local communities, particularly the poor, who may be forced to pay higher prices for essential supplies resulting in an escalation in the cost of living in the area.

Social services such as medical and educational facilities could also be placed under pressure due to increased demand. Although this may reach its peak during the construction phase it should be mitigated somewhat by the fact that the construction of the various project will be spread across different timelines, with some project commencing while others reach completion. Employing local people across the various projects and project phases will help in reducing the stress placed on services, supplies and infrastructure in the area.

During the operational phases it is likely that these demands will continue as operational staff take up more long-term residency in the area and are supported by service and maintenance personnel who may spend some time on site on a contractual basis. An influx of temporary maintenance and service workers is likely to last over the operational phase of the projects but is likely to settle within the medium term as the economy adjusts and the municipal authorities are able to respond to this growth.

8.5. Economic benefit

The cumulative economic impact of the project will be both positive and negative. The negative economic impacts, associated with a possible rise in living costs driven by market demand, are considered under the section above. Under this section the positive economic impacts will be addressed.

From a positive perspective the proliferation of renewable energy facilities within the region is likely to result in significant and positive cumulative impacts in the area associated with both direct and indirect job creation, skills development, training opportunities, and the creation of business opportunities for local businesses. The district and local municipalities within the area have identified renewable energy as a strategic economic opportunity in a region that previously had few such opportunities. This is indicated in the various IDPs and LEDs pertaining to the affected municipalities.

8.6. ASSESSMENT OF CUMULATIVE IMPACTS

The cumulative impacts discussed above are assessed below in **Table 14**. It must, however, be noted that this assessment is at a superficial level as any in-depth investigation of the cumulative effects of the various developments being planned for the region are beyond the scope of this study as they would require a broad based investigation on a far larger scale.

Table 14: Assessment of cumulative impacts

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Risk of HIV infection	Risk associated with the influx of workers in the area.	3	3	4	3	4	3	51	-	High	<u>Mitigation can only be implemented on a regional basis and are not project specific.</u> Ensure that all companies coming into the area have and are implementing an effective HIV/AIDS policy. Introduce HIV/ADS awareness programs to schools and youth institutions. Carefully monitor and report on the HIV status of citi ens in the region. Be proactive in dealing with any increase in the HIV prevalence rate in the area.	3	2	4	3	4	2	32	-	Medium
Sense of place	The transformation of the sense of place of the region.	2	4	4	3	4	3	51	-	High	<u>Mitigation measures can only be implemented on a regional basis and are not project specific.</u> Consider undertaking a cumulative impact assessment to evaluate the changes taking place across the area on a broader scale. Form a regional work group tasked with addressing the effect of changes to the sense of place of the region. Establish grievance mechanisms to deal with complaints associated with changes to the area. Enlighten the public about the need and benefits of renewable energy. Engage with the tourism businesses and authorities in the region to identify any areas of cooperation that could exist.	2	4	4	3	4	2	34	-	Medium

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Services, supplies and infrastructure	The influx of construction workers is likely to place pressure on accommodation and the need for both services and supplies.	2	3	2	2	2	2	22	-	Low	<u>Mitigation measures can only be implemented on a regional basis and are not project specific.</u> Engage with the municipal authorities to ensure that they are aware of the expansion planned for the area and the possible consequences of this expansion. Ensure that local labour is recruited in respect of these developments in the area.	2	2	2	2	2	2	20	-	Low
Economic	A proliferation of renewable energy facilities across the region is likely to result in significant and positive impacts in the area in terms of job creation, skills development, training opportunities and the creation of business opportunities for local businesses.	3	3	2	2	2	3	36		Medium	<u>Optimisation measures can only be implemented on a regional basis and are not project specific.</u> Implement a training and skills development programme for locals. Ensure that the procurement policy supports local enterprises. Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme. Ensure that any trusts or funds are strictly managed in respect of outcomes and funds allocated.	3	3	2	2	2	4	48		High

The assessment of the cumulative impacts takes into consideration the impacts associated with all renewable energy facilities within a 35 km circumference of the Umsobomvu Solar PV Facilities. On this basis no fatal flaws associated with the cumulative impacts are evident at a social level. The findings support the recommendations of the reports listed in **Table 13** that, on an overall basis, the social benefits of renewable energy projects in the area outweigh the negative benefits and that the negative social impacts can be mitigated.

The impacts as assessed in respect of the construction and operational phases as well as the 'no-go' alternative and cumulative impacts are summarised for all three solar PV facilities and respective grid connection infrastructure in **Table 15** with a pre and post mitigation comparison being presented. This summery is in respect of all three solar PV facilities and associated grid connection infrastructure as there are no significant differences in respect of the social impacts associated with these facilities. To present three different comparative tables for each project would be repetitive and superfluous as the impacts associated with all three facilities are identical.

Table 15: Impact summary for all three solar PV energy facilities and associated grid infrastructure

Construction Phase					
Environmental parameter	**Issues**	**Rating prior to mitigation**	**Average**	**Rating post mitigation**	**Average**
Health & social wellbeing	Annoyance, dust and noise	-16 low	**Health & social wellbeing -27 medium**	-8 low	**Health & social wellbeing -20 low**
	Increase in crime	-33 medium		-22 low	
	Increased risk of HIV infections	-48 high		-32 medium	
	Influx of construction workers and job seekers	-22 low		-20 low	
	Hazard exposure.	-20 low		-18 low	
Quality of the living environment	Disruption of daily living patterns	-20 low	**Quality of the living environment -20 low**	-18 low	**Quality of the living environment-18 low**
	Disruptions to social and community infrastructure	-20 low		-18 low	
Economic	Job creation and skills development	+22 low	**Economic +23 low**	+24 medium	**Economic +25 medium**
	Socio-economic stimulation	+24 medium		+24 medium	
Operational Phase					
Quality of the living environment	Transformation of the sense of place	-51 high	**Quality of the living environment -51 high**	-34 medium	**Quality of the living environment -34 medium**
Economic	Job creation and skills development	+24 medium	**Economic +26 medium**	+24 medium	**Economic +33 medium**
	Socio-economic stimulation	+28 medium		+42 medium	
No Project Alternative					
No project	Status quo will remain	-51 high	**-51 high**	No mitigation measures	
Cumulative Impacts					
Health & social wellbeing	Risk of HIV	-51 high	**Health & social wellbeing -51 high**	-32 medium	**Health & social wellbeing -32 medium**
Quality of the living environment	Transformation of sense of place	-51 high	**Quality of the living environment -36.5 medium**	-34 medium	**Quality of the living environment -27 medium**
	Services, supplies & infrastructure	-22 low		-20 low	
Economic	Job creation, skills development and socio-economic stimulation	+36 medium	**Economic +36 medium**	+48 high	**Economic +48 high**

9. Comparative Assessment of Layout Alternatives

As no social preference emerged in respect of any of the grid connection options, the other specialist reports were perused to establish if there was any preference that would have an influence on the social aspect. The results of this analysis are as follows:

Agricultural Report (Lan , 2019, p. 32)

"*There is no preference in terms of the proposed power line route alternatives and all alternatives are supported*."

Avifauna Report (Chris van Rooyen Consulting, 2019)

There are no preferences with regard to the PV infrastructure alternatives inclusive of the laydown areas and O&M buildings. In respect of the power line corridors and associated substations the following preferences were identified:

Mooi Plaats Solar PV Facility:

- Grid connection option 1a & 1b preferred as they are the shorter alternatives.
- Grid connection option 2a & 2b are least preferred due to their length over Option 1.

Wonderheuvel Solar PV Facility:

- Grid connection options 1a, 1b, 1c & 1d are least preferred due to being longer than options 2 and 3.
- Grid connection options 2a, 2b & 3 are preferred due to them being shorter.

Paarde Valley Solar PV Facility:

- Grid connection options 1a, 1b, 1c & 1d are least preferred as they will create a new impact, because for most of the way they do not run parallel to any of the other options.
- Grid connection options 2a, 2b, 2c & 2d are preferred as the majority of the way these routes run parallel to the proposed Mooiplaats and Wonderheuvel grid connection options and consequently will not create a new impact.

Due to the ecological importance of birds and the long standing relationship between humans and birds a social significance exists in respect of the avifauna report. This significance is recognised in the comparative assessment of layout alternatives below.

Ecology Scoping Assessment (David Hoare Consulting (Pty) Ltd, 2019, p. 106)

> "*If it is technically possible to share a powerline between all three projects, i.e. without having multiple powerlines adjacent to one another, then it is preferable to use a single corridor for all the projects, rather than splitting the projects. Due to the fact that Mooi Plaats only has the option to link to Hydra D MTS, it would be preferable to have all the projects link up to Hydra D MTS than to have an additional powerline linking up to Coleskop WEF – the overall impact will be less if only one corridor is utilized.* ***If projects share a single powerline then the potential impact is very different to if separate powerlines have to be constructed adjacent to one another.***"

As with the avifauna report, the ecological assessment also caries social significance as a result of the interdependency of people and nature and as such is recognised in the comparative assessment.

Heritage Assessment (PGS Heritage (Pty) Ltd, 2019)

In respect of the PV infrastructure alternatives, inclusive of the laydown areas and O&M buildings, there are no preferences. With regard to the grid connection infrastructure there is no preference in respect of the Mooi Plaats facility. However, although all alternatives for the Wonderheuvel and Paarde Valley facilities are assessed as being favourable, a paleontological sensitive area situated on the northern corridor towards substation 3a has been identified. Although considered favourable, this area will require monitoring during construction and is consequently recognised in the comparative assessment below.

Surface Water Assessment (SiVEST SA (Pty) Ltd, 2019a)

A number of preferred and least preferred options emerged in the surface water assessment. Due to the social significance of securing water resources these preferences are incorporated below in the comparative assessment of the project alternatives.

Transportation Impact Assessment (SiVEST SA (Pty) Ltd, 2019c)

No alternatives emerged in the transportation assessment in respect of either the PV infrastructure or the power line corridors and associated substations.

Visual Impact Assessment (SiVEST SA (Pty) Ltd, 2019b, pp. 109-117)

The results of the visual assessment identified various preferences which, due to the fact that visual impact will have a significant influence in respect of the social construct 'a sense of place' are incorporated into the comparative assessment below.

Based on the above discussion the socially preferred options are presented in **Table 16**.

Table 16: Comparative assessment of alternative grid connection infrastructure

Key	
Preferred	The alternative will result in a low impact / reduce the impact
Favorable	The impact will be relatively insignificant
Least preferred	The alternative will result in a high impact / increase the impact
No preference	The alternative will result in equal impacts

PV infrastructure alternatives (laydown areas and O&M buildings)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY		
Laydown Area and O&M Building Site Option 1	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequently lower social risk associated with surface water.
Laydown Area and O&M Building Site Option 2	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequently lower social risk associated with surface water.

Laydown Area and O&M Building Site Option 3	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequently lower social risk associated with surface water.
Laydown Area and O&M Building Site Option 4	Least preferred	Based on findings of the surface water and visual assessments – Higher impact on surface water is likely to carry associated social risk while higher visual impacts are likely to have a negative effect on a sense of place.
Laydown Area and O&M Building Site Option 5	Least preferred	Based on findings of the surface water assessment – Higher impact on surface water is likely to carry associated social risk.
Laydown Area and O&M Building Site Option 6	Least preferred	Based on findings of the surface water assessment – Higher impact on surface water is likely to carry associated social risk.
WONDERHEUVEL SOLAR PV FACILITY		
Laydown Area and O&M Building Site Option 1	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequently lower social risk associated with surface water.
Laydown Area and O&M Building Site Option 2	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequently lower social risk associated with surface water.
Laydown Area and O&M Building Site Option 3	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequently lower social risk associated with surface water.

Laydown Area and O&M Building Site Option 4	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequently lower social risk associated with surface water.
Laydown Area and O&M Building Site Option 5	Least preferred	Based on findings of the surface water assessment – Higher impact on surface water is likely to carry associated social risk.
Laydown Area and O&M Building Site Option 6	Least preferred	Based on findings of the surface water and visual assessments – Higher impact on surface water is likely to carry associated social risk while higher visual impacts are likely to have a negative effect on a sense of place.
Laydown Area and O&M Building Site Option 7	Least preferred	Based on findings of the surface water assessment – Higher impact on surface water is likely to carry associated social risk.
Laydown Area and O&M Building Site Option 8	Least preferred	Based on findings of the surface water and visual assessments – Higher impact on surface water is likely to carry associated social risk while higher visual impacts are likely to have a negative effect on a sense of place.
PAARDE VALLEY SOLAR PV FACILITY		
Laydown Area and O&M Building Site Option 1	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Laydown Area and O&M Building Site Option 2	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.

Laydown Area and O&M Building Site Option 3	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Laydown Area and O&M Building Site Option 4	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Laydown Area and O&M Building Site Option 5	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Laydown Area and O&M Building Site Option 6	Least preferred	Based on findings of the surface water assessment – Higher impact on surface water is likely to carry associated social risk.
Laydown Area and O&M Building Site Option 7	Least preferred	Based on findings of the surface water and visual assessments – Higher impact on surface water is likely to carry associated social risk while higher visual impacts are likely to have a negative effect on a sense of place.
Laydown Area and O&M Building Site Option 8	Least preferred	Based on findings of the surface water assessment – Higher impact on surface water is likely to carry associated social risk.
Laydown Area and O&M Building Site Option 9	Least preferred	Based on findings of the surface water assessment – Higher impact on surface water is likely to carry associated social risk.

Grid Connection Infrastructure Alternatives (Power Line Corridors and Associated Substations)	Preference	Reasons (incl. Potential issues)
MOOI PLAATS SOLAR PV FACILITY		
Grid Connection Option 1a	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Grid Connection Option 1b	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Grid Connection Option 2a	Favourable	Based on the findings of the visual assessment and the association with the social construct "a sense of place".
Grid Connection Option 2b	Favourable	Based on the findings of the visual assessment and the association with the social construct "a sense of place".
WONDERHEUVEL SOLAR PV FACILITY		
Grid Connection Option 1a	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 1b	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 1c	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 1d	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 2a	Favourable	Based on the findings of the surface water and visual assessment and the related social risk and association with the social construct "a sense of place".
Grid Connection Option 2b	Favourable	Based on the findings of the surface water and visual assessment and the

		related social risk and association with the social construct "a sense of place".
Grid Connection Option 3	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
PAARDE VALLEY SOLAR PV FACILITY		
Grid Connection Option 1a	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 1b	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 1c	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 1d	Least preferred	Based on findings of the surface water assessment – Higher impact on surface and associated social risk.
Grid Connection Option 2a	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Grid Connection Option 2b	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Grid Connection Option 2c	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.
Grid Connection Option 2d	Preferred	Based on findings of the surface water assessment – Lower impact to surface water and consequent lower social risk.

10. Conclusion and Recommendations

In assessing the social impact of the Umsobomvu Solar PV Facilities, it was found that in respect of the energy needs of the country and South Africa's need to reduce its carbon emissions that the project fits with national, provincial and municipal policy.

Regarding the social impacts associated with the project it was found that most apply over the short term to the construction phase of the project. Of these impacts all can be mitigated to within acceptable ranges and there are no fatal flaws associated with the construction or operation of the project.

On a cumulative basis it is evident that the cumulative impacts associated with changes to the social environment of the region are more significant than those attached to the project in isolation. On a negative front there are two issues associated with developments in the region that are of most concern. The first of these issues is the change to the sense of place of an area that was once considered a pristine region of South Africa. The second is the potential, through an influx of labour and an increase in transportation to constructions sites, of the risk for the prevalence of HIV to rise in an area that has a relatively low HIV prevalence rate. In this regard it is important that the relevant authorities recognise these issues and find ways of mitigating them to ensure that they do not undermine the benefit that renewable energy projects bring, both to the region as well as to the country as a whole. These issues are beyond a project specific basis and as such will need to be addressed at a higher level.

10.1. Impact Statement

The project site and surrounding areas are sparsely populated with the agricultural potential of the area being low. Accordingly, the negative social impacts associated with the proposed Mooi Plaats, Wonderheuvel and Paarde Valley solar PV facilities and associated grid connection infrastructure are of low to moderate significance with most occurring over the short term construction phase. The project has a positive element which outweighs the negative in that it will contribute towards the supply of renewable energy into a grid system heavily reliant on coal powered energy generation. In this sense the projects form part of a national effort to reduce South Africa's carbon emissions and thus carries with it a significant social benefit and is thus supported and should proceed.

10.2. EIA PHASE

As the area is sparsely populated and the negative social impacts associated with all three solar PV facilities and associated grid infrastructure of moderate significance it is most unlikely that any further social study will be necessary. This will, however, be dependent on the outcome of the public participation process which may result in a need to update the current report by incorporating the comments recorded and updating the social impacts accordingly.

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Appendix 1:- Environmental impact assessment methodology

1. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1. Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the si e of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

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 total number of points scored for each impact indicates the level of significance of the impact.

1.2. Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1. *Rating System Used to Classify Impacts*

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
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 (P)		
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).

REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter 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 (L)		
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.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects 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 and its effects 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 – 50 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 transient (Indefinite).

INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
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 (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE (S)		
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. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) 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**
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	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 .
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.

Table 2: Rating of impacts template and example

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Vegetation and protected plant species	Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species.	2	4	2	2	3	3	39	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	4	2	1	3	2	24	-	Low

Operational Phase																			
Fauna	Fauna will be negatively affected by the operation of the wind farm due to the human disturbance, the presence of vehicles on the site and possibly by noise generated by the wind turbines as well.	2	3	2	1	4	3	36	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	4	2	22	-	Low
Decommissioning Phase																				
Fauna	Fauna will be negatively affected by the decommissioning of the wind farm due to the human disturbance, the presence and operation of vehicles and heavy machinery on the site and the noise generated.	2	3	2	1	2	3	30	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	2	2	1	2	2	18	-	Low

Cumulative																				
Broad-scale ecological processes	Transformation and presence of the facility will contribute to cumulative habitat loss and impacts on broad-scale ecological processes such as fragmentation.	2	4	2	2	3	2	26	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	3	2	1	3	2	22	-	Low