

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED MAJUBA PV SOLAR ENERGY FACILITY
NEAR AMERSFOORT, MPUMALANGA PROVINCE

DEA REF NO.: 14/12/16/3/3/2/752

FINAL FOR SUBMISSION TO THE DEA
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PROJECT DETAILS

DEA Reference No.	: 14/12/16/3/3/2/752
Title	: Environmental Impact Assessment Process Environmental Impact Assessment Report for the Proposed Majuba PV Solar Energy Facility near Amersfoort, Mpumalanga Province
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PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Eskom Holding SOC (state owned company) Ltd (hereafter to be referred to as Eskom) is proposing to establish a **photovoltaic (PV)** solar energy facility of up to 65 MW and associated infrastructure on a site within the Majuba Coal Fired Power station boundary, approximately 15 km south-west of Amersfoort and 40 km northwest of Volksrust in the Mpumalanga Province. This project is to be known as the Majuba PV Solar Energy Facility. Savannah Environmental is appointed as the independent environmental consultants, to undertake the requisite Environmental Impact Assessment (EIA) Process. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The EIA Phase aims to address those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with the project including design, construction, operation and decommissioning, and recommend appropriate mitigation measures for potentially significant environmental impacts. The purpose of this EIA report is to assess the impacts associated with the proposed layout for the Majuba PV Solar Energy Facility through detailed specialist studies and public consultation. This EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report incorporates all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project. The Final EIA report demonstrates that the conditions of the Acceptance of the Scoping Report, and the comments received during the review period of the EIA report (including those received from the Competent Authority) have been considered and addressed as required.

This Environmental Impact Assessment Report represents the findings EIA phase of the EIA process and contains the following sections:

- » **Chapter 1** provides background to the Project and the environmental impact assessment, and an introduction to the rationale behind the selected site and technology proposed.
- » **Chapter 2** provides the project description, need and desirability, site selection information and identified project alternatives.

- » **Chapter 3** outlines the strategic legal context for the energy planning and the Project.
- » **Chapter 4** outlines the approach to undertaking the environmental impact assessment process.
- » **Chapter 5** describes the existing biophysical and socio-economic environment within and surrounding the Project development footprint.
- » **Chapter 6** provides an assessment of the potential issues and impacts associated with the Project and presents recommendations for mitigation of significant impacts.
- » **Chapter 7** provides an assessment of cumulative impacts.
- » **Chapter 8** presents the conclusions and recommendations based on the findings of the EIA.
- » **Chapter 9** provides a list of reference material used to compile the EIA Report.

DEA & LEGAL REQUIREMENTS

As outlined in the acceptance of the FSR dated June 2015, Savannah Environmental has compiled a tables (refer to Table 1 and 2 below) which outline the general site information and technical details of the proposed facility.

Table 1: A detailed description of the project site

Province	Northern Cape Province
District Municipality	Gert Sibande District Municipality
Local Municipality	Dr.Pixley Ka Isaka Seme Local Municipality
Ward number(s)	6
Nearest town(s)	Volksrust
Farm name(s) and number(s)	Witkoppies 81 HS
Portion number(s)	1, 2 & 6 of Witkoppies 81 HS
SG 21 Digit Code (s)	T08S00000000008100001 T08S00000000008100002 T08S00000000008100006

Table 2: Dimensions of typical structures required for the PV Facility

Component	Description/ Dimensions
Electricity Generating capacity	65MW
Extent of the proposed development footprint	96.9ha
Centre Point proposed site	Longitude: 29° 46.629'E Latitude: 27° 6.702'S
Extent of broader site	850 ha
Site access	The main access to the site will be directly from the R23 that runs along the western boundary of the proposed site, or alternatively the N11 national road, located approximately 10km to the east of the study area. Internal access roads of up to 5-8m wide will also be required.
Proposed technology and Height of installed panels from ground level	Static PV - Fixed mounted PV up to 3.5 m above ground Tracking – single/double axis up to 6 m
Number of Panels	Dependant on module to be used. This will be confirmed before construction. Typically it would be » 243,000 (considering 250 Wp capacity per PV module) » 627,620 PV modules (considering 105 Wp capacity per thin film PV module)
Panel Dimensions	» 1.638 × 0.982 × 0.04 m (considering standard crystalline

Component	Description/ Dimensions
	silicon modules 250 Wp capacity per module) » 1.200 × 0.600 × 0.0068 m (considering standard thin film PV module 105 Wp capacity)
Panel direction	25° slope and facing to North
Number of inverters	Dependant on inverter to be used. This will be confirmed before construction. Typically it would be approx. 120 inverters and height of each inverter up to 2.6 m (Assumption: 500 kW inverter per capacity)
Main transformer / on-site substation capacity and size	» Step-up up to 6.6/11 kV (for connection at station board) » Step-up up to 88/132 kV (for connection at HV yard) » On site substation size approximately 50m x 50m
Associated buildings (size)	±150 m ²
New overhead power line	Servitude width – depending upon the overhead voltage level (between 9 m to 15.5 m : measured from the centre line of the power line) Length: 1800m Height of towers – maximum height of 13m
Services required	» Sewage and Refuse material disposal - all sewage and refuse material generated during the establishment of the proposed site will be collected by a contractor to be disposed of at a licensed waste disposal site » Water and electricity – water will be obtained from the power station. Electricity will be generated from generators for any electrical work on site or electricity will be obtained from an Eskom auxiliary supply, depending on the feasibility during construction.

The requirements of an Environmental Impact Assessment Report, in accordance with regulation 31 of GN 543 are presented in **Table 3**.

Table 3: Content of the EIA report

EIA Regulations requirements		Environmental Impact Assessment Report
(a)	Details of EAP and expertise to carry out an environmental impact assessment	Chapter 1
(b)	Description of the proposed activity	Chapter 1
(c)	Description of the property on which the activity is to be undertaken and the location of the activity on the property	Chapter 1
(d)	Description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may	Chapter 5

	be affected by the proposed activity	
(e)	<p>Details of the Public Participation Process (PPP) conducted:</p> <ul style="list-style-type: none"> (i) Steps taken in accordance with the plan of study; (ii) A list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) A summary of comments and issues raised by interested and affected parties (I&APs) including response from EAP on issues; and (iv) Copies of any representations and comments received from registered I&APs. 	Chapter 4 and Appendix C
(f)	Need and Desirability of proposed activity	Chapter 2
(g)	Description of alternatives, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Chapter 2
(h)	Methodology used in determining the significance of potential environmental impacts	Chapter 4
(i)	Description and comparative assessment of alternatives	Chapters 1; 2 and 6
(j)	Summary of the findings and recommendations of specialist reports	Chapter 6, 7 and 8
(k)	Description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapters 6, 7 and 8 and Appendix M
(l)	<p>Assessment of each identified potentially significant impact, including—</p> <ul style="list-style-type: none"> (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated 	Chapters 6 and 7

<p>affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and</p>	<p>Chapters 4</p>
<p>(b) must include, with respect to every application for an environmental authorisation and where applicable-</p>	
<p>(i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;</p>	<p>Chapter 6</p>
<p>(ii) investigation of mitigation measures to keep adverse consequences or impacts to a minimum;</p>	<p>Chapter 6</p>
<p>(iii) investigation, assessment and evaluation of the impact of any proposed listed or specified activity on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;</p>	<p>Chapter 6</p>
<p>(iv) reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;</p>	<p>Appendix F</p>
<p>(v) investigation and formulation of arrangements for the monitoring and management of consequences for or impacts on the environment, and the assessment of the effectiveness of such arrangements after their implementation;</p>	<p>Appendix M</p>
<p>(vi) consideration of environmental attributes identified in the compilation of information and maps contemplated in subsection (3); and (vii) provision for the adherence to requirements that are prescribed in a specific environmental management Act relevant to the listed or specified activity in question.</p>	<p>Appendix L</p>

The FSR described the potential environmental impacts, site alternatives, and Plan of Study (PoS) for the EIA. The FSR was submitted to DEA and accepted in June 2015. Specific Information required by the Competent Authority (CA) is detailed in a summary provided in **Table 4**

Table 4: Specific Information required by the Competent Authority CA

Ref. in the DEA Acceptance letter	DEA Requirement	Environmental Impact Assessment Report
i.	Following a review of the SR and application form, the following information must form part of the EIAR as well as a separate document for ease of reference: <ul style="list-style-type: none"> • An amended application form with an indication of all the 2010 listed activities that are still listed; An indication of all the similarly listed activities in terms of G.N. R 982 of 04 December 2014; • An indication if there are any new activities that are listed in terms of G.N. R 982 of 04 December 2014; • An indication where in the report all the activities listed in terms of in terms of G.N. R 982 of 04 December 2014 have been assessed and mitigated for; and, • A letter/affidavit from the EAP indicating that the above is true and correct. 	Appendix N Chapter 4 Appendix O
ii.	Please note that the Department's application form template has been amended and can be downloaded from the following link https://www.environment.gov.za/documents/forms	Appendix N
iii.	It is imperative that the relevant authority are continuously involved throughout the EIA process	Chapter 4 Appendix C
iv.	The EIAR must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	Appendix M Chapter 6-7
v.	Cumulative impacts of a similar type of developments in the area must form part of the studies that must be assessed as part of the EIA process.	Chapter 7
vi.	The following activities applied for may trigger Section 19 and section 21 of the National Water Act No.36 of 1998: GN R 544 Activities 11(xi) and 18 (i). The EAP is advised to conduct a surface hydrological study as part of the EIAR.	Appendix K
vii.	The listed activities represented in the EIAR and the application form must be the same and correct.	Chapter 5 and Appendix N
viii.	The EIAR must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions.	Table 1-2

ix.	The EIAR must provide the four corner coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	Chapter 2 Table 2.1 and 2.2
x.	The EIAR must provide the following: Clear indication of the envisioned area for the proposed solar energy facility; i.e. placing of photovoltaic panels and all associated infrastructure should be mapped at an appropriate scale. Clear description of all associated infrastructure. This description must include, but is not limited to the following: <ul style="list-style-type: none"> • Power lines; • Internal roads infrastructure ; • All supporting onsite infrastructure such as laydown area, guard house and control room etc. • All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation. 	Chapter 5 Chapter 8 Appendix L
xi.	The EIAR must also include a comments and response report in accordance with Regulation 28(m) of the EIA Regulations, 2010.	Appendix C
xii.	The EIAR must include the detail inclusive of the PPP in accordance with Regulation 54 of the EIA Regulation	Chapter 4 Appendix C
xiii.	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies	Chapter 2
xiv.	An Avifaunal Assessment must be conducted to determine the impacts that the proposed activity (including the powerline) may have on avifauna. Mitigation measures must be proposed and included in the EIAR and the EMPr.	Chapter 6 Appendix D
xv.	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided	Chapter 2
xvi.	The EIAR must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites.	Chapter 2
xvii.	A copy of the final site layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible	Chapter 8 Appendix L
xviii.	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA	Chapter 6 Chapter 8

	process.	Appendix L
xix.	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Chapter 8
xx.	A shape file of the preferred development layout/footprint must be submitted to this Department.	Submitted with FEIAR
	The Environmental Management Programme (EMPr) to be submitted as part of the EIAR	Appendix M

COMMENT ON THE EIA REPORT

Members of the public, local communities and stakeholders were invited to comment on the EIA report for the Majuba PV facility dated March 2016, which was made available for a 30-day public participation period, between **24 March 2016 – 26 April 2016** at the following places

- » Amersfoort Library
- » Volkskrust Public Library

The report was also available for download on:

- » www.savannahsa.com

Comments were received through written submission via fax, post or e-mail. All comments received were captured and have been addressed as required in this Final EIAr and Appendix C of this report.

EXECUTIVE SUMMARY

Background

Eskom Holding SOC Ltd is proposing to establish a 65MW photovoltaic solar energy facility and associated infrastructure on a site within the Majuba coal fired power station boundary, approximately 15 km south-west of Amersfoort and 40 km northwest of Volksrust in the Mpumalanga Province.

Based on a pre-feasibility analysis and site identification process undertaken by Eskom, a favourable area has been identified for consideration and evaluation through an environmental impact assessment process. The study area is situated in the jurisdiction of Gert Sibande District Municipality and Dr. Pixley Ka Isaka Seme Local Municipality within the Mpumalanga Province.

The **Majuba PV Solar Energy Facility** is proposed to accommodate several arrays of photovoltaic (PV) panels and associated infrastructure. From a local perspective, the site is preferred due to suitable topography, grid connection access, and by virtue of the extent of the site.

An EIA process and public participation process is being undertaken for the proposed project. The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases are

explored in more detail in this EIA Report.

Project Location

The project is located on Portions 1, 2 and 6 of the farm Witkoppies 81 HS within the boundaries of the Majuba Coal Fired Power Station.

Project Components

The facility is proposed to include several arrays of PV solar panels with a net generating capacity of up to 65 MW. A development footprint of approximately ~96.9 ha will be required in order to accommodate the following infrastructure:

- » Solar panels (fixed/tracking technology) with a net generating capacity of up to 65 MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation or switching station.
- » A power line to facilitate the connection of the solar energy facility from the on-site substation to Majuba power

- station or nearest grid connection within the Majuba power station.
- » Internal access roads.
- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

The overarching objective for the solar energy facility is to maximise electricity production through **exposure to the solar resource**, while minimising infrastructure, operational and maintenance costs, as well as **social and environmental impacts**. In order to meet these objectives local level environmental and planning issues are assessed in the EIA process through site-specific studies in order to delineate areas of sensitivity within the broader site; this will serve to inform the design of the facility.

Evaluation of the Proposed Project

The chapters contained of this report together with the specialist studies contained within **Appendices D - K** provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the Majuba PV Solar Energy Project. The assessment of potential environmental impacts presented in this report is based on a layout of the PV facility and associated infrastructure provided by Eskom. This initial layout accommodates several arrays of tracking or static **PV panels** and associated infrastructure over the proposed site.

The potential for impacts of major, high significance and no-go areas were identified which require mitigation. Mitigation to avoid impacts are primarily associated with the modification of the initial layout to prevent encroachments into the wetlands. These are discussed in more detail in the sections which follow. Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the Environmental **Management Programme (EMPr)** included within **Appendix M**.

The environmental impacts identified and assessed to be associated with the proposed PV facility include:

- » Impacts on wetlands.
- » Impacts on ecology and habitats occurring on the site.
- » Impacts on heritage and paleontological resources.
- » Impact on avifauna.
- » Visual impacts
- » Social and economic impacts.

The sections which follow provide a summary of the environmental impacts associated with the proposed project, as identified

Surface water Ecology - Four wetlands, one unchannelled valley-bottom and three seeps, were found on the site. The wetlands have been exposed to varying degrees of impact. Overall the wetlands on site

were moderately modified. The wetland was found to have a moderate importance and sensitivity to changes in flow regime and lacked sensitive biota. In order to mitigate the potential impacts it is recommended that development within these wetland areas are avoided and that a 30m buffer is set to protect wetland functionality. From the conclusions of the detailed Wetland study undertaken the overall impact on wetlands is likely to be of a High to medium significance prior to mitigation. This could be reduced to low negative significance following the implementation of mitigation measures. Overall and with the suggested mitigation measures implemented, the **wetland** impacts of the development are likely to be of **moderate significance** and no impacts of high significance are likely with mitigation. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

Impacts on Ecology– The overall impact on the ecology (including flora and fauna) is likely to be of a **medium negative significance prior to mitigation**. This impact could be reduced to low significance following the implementation of mitigation measures, and safe rescue and relocation of protected species (including *Aloe ecklonis* *Eucomis autumnalis* and *Gladiolus sericeovillosus* s. *Calvatus Habernaria dives*). It is not expected that the development will compromise the survival of or significantly impact any

flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented; and the associated integrity of surrounding wetlands maintained. Overall and with the suggested mitigation measures implemented, the **ecological** impacts of the development are likely to be of **moderate to low significance**. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

Avifauna – The overall impact on Avifauna is likely to be of a **medium negative** significance **prior to mitigation**. This could be reduced to **low significance** following the **implementation of mitigation measures**, which includes a buffer around the wetlands. Given the presence of existing habitat degradation and disturbance associated with the mining, energy generation and industrial activities that are prevalent in the study area and surrounds, and due to the relatively low importance of the site for many bird species, it is anticipated that the Majuba Solar Photovoltaic Facility can be constructed at the proposed site with acceptable levels of impact on the resident avifauna.

Heritage and palaeontology - The overall impact on the heritage and paleontological resources is likely to be of a **low significance**. If the recommendations made through this EIA process are adhered to, and based on approval from SAHRA, it is concluded that the development can continue as the impact of the development on heritage and paleontological resources will not impact negatively on the heritage record of Mpumalanga. If during the pre-construction phase or during construction, any archaeological or paleontological finds are made (e.g. graves, stone tools, fossils and skeletal material), the operations must be stopped, and the archaeologist or palaeontologist (depending on the find) must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological and palaeontological material and graves, the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded, but can be easily mitigated by preserving the sites *in-situ* within the development.

Soils & agricultural potential –

The overall impact on Soils and Agricultural Potential is likely to be of a **medium to low** negative significance prior to mitigation. This could be reduced to **low significance following the implementation of mitigation** measures. Within the broader study area around Majuba Power Station, the loss of the land where the PV facility is proposed would not have a

significant effect on agricultural production due to the low agricultural potential of the site. There are **no fatal flaws** associated with the soils and agricultural potential on the site and the project can be developed with the use of good soil management measures during all phases of development of the project.

Social impacts: The overall social impact is likely to be of a medium significance in terms of positive impacts, and a **low medium significance** in terms of the negative impacts. From a social perspective it is concluded that the proposed Majuba Solar Energy Facility can be developed subject to the implementation of the recommended mitigation measures and management actions. The proposed development represents greater positive social potential than negative implications due to the development being located in an industrial area.

Visual: The overall visual impact is likely to be of a **low significance**. The proposed development is unlikely to have any noticeable impact on landscape character. The orientation of the power station, its coal storage area, PFA dump, conveyors and other associated structures serve to screen the proposed solar array from the majority of surrounding roads and farmsteads. The impact on visual receptors is therefore expected to be negligible to small. The proposed array will have a minor impact on the

road to the east of the site. It is also likely to have a more significant impact on a flight path into the airstrip to the north of the power station with a temporary impairment of vision likely due to glare.

Evaluation of the Potential Issues with Associated Infrastructure - Invertors, and Internal Access Roads

In order to connect the Majuba PV Solar Energy Facility to the power grid, the Eskom intends on building on-site substation and power line, which follows the existing access road, for which will connect into the existing substation located on the site. Potential issues identified to be associated with a proposed overhead power line, substation, access roads and invertors include impacts on flora, fauna and ecological processes, impacts on avifauna as a result of collisions and electrocutions, heritage and visual impacts. There are no fatal flaws associated with the associated infrastructure of the Majuba PV Solar Energy Facility site

Assessment of Potential Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on

each of the receptors and the site specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

There are no renewable project development sites within a 30km radius of the proposed Majuba PV Solar Energy Facility. In general, Cumulative impacts of the proposed Majuba PV Solar Energy Facility, to the larger area is likely to have low or no influence on the nature of the area due to heavy industrial areas located next to the project site and the general low sensitivity of the proposed development area. The overall cumulative impact on wetlands is likely to be of a High significance prior to mitigation. This could be reduced to medium negative significance with the implementation of the proposed mitigation measures

Environmental Sensitivity and Micro-siting

In response to the identified need to adequately manage impacts within sensitive areas identified on the site development footprint, and in order to demonstrate the ability of the project to adhere to recommended

mitigation measures, Eskom has developed a best practice mitigation strategy with regards to the facility layout.

The EIA recommendations have been taken into account by Eskom, and the PV facility layout has been refined to avoid encroachment into the wetlands in order to maintain optimal wetland functionality. The refinement of the layout has resulted in a decrease in the net generating capacity, from 65 MW to 30 MW. This refined layout will still be able to meet the main objective of supplementing Eskom's self consumption at the Majuba Power station. **The required mitigation measures are illustrated in Figure 1 and Figure 2 and represent a positive outcome in terms of impact reduction and mitigation and the optimal layout for the facility**

Conclusion and Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Majuba PV Solar Energy Facility project can be mitigated to an acceptable level. As per the requirements of the NEMA (Act 107 of 1998), this EIA has

identified and assessed project alternatives and the potential environmental impacts associated with the proposed PV facility. In terms of this conclusion, the EIA project team support the decision for environmental authorisation on the proposed site. The optimised layout shown in **Figure 8.1 and Figure 8.2** is acceptable and the following conditions would be required to be included within an authorisation issued for the project:

The following conditions would be required to be included within an authorisation issued for the project:

- » All mitigation measures detailed within this report and the specialist reports contained within Appendices D to K must be implemented.
- » Following the final design of the facility to include the 30 m buffer around the identified wetlands, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
- » The Environmental Management Programme (EMPr) as contained within Appendix M of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate

- environmental management standards as detailed for this project.
- » An independent Environmental Control Officer (ECO) must be appointed by Eskom prior to the commencement of any authorised activities. The ECO should remain employed for the duration of the construction phase to monitor compliance with the requirements of the EMPr and Environmental Authorisation.
 - » If any protected plant or tree species are required to be removed/destroyed as part of the construction of the development, a collection/destruction permit to be obtained from DAFF for the protected trees and Mpumalanga Department of Economic Development, Environment and Tourism for other protected plants.
 - » A water use license must be obtained as the proposed facility is within 500m of a wetland. The viability and sustainability of this resource should however first be investigated in consultation with DWS.
 - » It is recommended that weeds and invasives in the remaining natural veld on the eastern portion of the study area be eradicated and controlled, but that the area is excluded as much as possible from the development. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended. A rigorous alien invasive plant monitoring and management plan must therefore be implemented right up to the decommissioning phase.
 - » Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
 - » All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
 - » Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
 - » Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.
 - » Develop emergency preparedness plan for the construction and operation phase, in line with that of the Majuba Power Station, to deal with any event of contamination, pollution, or spillages.
 - » Compile a comprehensive storm-water management method statement, as part of the final design of the project and

implement during construction and operation.

- » All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
- » Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

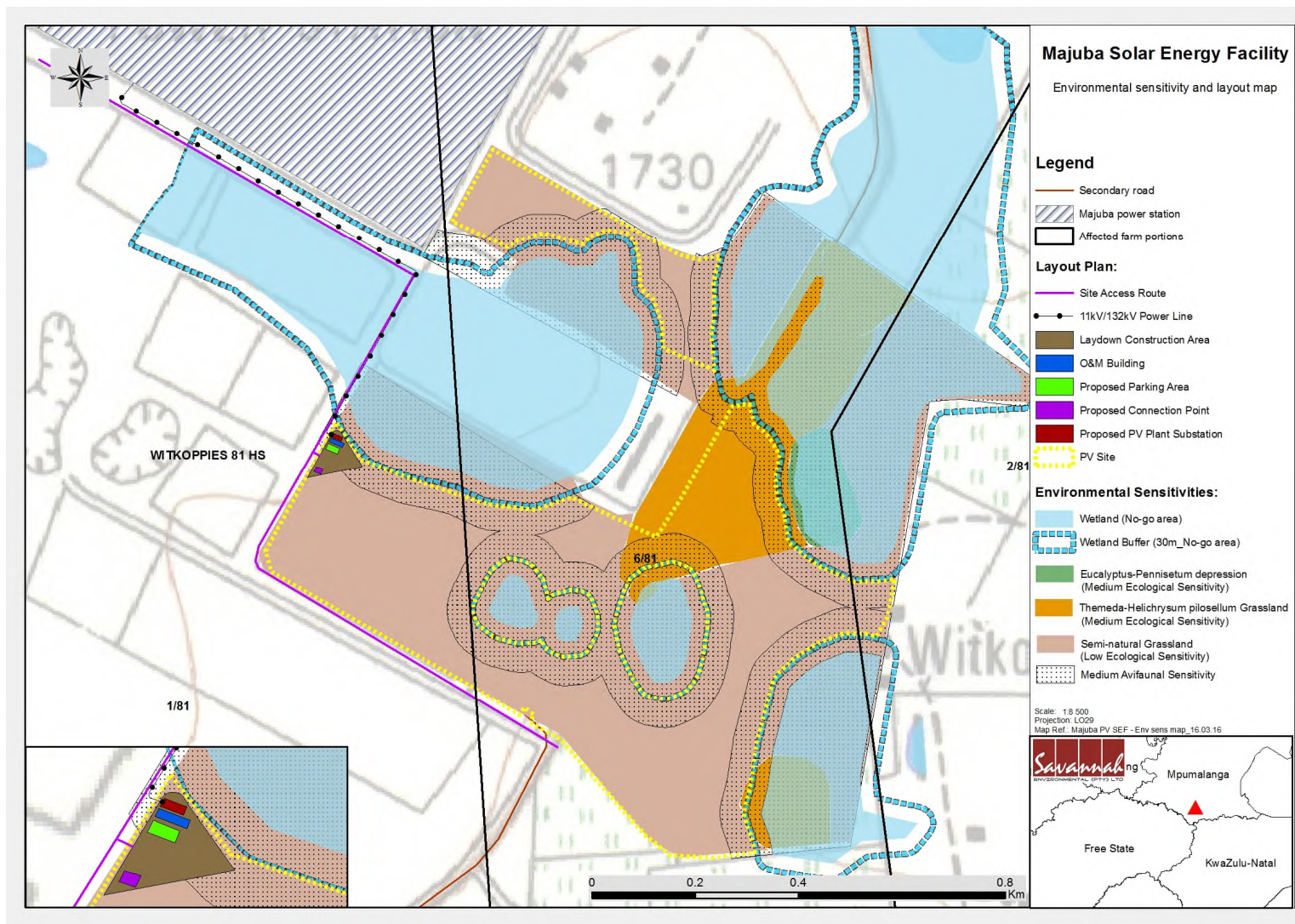


Figure 1: The final/optimised layout map superimposed (overlain) on the environmental sensitivity for the proposed Majuba PV Solar Energy Facility

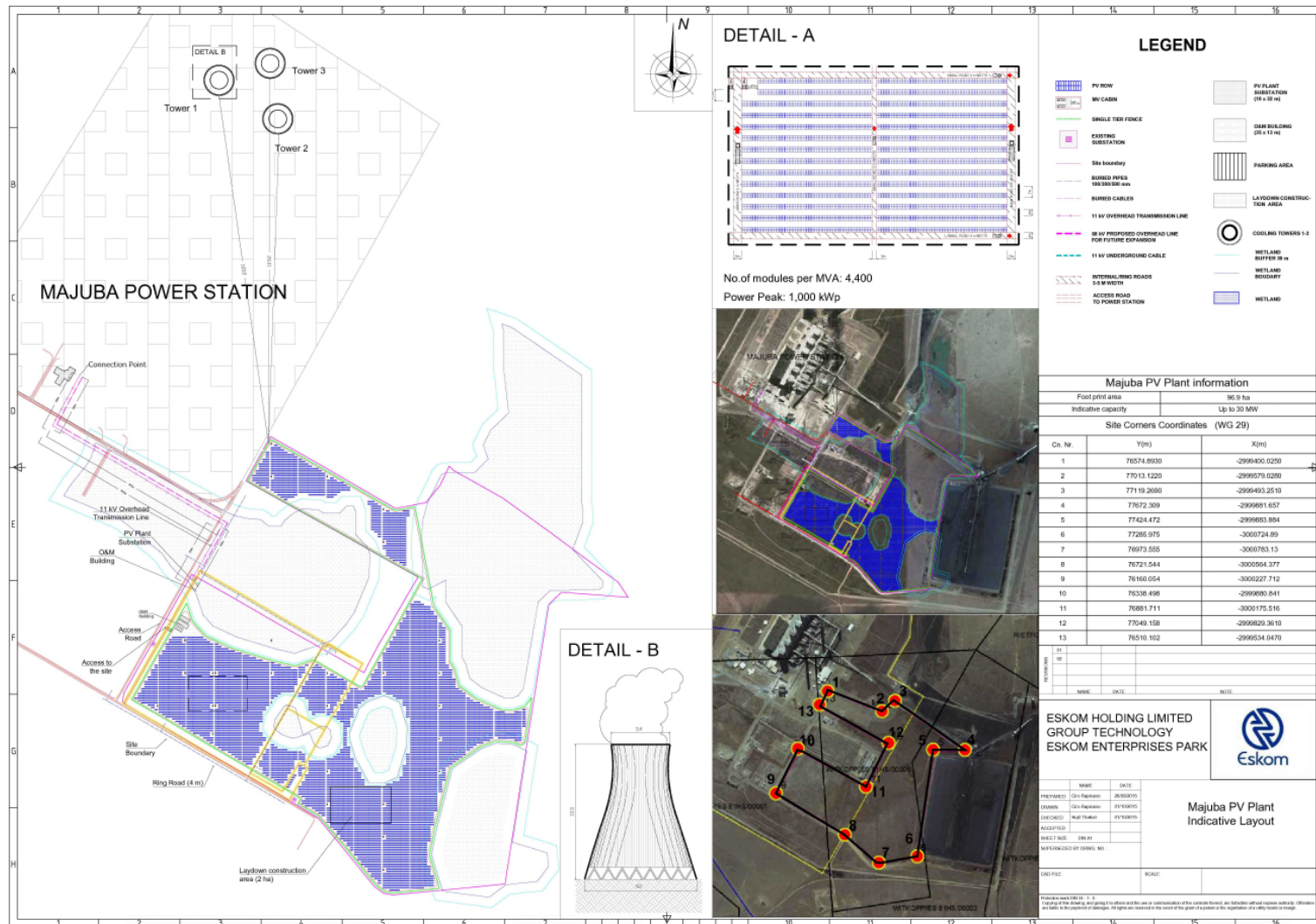


Figure 2: The optimised Layout showing the development footprint of the proposed Majuba PV Solar Energy Facility

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DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Archaeological material: Remains resulting from human activities which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Article 3.1 (*sensu* Ramsar Convention on Wetlands): "Contracting Parties "shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory"".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see <http://www.ramsar.org/>)

Calcrete: A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.

Cumulative impacts: 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 (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). 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.

Demand-side Management Programme (DSM): A joint initiative between the DME, the National Electricity Regulator (NER) and Eskom which aims to provide lower cost alternatives to generation system expansion by focusing on the usage of electricity. Consumers are incentivised to use electricity more efficiently and at times of the day outside of Eskom's peak periods.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Early Stone Age: A very early period of human development dating between 300 000 and 2.6 million years ago.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

- i. the land, water and atmosphere of the earth;
- ii. micro-organisms, plant and animal life;
- iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
- iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to 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.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Late Stone Age (LSA): In South Africa this time period represents fully modern people who were the ancestors of southern African Khoekhoen and San groups (40 000 – 300 years ago).

Middle Stone Age (MSA): An early period in human history characterised by the development of early human forms into modern humans capable of abstract thought process and cognition 300 000 – 40 000 years ago.

Midden: A pile of debris or dump (shellfish, stone artefacts and bone fragments) left by people after they have occupied a place.

Miocene: A geological time period (of 23 million - 5 million years ago).

National Integrated Resource Plan (NIRP): Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, in order to provide a long-term, cost-effective resource plan for meeting electricity

demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "...physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see <http://www.ramsar.org/>)

Palaeontological: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Pleistocene: A geological time period (of 3 million – 20 000 years ago).

Pliocene: A geological time period (of 5 million – 3 million years ago).

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Self-consumption: The possibility for any kind of electricity consumer to connect a photovoltaic system, with a capacity corresponding to his/her consumption, to his/her own system or to the grid, for his/her own or for on-site consumption, while receiving value for the non-consumed electricity which is fed into to the grid.

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Sustainable Utilisation (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer <http://www.ramsar.org/>).

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CO ₂	Carbon dioxide
DEA	National Department of Environmental Affairs
DMR	Department of Mineral Resources
DOT	Department of Transport
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km ²	Square kilometres
kV	Kilovolt
m ²	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework
SIA	Social Impact Assessment
ZVI	Zone of visual influence

INTRODUCTION

CHAPTER 1

Eskom Holding SOC (state owned company) Ltd (hereafter to be referred to as Eskom) is proposing to establish a **photovoltaic (PV)** solar energy facility of up to 65 MW and associated infrastructure on a site within the Majuba Coal Fired Power station boundary, approximately 15 km south-west of Amersfoort and 40 km northwest of Volksrust in the Mpumalanga Province (Refer to Figure 1.1). This project is to be known as the Majuba Photovoltaic (PV) Solar Energy Facility. Based on a pre-feasibility analysis and site identification process undertaken by Eskom a favourable area has been identified for consideration and evaluation through an Environmental Impact Assessment (EIA).

The solar energy facility is proposed to accommodate several arrays of tracking or static **PV panels** and associated infrastructure over the proposed site. From a regional perspective, the greater area is considered technically favourable for the development of a commercial solar electricity generating facility by virtue of the **climatic conditions** (primarily as the economic viability of a solar energy facility is directly dependent on the annual solar irradiation values for a particular area), relief and aspect, the extent of the site, availability of the land for development, and the availability of a direct **grid connection** (i.e. point of connection to the National grid). In addition, the project will contribute towards Eskom's target for the reduction of its self-consumption at its sites by introducing a PV Programme at various Eskom-owned properties across the country.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Environmental Impact Assessment Report.

1.1. Background to the project

The Majuba PV Solar Energy Facility is proposed on portions 1, 2 and 6 of the farm Witkoppies 81 HS, located in the jurisdiction of Gert Sibande District Municipality and Dr. Pixley Ka Isaka Seme Local Municipality within the Mpumalanga Province (refer to Table 1.1). A study area of 96.9 ha is being considered within which the facility is to be constructed. It is anticipated that the PV panels and the associated infrastructure can be appropriately placed within the boundaries of the site to avoid any identified environmental sensitivities or constraints identified through the EIA process. The site falls within Eskom-owned land and was confirmed by Eskom as being potentially suitable for solar energy generation through an internal site selection and feasibility study (refer to Chapter 2). The proposed development site is traversed by a number of power lines connecting into the Majuba Power Station. Access to the site is provided

directly from the R23 that runs on the western boundary of the proposed site or alternatively from the N11 national road, located to the east of the study area, approximately 10km away.

The facility is proposed to include several arrays of PV solar panels with a net generating capacity of up to 65 MW. The broader site is proposed to accommodate the following infrastructure:

- » Solar panels (fixed/tracking technology) with an net generating capacity of up to 65 MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation or switching station.
- » A power line to facilitate the connection of the solar energy facility from the on-site substation to Majuba Power Station or nearest grid within the power station.
- » Internal access roads.
- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

The overarching objective for the Majuba PV Solar Energy Facility is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. Furthermore, the project will contribute towards Eskom's target to reduce self-consumption at their various owned or utilised sites by installing 150 MWp at selected power stations, offices and substations. The solar PV facilities will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme. In order to assess the environmental feasibility of the proposed project, local level environmental and planning issues will be assessed through the EIA through site-specific studies in order to delineate areas of sensitivity within the broader site. This will serve to inform the design of the facility.

Table 1.1: A detailed description of the project site

Province	Northern Cape Province
District Municipality	Gert Sibande District Municipality
Local Municipality	Dr.Pixley Ka Isaka Seme Local Municipality
Ward number(s)	6
Nearest town(s)	Volkstrust

Farm name(s) and number(s)	Witkoppies 81 HS
Portion number(s)	1, 2 & 6 of Witkoppies 81 HS
SG 21 Digit Code (s)	T08S00000000008100001 T08S00000000008100002 T08S00000000008100006

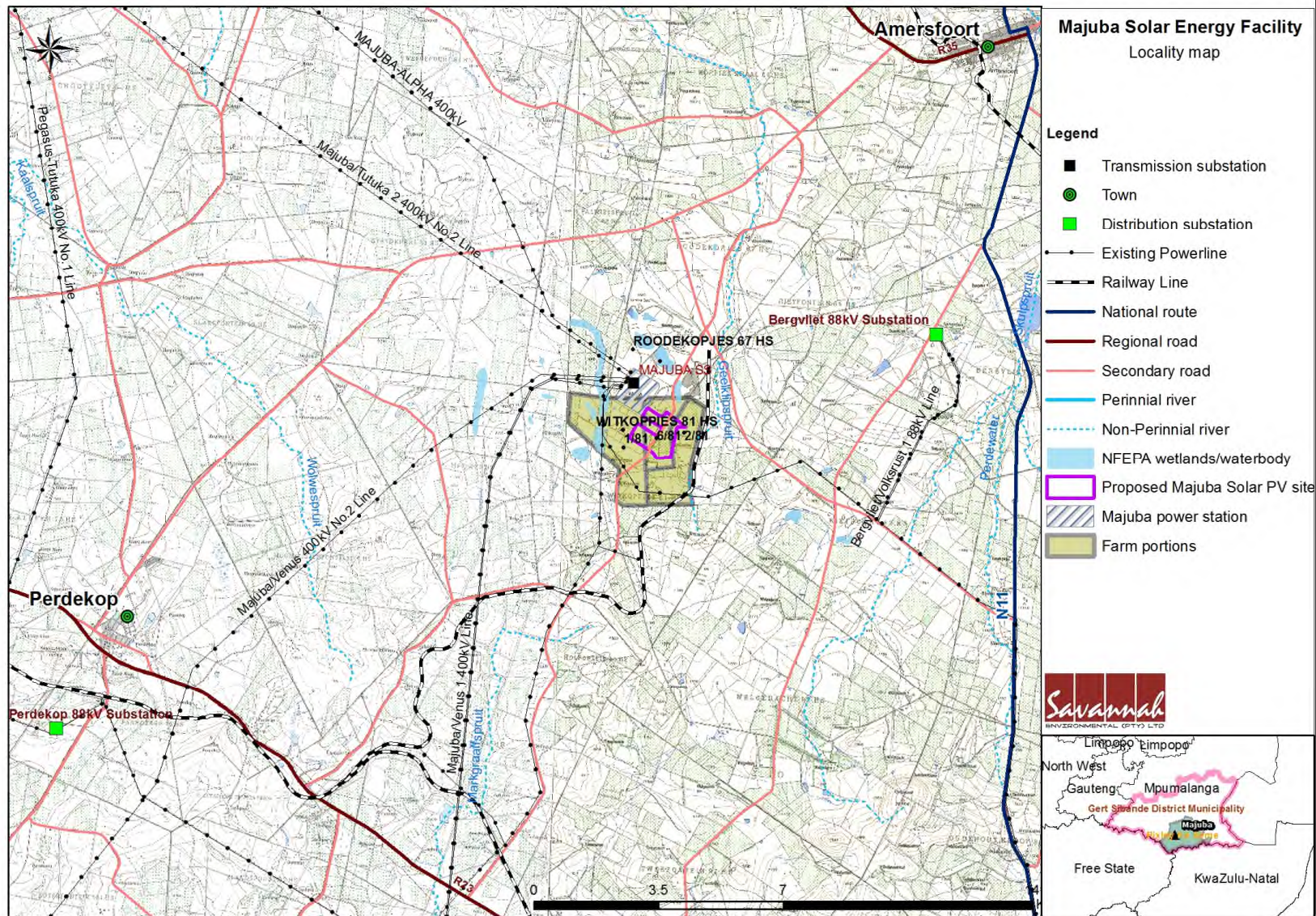


Figure 1.1: Locality map showing the location of Witkoppies 81 HS for the proposed Majuba PV Solar Facility.

1.2. Conclusions from the Scoping Phase

Specialist input: Several desktop specialist studies were undertaken as part of the Scoping Study for the purposes of identifying potential impacts and potential fatal flaws relating to the proposed Majuba PV Solar Energy Facility. The impacts identified as potentially resulting from the project broadly included agricultural, ecological, heritage, visual and social impacts and are summarised below:

Avifauna – Given the presence of existing habitat degradation and disturbance associated with the mining and energy generation activities in the study area, it is anticipated that the proposed Majuba PV Solar Energy Facility can be constructed at the identified site with acceptable levels of impact on the resident avifauna. Potential impacts that were identified relating to the PV plant itself are: bird collisions with PV panels; loss of habitat; disturbance; and the nesting of birds on plant infrastructure, of which habitat destruction is likely to be the most significant. Potential impacts of associated infrastructure include the following: collision of large terrestrial birds with overhead power lines; electrocution of birds on pylons; nesting of birds on pylons; habitat destruction and disturbance. Certain levels of habitat destruction and disturbance may also result from the construction of internal access roads, on-site substations and operations buildings.

Ecologically sensitive areas on the site – The Mpumalanga Biodiversity Conservation Plan classified a small central portion of the study area as being of Least Concern, whilst the remainder has been classified as having no natural habitat remaining. Although most of the study area appears to have been previously disturbed, the actual state of the ecosystem will have to be studied in detail during the peak growing season, before a definite assessment statement can be made as to the ecological impact of the proposed development. The largest concerns currently identified are:

- » All wetland areas on and adjacent to the study area will have to be delineated to determine suitable buffer areas between them and the proposed development;
- » The ecological state of the vegetation of the study area needs to be assessed in detail to correctly identify its conservation status;
- » All indigenous and alien invasive species, weeds and potential invasive species within the development area will have to be cleared prior to development and controlled after construction until decommissioning;
- » An ongoing monitoring program will be necessary to control and/or eradicate newly emerging invasive species;
- » Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed.

Heritage and palaeontology – The desktop study did not identify any paleontological reason to inhibit the development of the Majuba PV Solar Energy Facility within the preferred project location subject to the recommended damage mitigation procedures being implemented. The geological strata underlying the project area will be restricted to the Early Permian Volksrust Formation; this geological unit is known to be fossiliferous. The probability of the project resulting in a negative impact on the paleontological heritage of the Volksrust Formation has been assessed as moderate and therefore it has been recommended that a thorough examination of the central and south-eastern portions of the project area should be made by a palaeontologist as part of a full Paleontological Impact Assessment Study.

This scoping study revealed that a range of heritage sites occur in the larger region and similar sites can be expected within the study area. Every site is relevant to the Heritage Landscape, but it is anticipated that no site in the study area could have conservation value of high significance. The following conclusions are applicable to the following sites:

- » Archaeological sites: If any sites occur in the study area they could be mitigated either in the form of conservation of the sites within the development or by a Phase 2 study where the sites will be recorded and sampled before the client can apply for a destruction permit for these sites prior to development.
- » Historical finds and Cultural landscape: No structures appear to occur in the study area. This assumption will need to be verified in the field.
- » Burials and cemeteries: Formal and informal cemeteries as well as pre-colonial graves occur widely across Southern Africa. It is generally recommended that these sites are preserved within a development. These sites can however be relocated if avoidance is not possible, but this option must be seen as a last resort and is not advisable. The presence of any grave sites must be confirmed during the field survey and the public consultation process.

- » Soils & agricultural potential – The area investigated is comprised of mainly moderately deep to deep soils, with a small percentage of shallow soils. As such, the area can be considered as at least moderate to high potential for agricultural purposes.

- » Visual / Social Receptors - The brief assessment undertaken for the scoping stage indicated that because the project is proposed against the backdrop of the Majuba Power Station which includes associated infrastructure such as internal buildings, HV overhead power lines, coal stockpiles, a PFA tip and above ground conveyors, visual impacts of the proposed solar array are generally unlikely to be significant. In terms of possible landscape

degradation, the landscape does not appear to have any specific protection, although rural areas are clearly defined particularly from a distance and it is assumed that the majority of people would prefer rural views over views over heavy industry. Proposed development is likely to be viewed against the backdrop of existing industrial elements and so there is unlikely to be any significant further loss of the rural landscape character in the area.

- » Cumulative effects - There are no other solar developments in the study area but the presence of the existing Majuba Power Station in close proximity to the site could result in cumulative impacts. Based on the outcomes of the desk-top scoping study, the anticipated cumulative impacts on agricultural resources, ecology, heritage sites, and visual and social receptors are not considered to be of high significance.

The areas of potential environmental sensitivity relate mostly to the ecological and wetland aspects of the site and are illustrated in the sensitivity map (refer to Figure 1.2). It was recommended that infrastructure should be placed so as to consider the identified sensitive areas to minimise impacts.

Public participation: During the public participation process conducted during Scoping, the proposed project was generally well received from the recipient community, interested and affected parties as well as stakeholders. No objections to the proposed project were received on any environmental or social basis.

Approval of the Scoping Report: No environmental or social fatal flaws were identified to be associated with the broader site during the Scoping stage of the EIA process, and the Final Scoping Report was accepted by DEA in June 2015.

1.3. Requirement for an Environmental Impact Assessment Process

The construction and operation of the proposed Majuba PV Solar Energy Facility is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA) 107 of 1998. This section provides a brief overview of the EIA Regulations and their application to this project.

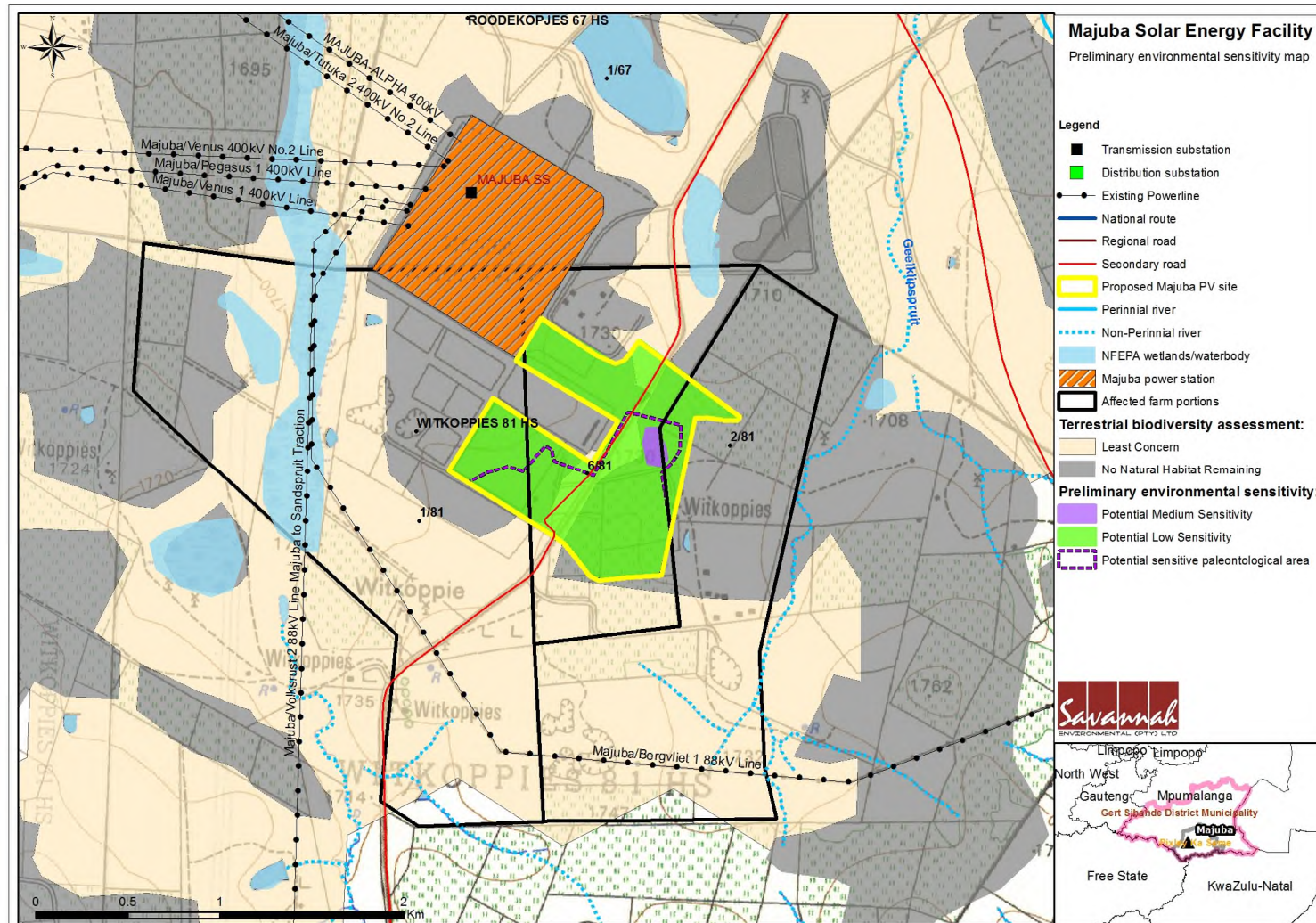


Figure 1.2: Scoping Environmental Sensitivity Map for the proposed Majuba Solar Energy alternatives sites showing low sensitive ecological areas and potential wetlands.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs (DEA¹) is the competent authority for this project. An application for authorisation for Majuba PV Solar Energy Facility has been accepted by the DEA (under Application Reference number: 14/12/16/3/3/2/752). Through the decision-making process, the DEA will be supported by the Mpumalanga Department of Economic Development, Environment and Tourism, as the commenting authorities.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project. Eskom has appointed Savannah Environmental (Pty) Ltd as the independent Environmental Assessment Practitioner (EAP) to undertake the required EIA process for Majuba PV Solar Energy Facility.

1.4. Objectives of the EIA Process

The Scoping Phase was completed in **May 2015** with the submission of a Final Scoping Report to the DEA, and the acceptance of scoping was received from DEA in **June 2015**. The scoping phase included desk-top studies and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. Input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs) was included in the evaluation of impacts.

The EIA Phase aimed to address those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with the project including design, construction, operation and decommissioning, and recommend appropriate mitigation measures for potentially significant environmental impacts. The purpose of this EIA report is to assess the impacts associated with the

¹ In terms of the Energy Response Plan, the DEA is the competent authority for all energy related applications.

currently proposed layout for the Majuba PV Solar Energy Facility through detailed specialist studies and public consultation. This EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report for a 30 day period provided stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The final EIA Report for submission to DEA incorporates all issues raised during the public review period of the draft report and responses provided.

1.5. Details of the Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA Phases

Savannah Environmental was contracted by Eskom as the independent Environmental consultants to undertake both Scoping and EIA processes for the proposed Majuba PV Solar Energy Facility. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Eskom. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team has considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

- » *Sandhisha Jay Narain* – the principle for this report holds an Honours degree in Environmental Management. She has 8 years of experience consulting in the environmental field. Her key focus is on on-site Environmental Management; Environmental Compliance Auditing and Monitoring, and has been involved in environmental impact studies and water use licence applications.
- » *Sheila Muniongo* - the co-author of this report holds an Honours Bachelor degree in Environmental Management and 4 years of experience in the environmental field. Her key focus is on environmental impact assessments,

public participation, environmental management programmes, and mapping through ArcGIS for variety of environmental projects. She is currently involved in several EIAs for renewable energy projects EIAs across the country.

- » *Jo-Anne Thomas* - the principle Environmental Assessment Practitioner (EAP) for this project, is a registered Professional Natural Scientist and holds a Master of Science degree. She has 18 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy and power line projects across the country.
- » *Gabriele Wood* - holds an Honours Degree in Anthropology. She has 6 years consulting experience in public participation and social research. Her experience includes the design and implementation of public participation programmes and stakeholder management strategies for numerous integrated development planning and infrastructure projects. Her work focuses on managing the public participation component of Environmental Impact Assessments and Basic Assessments undertaken by Savannah Environmental

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has included the following specialist consultants to conduct specialist assessments:

- » Avifauna – Megan Diamond (Feathers Environmental Services)
- » Ecology – Marianne Strohbach (Savannah Environmental) and Michael Cohen (external reviewer)
- » Wetlands – Robert Taylor (Limosella Consulting)
- » Soils and Agricultural Potential – Garry Paterson (ARC-Institute for Soil, Climate and Water)
- » Heritage – Jaco van der Walt (Heritage Contracts and Archaeological Consulting CC (HCAC))
- » Palaeontological Assessment – Elize Butler (National Museum, Bloemfontein)
- » Visual – John Marshall (Afzelia Environmental Consultants and Environmental Planning and Design)
- » Social – Candice Hunter (Savannah Environmental) and Neville Bews (external reviewer)

Appendix A includes the curricula vitae for the environmental assessment practitioners from Savannah Environmental and the specialist consultants.

OVERVIEW OF THE PROPOSED PROJECT

CHAPTER 2

This chapter provides an overview of the Majuba PV Solar Energy Facility and details the project scope which includes the planning/design, construction, operation and decommissioning activities. This chapter also explores the need and desirability of the project at the preferred site location, site and technology alternatives as well as the 'do nothing' option. Lastly, it explores the use of solar energy as a means of power generation.

2.1. The Need and Desirability of the Development at the preferred site location

Internationally there is an increase in the deployment of renewable energy technologies for the generation of electricity due to concerns such as climate change and exploitation of non-renewable resources. Through the Integrated Resource Plan (IRP), the South African Government has set a target for renewable energy of 17 GWh renewable energy contributions to final energy consumption by 2030, to be produced mainly from biomass, wind, solar and small-scale hydro. Eskom has already successfully installed PV systems at offices and parking lots within Eskom-owned property to promote renewable energy awareness and to diversify their own energy mix. Furthermore, Eskom is looking at further reducing its self-consumption at its sites by introducing the PV Programme which aims to install up to 150 MWp at its various power stations, which includes the proposed Majuba PV Solar Energy Facility. The solar PV facilities will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme.

The approved strategy for the PV programme is to install 150 MWp of PV at various power stations. However, the program is exploring the possibility of maximizing the usage of available land at each power station which may result in more than 150 MW being installed. The capacity of 65 MW presented in this report represents the maximum estimated PV capacity at Majuba Power Station. This far exceeds the capacity allocated for self-consumption (8 – 12 MW) at Majuba. Currently, Eskom is not permitted to feed electricity from these renewable projects into the national grid. The Program is however exploring to construct maximum available capacity if Eskom receives permission to develop the project and connect into the national grid.

Receptiveness of the site to development of a PV Facility

The Majuba PV Solar Energy Facility is proposed on portions 1, 2 and 6 of the farm Witkoppies 81 HS, in the jurisdiction of Gert Sibande District Municipality and Dr. Pixley Ka Isaka Seme Local Municipality within the Mpumalanga Province. Eskom considers this area, to be highly preferred from a technical perspective for the development of a solar energy facility. The reasons include:

- » Extent of site: Availability of level land of sufficient area can be a restraining factor for development of PV facilities. For the development of the Majuba PV Solar Energy Facility, 96.9 ha of land is available for the development footprint within the Eskom-owned property. The larger farm portion owned by Eskom is approximately 850 ha in extent, which is sufficient for the installation of the facility allowing for avoidance of site sensitivities. The development footprint of the facility would comprise about 11.4 % of the total extent of the farm portion.
- » Power transmission considerations: connection to the grid is readily available on site. The electricity generated will be exported to the Majuba Power Station/distribution network.
- » Site access: The main access to the site will be directly from the R23 that runs along the western boundary of the proposed site, or alternatively from the N11 national road located approximately 10 km to the east of the study area. Internal access roads of up to 5-8 m wide will also be required. As material and components would need to be transported to the project site during the construction phase of the project, the accessibility of the site was a key factor in determining the viability of the project, particularly taking transportation costs (direct and indirect) into consideration and the impact of this on project economics.
- » Loss of current land use: The area around the Majuba PV site is characterised by three distinctive land uses: i) Heavy industrial development including the adjacent Majuba Power Station and associated conveyors and stockpiles. There are no other obvious industrial operations in the vicinity of the proposed site. ii) Urban development including the small settlements of Amersfoort and Perdekop which lie approximately 14 km to the north east and 15 km to the south west respectively. iii) Agricultural development is the main development type surrounding the proposed site. There is a mixture of arable agriculture and grazing land. Arable agriculture is more obvious in lower areas where water is more accessible. Grazing is the dominant use of higher areas.
- » Topographic conditions: The site is expected to be slightly undulating. Within close proximity of the site are several valley floor wetlands (vleis) and slope seepage areas. The proposed site has a ~2% north facing slope, with the altitude ranging from ~1740-1720 m.a.s.l.

- » Proximity to towns with a need for socio-economic upliftment: The Mpumalanga Province, like most of South Africa, is marred by unemployment, inequalities and poverty. To this extent the Majuba PV Solar Energy Facility is situated in close proximity to Volksrust, the main town of Dr Pixley Ka Isaka Seme Local Municipality. Volksrust together with Vukuzakhe form the largest urban settlement areas within the municipal area. These two areas are located in the southern portion of the municipal area of jurisdiction with other urban areas such as Amersfoort located to the north, Wakkerstroom to the east. These are relatively dense urban areas and local labour would be easy to source, which fits in well with economic development criteria for socio-economic upliftment. The project would present a new opportunity for skilled local labour.

2.2. Strategic Context for Energy Planning: National and Local Policy level

The need for harnessing renewable energy resources (such as wind energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry, a target of 17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This 17,8GW of power from renewable energy amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

Renewable energy technologies are among the supply-side options being considered by Eskom. The organisation has developed a renewable energy strategy which outlines a number of focus areas, including research and development of various technologies. Renewable energy sources which are being evaluated are wind, solar, wave, tidal, ocean current, biomass and hydro. Through the South African Bulk Renewable Energy Generation (SABRE-Gen) programme, a vehicle was established to enable the evaluation of multi-MW, grid connected generation. The initiatives all follow the same functional structure, namely:

- a) the identification of feasible options
- b) an assessment of the financial and economic viability as well as resource potential in the country
- c) the implementation of demonstration projects to conduct operational research
- d) the provision of strategies for the uptake and sustainable deployment of the technologies where feasible.

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. This is detailed in the sections which follow.

2.2.1. Mpumalanga Provincial Growth and Development Strategy (PGDS) (2004-2014)

The PGDS: 2004-2014 is the fundamental policy framework for the Mpumalanga Provincial Government. As a policy framework it sets the tone and pace for growth and development in the province. The PGDS addresses the key and most fundamental issues of development spanning the social, economic and the political environment and was developed for the purpose of aligning the policies and strategies of all spheres of Government. The province has identified six priority areas of intervention. These priority areas have been identified primarily based on the social, economic and developmental needs of the province, namely:

- » Economic Development:
 - * Enhance provincial economic development to improve the quality of life for all;
 - * Prioritise the advancement of the second economy to address poverty and unemployment.
- » Development Infrastructure:
 - * The development of multi-faceted infrastructure to address basic needs and improve the quality of life.
- » Social Development:
 - * Attain high levels of social development that will ensure a well-educated citizenry that is healthy, safe and has access to sufficient recreational facilities
- » Sustainable Environmental Development:
 - * To ensure sustainable development and environmental management.
- » Good Governance:
 - * Enhance and develop the institutional capacity of the public sector to ensure effective and efficient service delivery;
 - * Promote and enhance cooperative governance for integrated service delivery;
 - * Promote a culture of accountability and transparency in the public sector;
 - * Improved integrated service deliver through innovative and proactive practices;

- * Strengthening of social partnership and community participation in development and service delivery.
- » Human Resource Development:
 - * Invest in peoples skills to promote service delivery, economic growth and development
 - * To position higher education institutions to meet the skills demand of the province
 - * Improve access to and ensure quality education

The Mpumalanga PGDS emphasises the provinces priorities, some of which are aligned with the proposed development such as the need for economic development, addressing poverty, unemployment and human resource development, as well as infrastructure development and service delivery. The proposed development will contribute towards these priorities.

2.2.2. Mpumalanga Economic Growth and Development Path (MEGDP) (2011)

The primary objective of the Mpumalanga Economic Growth and Development Path (MEGDP) is to foster economic growth that creates jobs, reduce poverty and inequality in the Province. The main economic sectors have been identified as key to spur economic growth and employment creation and are as follows:

- a. Agriculture and forestry
- b. Mining and energy
- c. Manufacturing and beneficiation
- d. Tourism and cultural industries

As far as new economies within the province are concerned, focus is placed on the green economy and Information, Communication and Technology.

The Green Economy: The use of coal for energy production results in both the primary environmental impacts associated with the mining and removal of coal for use in coal fired power stations in the province, as well as the secondary impacts resulting from the burning of this coal for energy production. Coal intensive activities contribute to large-scale water and air pollution, including significant carbon dioxide emissions, which contribute to global warming. While energy is crucial for the socio-economic developmental objectives of the province, it is obvious that there has not been enough focus on renewable energy development as a key aspect of this developmental agenda. In order to adequately address the information gaps and to allow the province to meet its integrated energy needs for sustainable socio-economic development, there is a need for research to be conducted on a number of key areas with a view of developing an Integrated Renewable Energy Plan for the Province. This will

include research work in areas such solar energy; biomass (bagasse; wood-waste (saw-dust, wood off-cuts, etc.) and putrescible waste (including municipal solid waste, abattoir waste) and Hydro-power. The work on Bio-fuels in the Province has already set the scene for extensive research for other sources of renewable energy.

As is evident from the above, the proposed development falls directly in line with the Mpumalanga provincial growth path with regards to employment creation in the renewable energy industry (which support the province's green economy vision), the benefits it will bring to the local community as well as contributing towards diversifying the local economy towards a greener economy.

2.2.3. Gert Sibande District Municipality Spatial Development Framework (2009)

The Gert Sibande District Municipality SDF firstly seeks to encourage rural – urban migration by providing subsidised services in key selected areas / nodes / economic clusters. Secondly, the SDF seeks to strengthen and supplement the functional economic strips / corridors characterising the District's space-economy, as well as developing industry specific economic clusters / activity areas. The following are the development principles to be achieved as part of the Spatial Development Framework for the Gert Sibande District Municipality (GSDM):

1. To actively protect, enhance and manage the natural environmental resources of the District, in order to ensure a sustainable equilibrium between biodiversity conservation, mining, manufacturing and industrial activities, agriculture, forestry, and tourism related activities within the District.
2. To optimally capitalize on the strategic location of the District and its five key economic strips / corridors, and to functionally link all towns and settlements to one another through establishing and maintaining a strategic road and rail network comprising internal and external linkages.
3. To utilise the existing natural environmental, cultural-historic and man-made activity areas within the District as Tourism Anchors and Nodes; and to develop and promote the eastern parts of the District (around route R33) as a Primary Tourism Corridor linking the Lowveld Tourism Precinct to the north (in Ehlanzeni), to the St Lucia Tourism Precinct located to the south of the District.
4. To promote forestry within and along the identified Primary Tourism Corridor.
5. To promote intensive and extensive commercial farming activities throughout the District, and to facilitate and concentrate subsistence farming activities within certain rural communities.
6. To unlock the development potential of existing towns through developing industry specific Special Economic Zones / Economic Clusters throughout the

District, in line with the MPISF and the provincial LED Strategy and in accordance with the following sectors:

- a. Agricultural Cluster
 - b. Forestry Cluster
 - c. Industrial Cluster
7. To facilitate and accommodate mining in the District in a sustainable manner in order to support local electricity generation and industrial development.
 8. To establish a functional hierarchy of towns and settlements in the District, and to ensure equitable access to social infrastructure and the promotion of local economic development by way of Thusong Centres (Multi-Purpose Community Centres (MPCCs)).
 9. To ensure that all communities have access to at least the minimum levels of service as enshrined in the Constitution.
 10. To consolidate the urban structure of the District around the highest order centres by way of infill development and densification in Strategic Development Areas (SDAs).

Development Principles 1 to 9 highlighted the proposed future spatial structure of the District Municipality, as well as the major activity nodes/centres to be promoted as such. The proposed development is located in an industrial area within the boundary of the Majuba Power Station. The proposed development will not compromise agricultural land or tourism potential within this area and therefore the project falls in line with the SDF.

2.2.4. Gert Sibande District Municipality Integrated Development Plan (2015/2016)

The vision of the District Municipality is as follows - Striving to Excel in Good Governance and Quality Infrastructure. The developmental objectives and strategies are presented by Key Performance Area (KPA) as listed below. Key Performance Areas include:

- » KPA 1: Municipal Transformation and institutional Organizational Development
- » KPA 2: Basic Service Delivery and Infrastructure Development
- » KPA 3: Local Economic Development
- » KPA 4: Municipal Financial Viability and Management
- » KPA 5: Intergovernmental Relations, Good Governance and Public Participation
- » KPA 6: Spatial Rationale and Municipal Planning Alignment

The GSDM and its constituent local municipalities face a number of backlog and developmental challenges. Over and above the infrastructural backlog, the District is faced with a high unemployment and poverty rate.

Local economic development is seen as one of the most important ways of decreasing poverty. The proposed development will stimulate local economic growth through job creation, diversifying the local industry and skills development which is in line with the IDP KPA 3.

2.2.5. Dr Pixley Ka Isaka Seme Local Municipality Integrated Development Plan (IDP) (2013-2014)

In terms of the IDP, key priorities of the current council include:

- » *Access to land:* make land available, providing land that is furnished with all basic services, proper roads
- » *Provision of basic services:* Eradication of existing backlogs in access to sanitation, water and electricity; infrastructure development; infrastructure maintenance
- » *Economic Empowerment and Development:* BBBEE Act to be amended to assist a statutory commission to deal with non-compliance (SCM Policy); LED strategy and plan; Promotion of tourism in the Dr Pixley Ka Isaka Seme jurisdiction; Women empowerment and gender equity
- » *Human settlements:* RDP houses (In terms of allocation); Access to loans for those who do not qualify for either RDP or Bond; 30% of land distribution by 2014; willing seller willing buyer to be reviewed
- » *Health:* HIV/Aids awareness; Refurbishment of hospitals and nurses home; Increase in the number of mobile clinics in rural areas; Extension of operating hours for clinics; Visibility of Health inspectors; Availability of Specialized Doctors in the hospital; Improve response time for Ambulance
- » *Unemployment and job creation:* Expanded public works programme EPWP, IDC projects to be initiated through the job fund project; Rail Transport (for Coal haulage); People living with disabilities and youth to be catered in all projects initiated
- » *Education:* Workplace learning opportunities (in-service training and learnership); Provide higher education learning institution; improve the literacy rate within the municipal jurisdiction; Improve the matriculation pass rate through extra classes
- » *Clean Audit by 2014:* Implementation of AG action Plan; Municipal financial viability and management
- » *Heritage projects- tourism route and projects to be initiated:* Heritage sites of Dr Pixley Ka Isaka Seme and Mahatma Gandhi underway
- » *Good Governance:* Public Participation; Traditional leader involvement; Functional Ward Committees; Establishment and implementation of CBP model

Taking cognisance of the developmental challenges that the local municipality is faced with, coupled with the availability of funding allocated to support these

initiatives and ultimately realise the aforementioned Vision and Mission, the municipalities has set for itself the following Developmental Objectives and Strategies to be pursued in the short- to medium term. The Developmental objectives and strategies are presented by Key Performance Area as listed below, and in the format of Strategic Scorecards:

- » KPA 1: Municipal Transformation and Organizational Development
- » KPA 2: Basic Service Delivery and Infrastructure Development
- » KPA 3: Local Economic Development
- » KPA 4: Municipal Financial Viability and Management
- » KPA 5: Intergovernmental Relations, Good Governance and Public Participation

The proposed solar energy facility development will advance the objectives of KPA 3 in terms of local economic development through job creations and skills development, and will contribute towards the key priorities of the LM IDP.

2.2.6. Strategic Integrated Projects (SIPs)

The Presidential Infrastructure Coordinating Committee (PICC) is integrating and phasing investment plans across 18 Strategic Infrastructure Projects (SIPs) which have five core functions: to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development and enabling regional integration.

SIP 8 of the energy SIPs supports the development of the Solar Energy Facility which is as follows:

- » *SIP 8: Green energy in support of the South African economy:* Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010) and supports bio-fuel production facilities.

In fulfilment of SIP 8 (green energy) and to meet the targets set in the Integrated Resource Plan (IRP 2010), the proposed Majuba PV Solar Energy Facility could potentially contribute towards SIP 8 by addition of clean energy to the grid (should the project be constructed) and the project will create significant socio-economic benefits at a local, regional and national scale.

2.3. Financial Viability and Community Needs

In terms of the energy yield predicted from the facility, Eskom considers the Eskom Majuba project to be financially viable. The "need and desirability" from the perspective of the local community as reflected in the IDP and SDF for the area has been considered in the EIA process. In the South African context, developmental needs (community needs) are often determined through the above planning measures (IDP and SDF). Although the renewable energy sector is not explicitly identified as a sector or initiative in all current municipal policy and planning documents as outlined above, it could contribute positively to the needs of the local community, including development, social services, education and employment opportunities in this area, as identified in these planning documents. The Majuba PV Solar Energy Facility will create employment and business opportunities during the construction and operational phases, as well as the opportunity for skills development for the local community. In addition, indirect benefits and spend in the local area will benefit the local community.

2.4. The Desirability for the Majuba Solar Energy Facility Project

The use of solar irradiation for electricity generation is essentially a non-consumptive use of a natural resource. A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed site located on portions 1, 2 and 6 of the farm Witkoppies 81 HS was selected for the development of a solar energy facility based on its suitable proximity in relation to the existing and available electricity grid, the availability of the site for development, and minimum technical constraints from a construction, technical perspective and environmental suitability.

Additionally, Eskom has successfully installed PV at offices and parking lots to promote renewable energy awareness and to diversify their own energy mix. Eskom is looking at further reducing their self-consumption at their various owned or utilised sites by introducing Eskom's Ilanga PV Project Portfolio which aims to install 150MWp at its various power stations, offices and substations. The solar PV facilities will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme

2.5. Solar Energy Technology Roadmap 2013

Diffusion of renewable energy, generally, and solar technology, specifically, in South Africa is meant to address the government's desire to aggressively integrate renewable energy technologies into the national energy mix in order to

reduce the country's carbon emissions levels, to help address its growing electricity generation needs, and its industrial heat needs (DEA draft integrated Energy planning report, 2012). The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions during its operation. The generation of renewable energy will contribute to South Africa's electricity market which has, to date, been heavily dominated by coal-based power generation. The advancement of renewable energy is a priority for South Africa as the government has set a 17GW of electricity by 2030, as part of the IRP 2010. Furthermore, recent policy highlights the desirability of clean, green energy and solar generated energy will play a significant role in reaching these quotas.

The findings of the review of the relevant policies and documents pertaining to the energy sector therefore indicate that solar energy and the establishment of the Proposed Majuba PV Solar Energy Facility is supported at a national, provincial, and local level, and that the proposed project will contribute towards the various targets and policy aims at all three levels.

2.6. Project Alternatives

In accordance with the requirements of the EIA Regulations 2010, the consideration of alternatives including site and technology alternatives, as well as the "do-nothing" alternative should be undertaken. The follow sections address this requirement.

2.6.1. Site Alternatives

An internal investigation/screening process was undertaken by Eskom to assess the potential for installing PV facilities at Eskom power stations in Gauteng, Free-State, Mpumalanga and KwaZulu-Natal regions. This study provided an indication of the potential capacity, land availability, environmental constraints and electrical connection options for each of the power stations including Arnot, Duvha, Kendal, Kriel, Majuba, Majuba, Matimba, Tutuka, Camden, Komati and Ingula. The sites within the Arnot, Duvha, Majuba, Majuba and Tutuka power stations were selected as the first sites for consideration within EIA processes.

The following factors have been considered in determining a preferred site for PV solar development including:

- » Land availability and environmental constraints (i.e. ecological sensitive areas); and
- » Technical feasibility – taking into account all electrical considerations including point of connection and electrical infrastructure available.

At screening level, it was concluded by Eskom that the Majuba Power Station has land available for a large PV facility. In assessing the 8 potential land areas identified at Majuba Power Station (as indicated in Figure 2.1), the analysis of the land was separated into 3 criteria being preferred, potential, and problematic/restricted land sites. In each of the criteria the land parcel was analysed for the land availability (current and future), environmental issues in and around each site, point of electrical connection and future planned power station projects around the site. The parcels of land indicated in Figure 2.1 are land parcels identified as being of sufficient size to accommodate a PV facility. However, from the initial assessment undertaken, it was concluded that most of these sites are at too great a distance away from the power station and point of connection (presenting both land and environmental issues), could impact on private parties leasing Eskom owned land, and could impact on the planned underground coal gasification (UCG) project being investigated by Eskom at the power station. The proposed site for development, indicated as Site 5 on Figure 2.1 was identified as the preferred site based on the fact that the site is within the power station immediate fence and the site is flat with some grassland. This proposed site is supported by the power station operational staff.

Based on the above considerations, Eskom considers the proposed site as a highly preferred site for the development of a PV Solar Energy Facility.



Figure 2.1: Aerial view of zoomed in area of Majuba power station with coloured areas as possible identified PV sites.

2.6.2. Layout and Design Alternatives

The PV facility includes several arrays of PV solar panels with a net generating capacity of up to 65 MW. As mentioned above, the site is flat with some grassland and within the power station immediate fence and the site is flat with some grassland.

2.6.3. Technology Alternatives

Few technology options are available for PV facilities, and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail on the site, so that optimality is obtained by the final site selection. Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability. Solar PV was determined as the most suitable option for the proposed site as large volumes of water are not required for power generation purposes compared to concentrated solar power technology (CSP). PV is also preferred when compared to CSP technology because of the lower visual profile. Two solar energy technology alternatives are being considered for the proposed project and include:

- » Fixed Mounted PV systems (static/fixed-tilt panels);
- » Tracking PV systems (with solar panels that rotate around a defined axis to follow the sun's movement).

The primary differences between technologies available which affect the potential for environmental impacts relate to the extent of the facility, or land-take (disturbance or loss of habitat), fewer megawatts being installed in the same area, as well as the height of the facility (visual impacts). Regardless of the technology, the PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance. The impacts associated with the operation and decommissioning of the facility will be the same irrespective of the technology chosen. The technology to be used will be assessed in detail within this report.

Fixed Mounted PV System

In a fixed mounted PV system (fixed-tilt), PV panels are installed at a pre-determined angle from which they will not move during the lifetime of the plant's operation. The limitations imposed on this system due to its static placement are offset by the fact that the PV panels are able to absorb incident radiation reflected from surrounding objects. In addition, the misalignment of the angle of PV panels has been shown to only marginally affect the efficiency of energy

collection. There are further advantages which are gained from fixed mounted systems, including:

- » The maintenance and installation costs of a fixed mounted PV system are lower than that of a tracking system, which is mechanically more complex given that PV mountings include moving parts.
- » Fixed mounted PV systems are an established technology with a proven track record in terms of reliable functioning. In addition, replacement parts are able to be sourced more economically and with greater ease than with alternative systems.
- » Fixed mounted systems are robustly designed and able to withstand greater exposure to winds than tracking systems.
- » Fixed mounted PV systems occupy less space than the tracking systems for the same energy output.

Tracking PV System

Tracking PV Systems (single axis or dual axis trackers) are fixed to mountings which track the sun's movement. There are various tracking systems. A 'single axis tracker' will track the sun from east to west, while a dual axis tracker will in addition be equipped to account for the seasonal waning of the sun. These systems utilise moving parts and more complex technology, which may include solar irradiation sensors to optimise the exposure of PV panels to sunlight. Tracking PV panels follow the sun's rotational path all day, every day of the year giving it the best solar panel orientation and thereby enabling it to generate the maximum possible output power.

2.6.4. The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Majuba PV Facility. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a solar PV facility. However, the benefits of this renewable energy facility will not be realised as the generation of electricity from renewable energy resources can offer a range of socio-economic and environmental benefits for South Africa. This alternative is assessed in detail within this EIA Report.

2.7. Description of the Project

The facility is proposed to accommodate either static or tracking photovoltaic (PV) arrays to harness the solar resource on the site. The facility is proposed to have an export capacity of up to 65 MW. An area of up to 96.9 ha in extent will be occupied by the PV panels and associated infrastructure. A layout of the

proposed Majuba PV Solar Energy Project and associated infrastructure has been provided by the project developer, and is indicated in Figure 2.1. This is the layout which has been assessed within this EIA Report. Table 2.1 and 2.2 summarise the dimensions of the project components.

The proposed Majuba PV Solar Energy Project is proposed to include several arrays of photovoltaic (PV) solar panels and will comprise the following:

- » Solar panels (fixed/tracking technology) with a capacity of up to 65 MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation or switching station.
- » A power line to facilitate the connection of the solar energy facility from the on-site substation to Majuba Power Station or nearest grid access point
- » Internal access roads.
- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

Table 2.1: The position of the planned infrastructure

Infrastructure	Dimensions/ Details	
<u>Corner points for the Majuba PV facility site (left to right)</u>	Northern Section	
	Latitude	Longitude
	27° 6' 15.663" S	29° 46' 20.607" E
	27° 6' 22.199" S	29° 46' 33.714" E
	27° 6' 22.516" S	29° 46' 35.155" E
	27° 6' 22.272" S	29° 46' 36.616" E
	27° 6' 23.900" S	29° 46' 36.188" E
	27° 6' 26.121" S	29° 46' 36.244" E
	27° 6' 27.052" S	29° 46' 36.062" E
	27° 6' 29.461" S	29° 46' 36.287" E
	27° 6' 28.103" S	29° 46' 32.695" E
	27° 6' 26.451" S	29° 46' 32.555" E
	27° 6' 25.011" S	29° 46' 31.922" E
	27° 6' 24.378" S	29° 46' 31.079" E
	27° 6' 22.340" S	29° 46' 30.903" E
	27° 6' 21.426" S	29° 46' 30.622" E
	27° 6' 20.864" S	29° 46' 30.060" E
27° 6' 20.688" S	29° 46' 28.619" E	
27° 6' 21.075" S	29° 46' 27.530" E	

27° 6' 21.567" S	29° 46' 26.968" E
27° 6' 20.899" S	29° 46' 24.192" E
27° 6' 21.356" S	29° 46' 22.435" E
27° 6' 21.778" S	29° 46' 21.697" E
27° 6' 20.196" S	29° 46' 17.761" E

Southern Section

27° 6' 32.820" S	29° 46' 9.688" E
27° 6' 35.168" S	29° 46' 11.478" E
27° 6' 37.989" S	29° 46' 20.488" E
27° 6' 38.297" S	29° 46' 23.701" E
27° 6' 37.491" S	29° 46' 26.261" E
27° 6' 39.962" S	29° 46' 32.265" E
27° 6' 37.400" S	29° 46' 34.071" E
27° 6' 31.690" S	29° 46' 37.535" E
27° 6' 31.544" S	29° 46' 38.755" E
27° 6' 32.813" S	29° 46' 39.073" E
27° 6' 33.325" S	29° 46' 39.927" E
27° 6' 34.705" S	29° 46' 40.900" E
27° 6' 36.114" S	29° 46' 40.623" E
27° 6' 37.546" S	29° 46' 40.743" E
27° 6' 38.245" S	29° 46' 41.164" E
27° 6' 40.219" S	29° 46' 41.550" E
27° 6' 41.784" S	29° 46' 43.861" E
27° 6' 42.687" S	29° 46' 46.269" E
27° 6' 42.519" S	29° 46' 49.062" E
27° 6' 44.914" S	29° 46' 48.520" E
27° 6' 46.118" S	29° 46' 47.774" E
27° 6' 45.962" S	29° 46' 47.100" E
27° 6' 45.926" S	29° 46' 45.523" E
27° 6' 46.528" S	29° 46' 43.693" E
27° 6' 47.443" S	29° 46' 42.091" E
27° 6' 48.418" S	29° 46' 40.936" E
27° 6' 48.851" S	29° 46' 40.550" E
27° 6' 52.993" S	29° 46' 39.371" E
27° 6' 55.509" S	29° 46' 39.009" E
27° 6' 56.833" S	29° 46' 38.612" E
27° 6' 57.447" S	29° 46' 38.564" E
27° 6' 59.109" S	29° 46' 39.190" E
27° 6' 59.711" S	29° 46' 39.334" E
27° 7' 0.071" S	29° 46' 36.416" E
27° 6' 59.942" S	29° 46' 33.418" E
27° 6' 58.662" S	29° 46' 31.557" E
27° 6' 52.715" S	29° 46' 25.611" E
27° 6' 51.679" S	29° 46' 23.483" E

	27° 6' 51.169" S	29° 46' 23.737" E
	27° 6' 50.751" S	29° 46' 23.028" E
	27° 6' 51.206" S	29° 46' 22.755" E
	27° 6' 42.282" S	29° 46' 5.207" E
	27° 6' 40.972" S	29° 46' 4.818" E
<u>Corner points for the Majuba PV facility substation</u>	Latitude	Longitude
	27° 6' 33.530" S	29° 46' 9.515" E
	27° 6' 33.775" S	29° 46' 10.172" E
	27° 6' 34.028" S	29° 46' 10.077" E
	27° 6' 33.765" S	29° 46' 9.372" E
<u>Power Line</u>	Latitude	Longitude
Starting Point (0m) – PV Plant SS	27°6' 33.648" S	29°46' 9.444" E
250m	27°6' 26.727" S	29°46' 13.251" E
500m	27°6' 21.260" S	29°46' 11.058" E
750m	27°6' 17.216" S	29°46' 3.182" E
1000m	27°6' 13.251" S	29°45' 55.231" E
End Point (1072m) – Majuba Power station	27°6' 11.618" S	29°45' 55.335" E

Table 2.2: Details or dimensions of typical structures required for the PV Facility

Component	Description/ Dimensions
Location of the site	Witkoppies 81 HS, within jurisdiction of Gert Sibande District Municipality and the Dr. Pixley Ka Isaka Seme Local Municipality
SG Code	T08S00000000008100001 T08S00000000008100002 T08S00000000008100006
Project development footprint	96.9 ha
Proposed technology	Static or tracking photovoltaic
Export capacity	Up to 65 MW
Height of installed panels from ground level	Static - up to 3.5 m Tracking – single/double axis up to 6 m
Access road	The main access to the site will be directly from the R23 that runs along the western boundary of the proposed site, or alternatively the N11 national road, located approximately 10km to the east of the study area.
Width and length of internal roads	Main internal road - width: 5-8m, Secondary internal roads – width: 3-5 m
Construction laydown area (temporary)	2 ha

Component	Description/ Dimensions
On-site substation	80m x 120m
Power line	Servitude width – 32 m Length – Approx. 2.5km Height of towers – up to 24m
Workshop area	500m ²

2.8. Technology considered for the Solar Photovoltaic (PV) Facility and the Generation of Electricity

Solar energy facilities, such as those using PV technology use the energy from the sun to generate electricity through a process known as the Photoelectric Effect (Figure 2.2). A PV cell or solar cell is the semiconductor device that converts sunlight into electricity. These cells are interconnected to form panels which, in turn, are combined with associated structural and electrical equipment to create what are called arrays – the actual solar generation systems which connect to the energy grid. As sunlight hits the solar panel, photons can be reflected, absorbed, or pass through the panel. When photons are absorbed, they have the energy to knock electrons loose, which flow in one direction within the panel and exit through connecting wires as solar electricity.

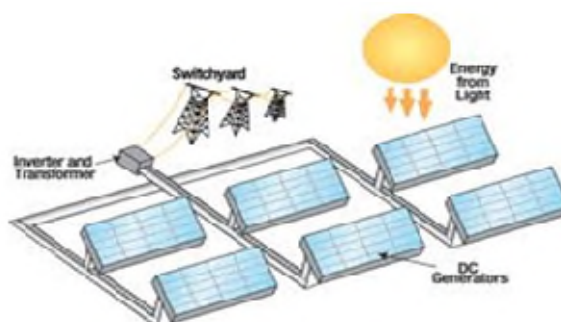


Figure 2.2: Schematic diagram of a PV plant (Sourced from: <http://www.solar-green-wind.com/archives/tag/solar-cells>)

A solar energy facility typically comprises the following components:

The Photovoltaic Panels

Solar photovoltaic (PV) panels consist primarily of glass and various semiconductor materials and, in a typical solar PV project, will be arranged in rows to form solar arrays, as shown in Figure 2.3 and Figure 2.4. The PV panels are designed to operate continuously for more than 25 years with minimal maintenance required.



Figure 2.3: Picture of a PV Modules (75 MW plant in Kalkbutt South-Africa Source: SMA)



Figure 2.4 Picture of the installation of a typical PV array (75 MW plant in Kalkbutt South-Africa Source: PennEnergy)

The **Inverter**

The photovoltaic effect produces electricity in direct current (DC). Therefore an inverter (refer to Figure 2.5) must be used to invert it to alternating current (AC) for transmission in the national grid. The inverters convert the DC electric input into AC electric output, and then a transformer steps up the voltage to required transmission voltage level (6.6/11/84/132 kV) for on-site transmission of the power. The inverter and transformer are housed within the power conversion station (PCS) (refer to Figure 2.6). The PV combining switchgear (PVCS), which are dispersed among the arrays, collects the power from the arrays for transmission to the project's substation.



Figure 2.5: Image of a typical inverter



Figure 2.6: Image of a typical power conversion station

The **Support Structure**

The photovoltaic (PV) modules will be mounted to steel support structures. These can either be mounted at a fixed tilt angle, optimised to receive the maximum amount of solar radiation and dependent on the latitude of the proposed facility, or on a tracking mechanism where at a maximum tilt angle of 45 to 45 degrees. The lowest part of the panel can be 30-50cm from the ground (refer to Figure 2.7).



Figure 2.7: The support structures elevate the PV panels and allow for single axis tracking of the sun for increased efficiency (Source: SAPVIA)

2.9. Services requirements

Water requirements - the proposed Majuba PV Solar Energy Project will require the use of water during its construction and operation phases. The water requirement for the project is anticipated to be approximately ± 4800 l/day over the construction period. Approximately $\pm 5\,000$ m³ per annum for a 20-year operational lifespan of the solar energy facility is required for maintenance (cleaning panels) during the operational phase. Water will be obtained from the Majuba Power Station water ring main that is located in close proximity to the identified location of the O&M Substation building. The water required for panel washing and dust suppression is to be supplied from a borehole storage tank which is to be located in close proximity to the Solar PV Plant Panels or will be supplied from the power station.

Electricity - will be generated from generators for any electrical work on site or electricity will be obtained from an Eskom auxiliary supply, depending on the feasibility during construction.

Sewage and Refuse material disposal - all sewage and refuse material generated during the establishment of the proposed site will be collected by a contractor to be disposed of at a licensed waste disposal site. Office waste generated during operation will be disposed of together with the waste from the Majuba Power Station.

2.10. Proposed Activities during the Project Development Stages

In order to construct the solar energy facility and its associated infrastructure, a series of activities will need to be undertaken during the design, pre-construction, construction, operation, and decommissioning phases which are discussed in more detail below.

2.10.1 Design and Pre-Construction Phase

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to confirmation of the micro-siting footprint (i.e. the precise location of the PV panels, substation and the plant's associated infrastructure) and a geotechnical survey. Geotechnical surveys are executed by geotechnical engineers and geologists to acquire information regarding the physical characteristics of soil and rocks underlying a proposed site. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

2.10.2 Construction Phase

The construction of the proposed project is expected to extend over a period of approximately 15-18 months and create at least 250-300 employment opportunities at peak. The majority of the employment opportunities, specifically the low and semi-skilled opportunities, are likely to be available to local residents in the area. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community, representing a significant positive social benefit in an area with limited employment opportunities. The construction phase will entail a series of activities including:

Undertake Site Preparation

Site preparation involves construction of new access roads and improvement of existing on-site construction access roads with compacted native soil, installation of drainage crossings, setup of construction staging areas, storm water management work, preparation of land areas for array installation, and other activities needed before installation of the solar arrays can begin. The work would involve trimming of vegetation, selected compacting and grading, and setup of modular offices and other construction facilities.

A relatively level and stable surface is required for the safe and effective installation of the PV arrays. Topographic, geotechnical, and hydrologic studies will be used to determine the necessary grading and compaction.

Trenching would occur within each array to accommodate the electrical cables. The trenches would be up to ~ 1.8m in width and 2m deep, for a total combined length of approximately 10 km. Minimal ground disturbance may occur within the trenched corridors to restore them after soil has been replaced in the trenches, so that the corridor can conform to the existing surface contours.

Transport of Components and Construction Equipment to Site

The components for the proposed facility will be transported to site by road. Some of the substation components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)² by virtue of the dimensional limitations (i.e. size and weight). The typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.), as well as the components required for the establishment of the on-site substation.

² A permit will be required for the transportation of these abnormal loads on public roads.

Establishment of Access Roads to the Site

The main access to the site will be directly from the R23 that runs along the western boundary of the proposed site, or alternatively from the N11 national road, located approximately 10km to the east of the study area. Internal access roads of up to 5m wide will also be required. Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. The strength and durability properties of the rock strata at the proposed site are not known at this stage; this will need to be assessed via a geotechnical study to be conducted by the project proponent. Depending on the results of these studies, it may be possible in some areas, to strip off the existing vegetation and ground surface and level the exposed formation to form an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

Installation of PV Panels and Construct Substation & Inverters

The PV panels will be arranged in arrays, the mounting structure will be preferably fixed onto the ground with the use of rammed or screw anchor foundations (see typical example Figure 2.8). Where the soil conditions do not lend themselves to these technologies, concrete or chemical anchors will be deployed. This approach reduces installation time, will make the installation of the plant less invasive for the territory and facilitate the decommissioning at the end of its production cycle. The height of the PV panel structure will be up to 3.5 m for fix mounted structures. In case of single/dual axis structures, the height of Panel Structure, can reach up to 6 m.



Figure 2.8: Frame, structural details (Lesedi Solar PV Project, Kimberly, South Africa. Source: Power Technology.com)

Inverters will be installed to facilitate the connection between the solar energy facility and the Eskom electricity grid via a new 11 kV (for connection at station board) or 132 kV (for connection at HV yard) power line. The position of the inverters within the footprint of the broader site will be informed by the final positioning of the PV components.

The construction of a substation would require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Establishment of Ancillary Infrastructure

Ancillary infrastructure will include; a workshop, laydown area and office. The laydown area will be a temporary structure. The establishment of these areas/facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

Undertake Site Rehabilitation

As construction is completed in an area, and as all construction equipment is removed from the site, the site must be rehabilitated where practical and reasonable. Upon completion of commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

2.10.3 Operational Phase

The solar energy facility is expected to be operational for a minimum of 20 years, with an opportunity for a lifetime of 50 years or more with equipment replacement and repowering. The project will operate continuously, 7 days a week, during daylight hours. While the project will be largely self-sufficient upon completion of construction, monitoring and periodic, as needed maintenance activities will be required.

An Operation and Maintenance plan will be compiled for the facility. Key elements of the Operation and Maintenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project.

The operational phase will create ~12 full-time employment positions. No large scale energy storage mechanisms for the facility which would allow for continued generation at night or on cloudy days are proposed. An operational PV plant has no direct water requirement associated with the generation of electricity. Water is required primarily for the construction of the facility and well as for human consumption (sanitation) during operation. In many instances, water is used to clean off dust or dirt that builds up on the panels. A volume of approximately 5000 m³ per annum would be required during the operational phase. This will be acquired from the Majuba Power Station adjacent to the proposed project.

2.10.4 Decommissioning Phase

Depending on the continued economic viability of the facility following the initial 20 year operational period, the solar energy facility will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to extend the operational phase, existing components would either continue to operate or be disassembled and replaced with new, more efficient technology/infrastructure available at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment.

Disassemble and Remove Existing Components

When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will either be removed, or cut off 1 m below the ground surface, and the surface restored to the original contours. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and can be returned to the agricultural or other beneficial land-use.

Future plans for the site and infrastructure after decommissioning

Depending on the continued economic viability of the facility following the initial 20-25 year operation period, the solar energy facility will either be decommissioned or the operation phase will be extended. If it is deemed financially viable to extend the operation phase, existing components would either continue to operate or be disassembled and replaced with new, more efficient technology/infrastructure available at that time. However, if the decision is made to decommission the facility, the following activities will form part of the project scope:

- » Site Preparation: Site preparation activities will include confirming the integrity of the site access to accommodate the required decommissioning equipment.
- » Disassemble and Remove Existing Components: When the project is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be, and the surface restored to the original contours. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials and would be recycled to the extent feasible. The components of the plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements.

Rehabilitation: The site will be rehabilitated and can be returned to its' pre-construction condition or another beneficial land-use.

3.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and is informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as PV facilities is illustrated in Figure 3.1. These policies are discussed in more detail in the following sections.

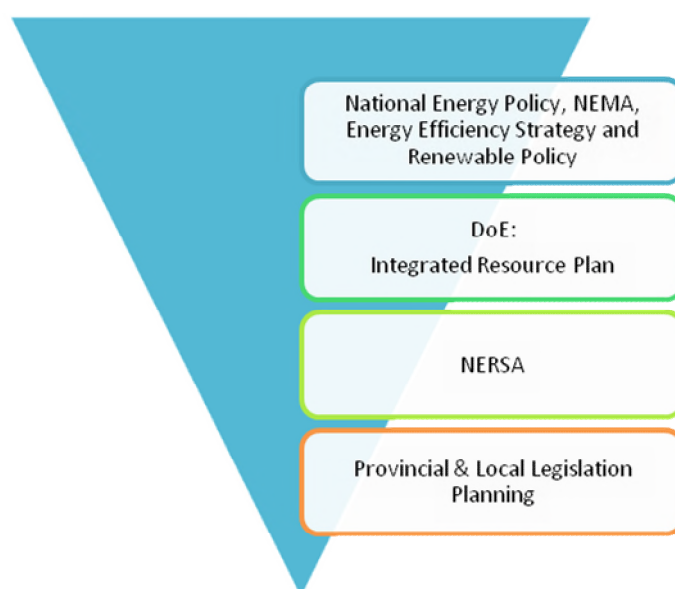


Figure 3.1: Hierarchy of electricity policy and planning documents

3.2.1 The Kyoto Protocol, 1997

South Africa's electricity is mainly generated from coal-based technologies. South Africa accounts for ~38 % of Africa's CO₂ (a greenhouse gas contributing to climate change) from burning of fossil fuels and industrial processes. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. South Africa ratified the Kyoto Protocol in 2002. The Kyoto Protocol requires developing countries to reduce its greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. Therefore certain guidelines and policies (discussed further in the sections below) were put in place for the Government's plans to reduce greenhouse gas emissions. The development of renewable energy projects (such as the proposed PV energy facility) is therefore in line with South Africa's international obligations in terms of the Kyoto Protocol. A second commitment period commenced from 1 January 2013, and extends to 31 December 2020.

3.2.2 White Paper on the Renewable Energy Policy of the Republic of South Africa (1998)

The White Paper on Renewable Energy Policy supplements the Government's overarching policy on energy as set out in its White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The White Paper on Renewable Energy Policy recognises the significance of the medium and long-term potential of renewable energy. The main aim of the policy is to create the conditions for the development and commercial implementation of renewable technologies. The position of the White Paper on Renewable Energy is based on the integrated resource planning criterion of:

"Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options."

The White Paper on Renewable Energy sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources in particular. However South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, but which have so far remained largely untapped. This White Paper fosters the uptake of renewable energy in the economy and has a number of objectives that include:

- » ensuring that equitable resources are invested in renewable technologies;
- » directing public resources for implementation of renewable energy technologies;
- » introducing suitable fiscal incentives for renewable energy and;
- » creating an investment climate for the development of renewable energy sector.

The objectives of the White Paper are considered in six focal areas, namely: financial instruments, legal instruments, technology development, awareness raising, capacity building and education, and market based instruments and regulatory instruments. The policy supports the investment in renewable energy facilities as they contribute towards ensuring energy security through the

diversification of energy supply, reducing GHG emissions and the promotion of renewable energy sources.

The White Paper set a target of 10 000GWh to be generated from renewable energy by 2013. The target was reviewed during the renewable energy summit of 2009 held in Pretoria. The summit raised the issue over the slow implementation of renewable energy projects and the risks to the South African economy of committing national investments in the energy infrastructure to coal technologies. Other matters that were raised include potential large scale roll out of solar water heaters and enlistment of Independent Power Producers to contribute to the diversification of the energy mix.

3.2.3 The National Energy Act (2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar thermal energy:

"To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of economic growth and poverty alleviation, taking into account environmental management requirements (...); to provide for (...) increased generation and consumption of renewable energies...(Preamble)."

The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The Act provides the legal framework which supports the development of renewable energy facilities for the greater environmental and social good.

3.2.4 The Electricity Regulation Act, 2006 (Act No. 4 of 2006), as amended

The Electricity Regulation Act, 2006, replaced the Electricity Act, 1987 (Act No. 41 of 1987), as amended, with the exception of Section 5B, which provides for the funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry & introduces the National Energy Regulator as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences & registration as the manner in which generation, transmission, distribution, trading & the import & export of electricity are regulated.

3.2.5 Renewable Energy Policy in South Africa

Internationally there is increasing development of the use of renewable technologies for the generation of electricity due to concerns such as climate change and exploitation of resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed Ilanga Tower 1 Project, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is *"based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential."* In addition, the National Energy Policy states that *"Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future"*. The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with meeting the following challenges:

- » Ensuring that economically feasible technologies and applications are implemented;
- » Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
- » Addressing constraints on the development of the renewable industry.

3.2.6 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies 9 key challenges and associated remedial plans. Managing the transition towards a low carbon

national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

The proposed project will support many of the objectives of the National Development Plan (NDP). Some of these objectives are listed below:

- » Create 11 million jobs by 2030; and
- » Procuring about 20 000MW of renewable electricity by 2030.

Infrastructure is a key priority of the NDP, which identifies the need for South Africa to invest in a strong network of economic infrastructure to support the country's medium- and long-term economic and social objectives. The NDP has been approved and adopted by government and has received strong endorsement from broader society. The plan sets out steps that aim to ensure that, in 20 years, South Africa's energy system looks very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar and imported hydroelectricity – will play a much larger role.

3.2.7 Integrated Energy Plan

The development of a national Integrated Energy Plan (IEP) was envisaged in the White Paper on Energy Policy of 1998 and the Minister of Energy, as entrenched in the National Energy Act of 2008, is mandated to develop and publish the IEP on an annual basis. The IEP takes existing policy into consideration and provides a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development.

The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include:

- » To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector.
- » To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels).
- » To guide investment in and the development of energy infrastructure in South Africa.
- » To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

Eight key objectives for energy planning were identified:

- » Objective 1: Ensure the security of supply
- » Objective 2: Minimise the cost of energy
- » Objective 3: Increase access to energy
- » Objective 4: Diversify supply sources and primary sources of energy
- » Objective 5: Minimise emissions from the energy sector
- » Objective 6: Promote energy efficiency in the economy
- » Objective 7: Promote localisation and technology transfer and the creation of jobs
- » Objective 8: Promote the conservation of water

The IEP recognises the potential of renewable energy for power generation.

3.2.8 Final Integrated Resource Plan 2010 - 2030

The Integrated Resource Plan (IRP) 2010-30 was promulgated in March 2011. The primary objective of the IRP 2010 is to determine the long term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. However, the IRP 2010 also serves as input to other planning functions, *inter alia* economic development, and funding, environmental and social policy formulation. The accuracy of the IRP 2010 is to be improved by regular reviews and updates, and a draft revised Plan is currently available for public comment. The IRP 2010 projected that an additional capacity of up to 56 539MW of generation capacity will be required to support the country's economic development and ensure adequate reserves over the next twenty years. The required expansion is more than two times the size of the existing capacity of the system.

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation. In addition to all existing and committed power plants, the RBS included a nuclear fleet of 9.6 GW; 6.3 GW of coal; **17.8 GW of renewables** (including wind and solar); and 8.9 GW of other generation sources. This means that 75% of new generation capacity by 2030 will be derived from energy sources other than coal.

3.2. Regulatory Hierarchy

At **National Level**, the main regulatory agencies are:

- » *Department of Energy (DoE)*: This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for formulating and approving the IRP (Integrated Resource Plan for Electricity).
- » *National Energy Regulator of South Africa (NERSA)*: This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for power generation facilities to generate electricity.
- » *Department of Environmental Affairs (DEA)*: This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
- » *The South African Heritage Resources Agency (SAHRA)*: SAHRA is a statutory organisation established under the National Heritage Resources Act, No 25 of 1999, as the national administrative body responsible for the protection of South Africa's cultural heritage.
- » *National Department of Agriculture, Forestry, and Fisheries (DAFF)*: This Department is responsible for activities pertaining to subdivision and rezoning of agricultural land. The forestry section is responsible for the protection of tree species declared as protected under the National Forests Act (Act No 84 of 1998).
- » *South African National Roads Agency (SANRAL)*: This Agency is responsible for the regulation and maintenance of all national routes.
- » *Department of Water and Sanitation (DWS)*: This Department is responsible for water resource protection, water use licensing and permits.
- » *Department of Mineral Resources (DMR)*: Approval from the DMR may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.

At **Provincial Level**, the main regulatory agencies are:

- » *Mpumalanga Department of Economic Development, Environment and Tourism- (DEDET)*: This department is the provincial commenting authority for this project.
- » *Mpumalanga Department of Public Works, Roads and Transport* – This department is responsible for roads.
- » *Mpumalanga Provincial Heritage Resources Authority (MPHRA)*: This deals with heritage resources within the Mpumalanga Province.

- » *Mpumalanga Department of Mineral Resources (DMR)*: Approval from this department may be required to use land surface contrary to the objects of the Act in terms of Section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act, approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.

At **Local Level**, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Mpumalanga Province, both the local and district municipalities play a role. The local municipality is the Dr Pixley Ka Isaka Seme Local Municipality which forms part of the Gert Sibande District Municipality. There are also numerous non-statutory bodies such as environmental non-governmental organisations (NGOs) and community based organisations (CBO) working groups that play a role in various aspects of planning and environmental monitoring that will have some influence on proposed solar energy development in the area

3.3. Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Final Scoping Report:

- » National Environmental Management Act (Act No. 107 of 1998)
- » EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)
- » Guidelines published in terms of the NEMA EIA Regulations, in particular:
 - * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010);
 - * Public Participation in the EIA Process (DEA, 2010);
 - * Integrated Environmental Management Information Series (published by DEA);
- » Dr Pixley Ka Isaka Seme Municipality Integrated Development Plan
- » International guidelines – the Equator Principles and the International Finance Corporation and World Bank Guidelines.

Several other Acts, standards or guidelines have also informed the project process and the scope of issues evaluated in the scoping report, and to be addressed in the EIA. A listing of relevant legislation is provided in Table 3.1. A more detailed review of legislative requirements applicable to the proposed project will be included in the EIA phase.

Table 3.1: Relevant legislative permitting requirements applicable to the proposed Majuba PV Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	<p>The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations.</p> <p>In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation.</p> <p>In terms of GN R543, R544, R545 and R546 of December 2010, a Scoping and EIA Process is required to be undertaken for the proposed project.</p>	<p>National Department of Environmental Affairs – lead authority.</p> <p>Mpumalanga Province: Department of Economic Development, Environment and Tourism (DEDET)</p>	The final EIA report is to be submitted to the DEA and Provincial Environmental Departments in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	<p>In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised.</p> <p>In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.</p>	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Environment Conservation Act	National Noise Control Regulations (GN R154 dated 10 January 1992)	Department of Environmental Affairs	Noise impacts are expected to be associated with the construction

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
(Act No 73 of 1989)		Mpumalanga Province: Department of Economic Development, Environment and Tourism (DEDET) Local Authorities	phase of the project and are not likely to present a significant intrusion to the local community. There is no requirement for a noise permit in terms of the legislation.
National Water Act (Act No 36 of 1998)	<p>Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required).</p> <p>Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b.</p> <p>Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i.</p>	Department of Water & Sanitation (DWS)	<p>A water use license (WUL) is required to be obtained if water resources (such as wetlands or drainage lines) are impacted on, or if infrastructure lies within 500m of wetland features or the regulated area of a watercourse (being the riparian zone or the 1:100yr floodline whichever is greatest).</p> <p>Should water be extracted from groundwater/ a borehole on site for use within the facility, a water use license will be required in terms of Section 21(a) and 21 (b) of the National Water Act.</p>
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	<p>A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act.</p> <p>Requirements for Environmental Management Programmes and Environmental Management Plans are</p>	Department of Mineral Resources	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained. Approval in terms of S53 will be required to be obtained..

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>set out in S39 of the Act.</p> <p>S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.</p>		
<p>National Environmental Management: Air Quality Act (Act No 39 of 2004)</p>	<p>Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality.</p> <p>Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.</p> <p>Section 32 makes provision for measures in respect of dust control.</p> <p>Section 34 makes provision for:</p> <p>(1) the Minister to prescribe essential national noise standards -</p> <p>(a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or</p> <p>(b) for determining -</p>	<p>National Department of Environmental Affairs – air quality</p> <p>Local Municipality - Noise</p>	<p>No permitting or licensing requirements applicable for air quality aspects.</p> <p>The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities.</p> <p>An atmospheric emission licence issued in terms of Section 22 may contain conditions in respect of noise. This will however, not be relevant to the facility, as no atmospheric emissions will take place.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<ul style="list-style-type: none"> (i) a definition of noise (ii) the maximum levels of noise <p>(2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.</p>		<p>The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.</p>
<p>National Heritage Resources Act (Act No 25 of 1999)</p>	<p>Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including</p> <ul style="list-style-type: none"> » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m² in extent. <p>The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50m, or any development or other activity which will change the character of a site exceeding 5 000 m²; or the re-zoning of a site exceeding 10 000 m² in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.</p> <p>Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate</p>	<ul style="list-style-type: none"> » National Department of Environmental Affairs where heritage assessment is a component of the EIA » South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. » Mpumalanga Heritage Resources Authority - Issue of permits for removal or destruction of heritage resources in the Mpumalanga Province 	<p>An HIA has been undertaken. Based on the results of the study there are no significant archaeological risks associated with the proposed solar facility. A chance finding procedure will be implemented should graves be discovered..</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	<ul style="list-style-type: none"> » Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). 	National Department of Environmental Affairs Mpumalanga Province: Department of Economic Development, Environment and Tourism (DEDET)	<ul style="list-style-type: none"> » The Mpumalanga Biodiversity Conservation Plan contains various classes of environmental features of conservation value, such as protected areas; irreplaceable areas etc. <p>Mapping of critical biodiversity areas is also provided in this document.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<ul style="list-style-type: none"> » The Department of Environmental Affairs (DEA) published Regulations on Alien and Invasive Species (AIS) in terms of the National Environmental Management: Biodiversity Act, on Friday 1st August 2014. A total of 559 alien species are now listed as invasive, in four different categories. A further 560 species are listed as prohibited, and may not be introduced into the country 		
<p>Conservation of Agricultural Resources Act (Act No 43 of 1983)</p>	<ul style="list-style-type: none"> » Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: <ul style="list-style-type: none"> » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. » These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E. 	<p>Department of Agriculture</p>	<ul style="list-style-type: none"> » While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented. » The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. However, none of these activities are expected to be undertaken on site.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Forests Act (Act No. 84 of 1998)	<ul style="list-style-type: none"> » Protected trees: According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. » Forests: Prohibits the destruction of indigenous trees in any natural forest without a licence. 	Department of Environmental Affairs	<p>A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest.</p> <p>No protected tree species were observed within or near the study area and it is highly unlikely that any protected tree species would be impacted by the development.</p>
National Veld and Forest Fire Act (Act 101 of 1998)	<p>In terms of S12 the landowner must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material.</p> <p>In terms of S17, the landowner must have such equipment, protective clothing, and trained personnel for extinguishing fires.</p>	Department of Water Affairs	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer proactively manage risks associated with veld fires and provide cooperation to the local Fire Protection Agency.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.</p> <ul style="list-style-type: none"> » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. <p>The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.</p>		<p>Department of Health.</p>
<p>National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)</p>	<p>The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.</p> <p>The Minister may amend the list by –</p> <ul style="list-style-type: none"> » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. <p>In terms of the Regulations published in terms of this</p>	<p>Hazardous Waste – National DEA General Waste –FS DETEA</p>	<p>As no waste disposal facility is proposed, no waste license is required to be obtained. Should waste be stored on site, this will be required to be in terms of the Norms and Standards for Waste Storage (GN 926 of November 2013).</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	<p>Act (GN 921), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.</p> <p>Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that:</p> <ul style="list-style-type: none"> » The containers in which any waste is stored, are intact and not corroded or in any other way rendered unfit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented. 		
<p>National Road Traffic Act (Act No 93 of 1996)</p>	<ul style="list-style-type: none"> » The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. 	<p>Provincial Department of Transport (provincial roads)</p>	<p>An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include:</p> <ul style="list-style-type: none"> » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	» The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).
Provincial			
The Nature Conservation Ordinance (NCO) 8 of 1969 and subsequent amendments	The Act provides for the conservation of fauna and flora and the hunting of animals causing damage and for matters incidental thereto	Mpumalanga Province: Department of Economic Development, Environment and Tourism (DEDET)	Permitting and requirements arise from this legislation for the proposed project as protected species namely, <i>Aloe ecklonis</i> , <i>Eucomis autumnalis</i> and <i>Gladiolus sericeovillosus s. calvatus</i> . <i>Habenaria dives</i> was identified on the proposed site. A permit is therefore required

APPROACH TO UNDERTAKING THE EIA PHASE

CHAPTER 4

An Environmental Impact Assessment (EIA) process refers to that process (in line with the EIA Regulations) which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project/ activity. The EIA process comprises two main phases: i.e. **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an Environmental Management Programme (EMPr) to the competent authority for decision-making. The EIA process is illustrated below:

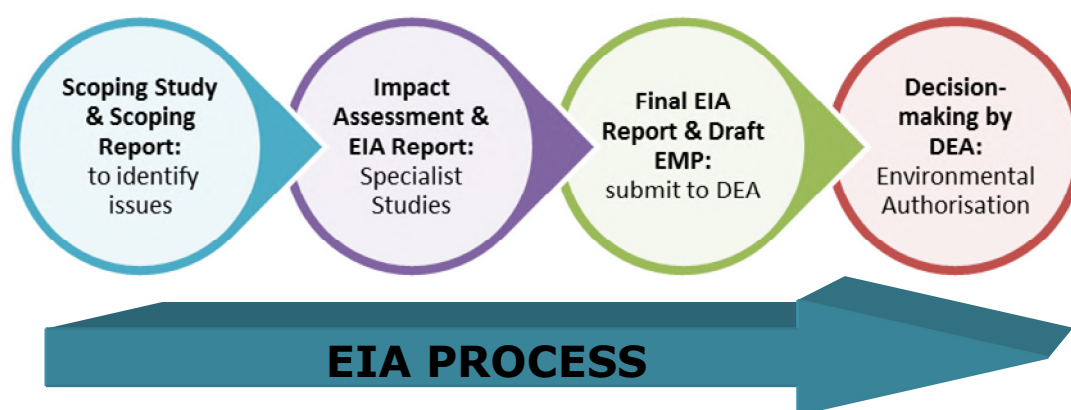


Figure 4.1: The Phases of an EIA Process

The EIA process for the proposed Majuba PV Solar Energy Facility is being undertaken in accordance with the sections 24 (5) of the National Environmental Management Act (No 107 of 1998). In terms of the EIA Regulations of June 2010 (GNR 543), a Scoping and EIA Study are required to be undertaken for this proposed project. The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

4.1 Relevant Listed Activities

The EIA Regulations were revised in December 2014 as promulgated in GNR 982 – 985. In terms of Sub-Regulations 53(2) and 53(3) of these Regulations) Transitional Arrangements):

"If a situation arises where an activity or activities, identified under the previous NEMA Notices, no longer requires environmental authorisation in terms of the current activities and competent authorities identified in terms of section 24(2) and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), and where a decision on an application submitted under the previous NEMA regulations is still pending, the competent authority will consider

such application to be withdrawn". And "where an application submitted in terms of the previous NEMA regulations, is pending in relation to an activity of which a component of the same activity was not identified under the previous NEMA notices, but is now identified in terms of section 24(2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and may authorise the activity identified in terms of section 24(2) as if it was applied for, on condition that all impacts of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed."

Therefore, similarly listed and additional activities relevant to the current application have been identified and are listed in the table below.

Table 4.1: Listed activities triggered by the proposed Majuba PV Solar Energy Facility

Listed activity as described in GN R.544, 545 and 546	Listed activity as described in GN R 983, 984 and 985	Relevance to the project
<p>GNR 544 Activity 10 (i)</p> <p>The construction of facilities or infrastructure for the transmission and distribution of electricity – (i)Outside urban areas with a capacity of more than 33 but less than 275 kilovolts</p>	<p>GN R 983 Activity 11: The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts</p>	<p><i>The facility will require the construction of an on-site substation and an overhead distribution power line outside an urban area, with a capacity of less than 275kV.</i></p>
<p>GNR 544 Activity 11(x)(xi)</p> <p>The construction of:</p> <p>(x) The construction of buildings exceeding 50 square metres in size or;</p> <p>(xi) infrastructure or structures covering 50 square metres or more,</p> <p>where such construction occurs within a watercourse or within 32 metres of a watercourse</p>	<p>GN R 983 Activity 12: The development of (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs-</p> <p>(a) within a watercourse, or (c) within 32m of a watercourse</p>	<p><i>The PV facility will include the development of infrastructure exceeding 50 square metres in size (workshop area, site office and underground cabling, panels) within 32 metres of a watercourse.</i></p>

measured from the edge of the watercourse.		
GNR 544 Activity 18(i) The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal, or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 5 cubic metres from (i) a watercourse	GN R 983 Activity 19: The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse	<i>Construction of the PV facility requires the infilling or excavation and removal of soil of more than 5 cubic metres from a watercourse.</i>
GNR 544 Activity 22 (ii) The construction of a road outside urban areas (ii) where no road reserve exists where the road is wider than 8 metres	GN R983 Activity 24: The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres	<i>The facility will require the construction of new internal access roads within the site which will be wider than 8m in width (up to 13m in width), to be constructed outside urban areas.</i>
GN544 Activity 47 (ii): The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre – (ii) where no reserve exists, where the existing road is wider than 8 metres	GN R 983 Activity 56: The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (ii) where the existing reserve is wider than 13,5 meters	<i>The facility will require the widening/lengthening of existing access roads to the site by more than 6 metres where no reserve exists, and where the existing road is wider than 8 metres.</i>
GN545 Activity 1: The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	GN R 984 Activity 1: The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more	<i>The PV facility will generate an electricity output of more than 20MW. The proposed facility will consist of arrays of photovoltaic (PV) panels with an electricity output of up to 65MW.</i>
GN545 Activity 15:	GN R983 Activity 28:	<i>Total area of land to be developed for the facility is larger</i>

<p>Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.</p>	<p>Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare</p>	<p><i>than 1 hectare. The area required for the development is ~96.9 ha</i></p>
<p>GN546 Activity 14 (a) i: The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation (a) In Mpumalanga: i. All areas outside urban areas</p>	<p>GN R 984 Activity 15: The clearance of an area of 20 hectares or more of indigenous vegetation</p>	<p>The solar energy facility will be located outside urban areas and will require the clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation cover. <i>The area required for the development is ~96.9 ha.</i></p>

4.2 Scoping Phase

The Scoping Phase was completed in **May 2015** with the submission of a Final Scoping Report to the DEA, and acceptance thereof received from DEA in **June 2015**. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

The Scoping Study provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern. The Scoping Report aimed at detailing the nature and extent of the proposed Majuba PV Solar Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

4.3. Environmental Impact Assessment Phase

The EIA Phase for the proposed Majuba PV Solar Energy Facility aims to achieve the following:

- » Provide a comprehensive assessment of the social and biophysical environments affected by the proposed project.
- » Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
- » Comparatively assess feasible alternatives put forward as part of the projects.
- » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
- » Undertake a fully inclusive public participation process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative³ impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

4.3.1. Tasks completed during the EIA Phase

The EIA Phase for the proposed Majuba PV Solar Energy Facility has been undertaken in accordance with the EIA Regulations published in GN 33306 of 18 June 2010, in terms of NEMA. Key tasks undertaken within the EIA phase included:

- » Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
- » Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
- » Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
- » Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.

³ "Cumulative environmental change or cumulative effects may result from the additive effect of individual actions of the same nature or the interactive effect of multiple actions of a different nature" (Spaling and Smit, 1993).

- » Preparation of an EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.
- » Prepare a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
- » Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.

These tasks are discussed in detail below.

4.3.2 Authority Consultation

The National DEA is the competent authority for this application. Consultation with the regulating authorities (i.e. DEA and DETEA) has continued throughout the EIA process. The following will also be undertaken as part of this EIA process:

- » Submission of a final EIA Report following the 30-day public review period of the draft EIA Report and an additional 21 days public review period of the final EIA Report.
- » If required, an opportunity for DEA and DEDET representatives to visit and inspect the proposed project site.
- » Notification and Consultation with Organs of State (refer to Table 4.2) that may have jurisdiction over the project, including:
 - * Provincial and local government departments (including South African Heritage Resources Agency, Department of Water and Sanitation , South African National Roads Agency Limited, Department of Agriculture, Department of Public Works, Roads and Transport, etc.).
 - * Parastatals and Non-Governmental Organisations (South African Civil Aviation Authority (SACAA), and Square Kilometre Array (SKA))
 - * Dr Pixley Ka Isaka Seme Local Municipality and Gert Sibande District Municipality.

A record of the authority consultation in the EIA process is included within **Appendix C**

4.3.3 Public Involvement and Consultation

The aim of the public participation process is primarily to ensure that:

- » Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.

- » Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
- » Comments received from stakeholders and I&APs were recorded and incorporated into the EIA process.

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the EIA Phase of the process have been provided, as follows:

- » Focus group meetings and a public meeting (pre-arranged and stakeholders invited to attend - for example with directly affected and surrounding landowners).
- » Telephonic consultation sessions (consultation with various parties from the EIA project team, including the project participation consultant, lead EIA consultant as well as specialist consultants).
- » Written, faxed or e-mail correspondence.
- » The Draft EIA Report was released for a 30-day public review period from 24 March 2016 – 26 April 2016. The comments received from I&APs is captured within a Comments and Response Report, which is included within the final EIA Report, for submission to the authorities for review and decision-making.

In terms of the requirement of Chapter 6 of the EIA Regulations of June 2010, the following public participation tasks are required to be undertaken:

- » Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
 - (i) the site where the activity to which the application relates is or is to be undertaken; and
 - (ii) any alternative site mentioned in the application;
- » Giving written notice to:
 - (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
 - (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - (iii) Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
 - (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
 - (v) the municipality which has jurisdiction in the area;

- (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
- (vii) any other party as required by the competent authority.
- » Placing an advertisement in:
 - (i) one local newspaper; and
 - (ii) in at least one provincial newspaper.
- » Open and maintain a register/ database of interested and affected parties and organs of state.
- » Release of a Draft EIA Report for Public Review
- » Preparation of a Comments and Responses Report which document all the comments received and responses from the project team.

Below is a summary of the key public participation activities conducted for the project to date.

- » **Placement of Site Notices**
 Site notices have been placed on-site and at relevant public places Proof of this is included in **Appendix C**.
- » **Identification of I&APs and establishment of a database**
 Identification of I&APs was undertaken by Savannah Environmental through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organisations (refer to Table 4.2 below).

Table 4.2: Key stakeholder groups identified during the EIA Process

Organs of State
National Government Departments
Department of Agriculture, Forestry and Fisheries (DAFF)
Department of Communications
Department of Energy (DoE)
Department of Mineral Resources (DMR)
Department of Public Works (DPW)
Department of Rural Development and Land Reform (DRDLR)
Department of Water and Sanitation (DWS)
Government Bodies and State Owned Companies
National Energy Regulator of South Africa (NERSA)
Sentech
South African Civil Aviation Authority (CAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)

Square Kilometre Array: Southern Africa

Telkom SA Ltd

Provincial Government Departments

Mpumalanga Provincial Heritage Resources Authority (MPHRA)

Mpumalanga Department of Economic Development, Environment and Tourism–
(DEDET):

Mpumalanga Department of Mineral Resources (DMR)

Mpumalanga Department of Public Works, Roads and Transport

Provincial Department of Water Affairs

Provincial Department of Agriculture

Local Government Departments

Dr Pixley Ka Isaka Seme Local Municipality

Gert Sibande District Municipality.

Conservation Authorities

BirdLife South Africa

Wildlife and Environment Society of South Africa (WESSA)

Endangered Wildlife Trust (EWT)

Landowners

Affected landowners and tenants

Neighbouring landowners and tenants

All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to **Appendix C**). While I&APs were encouraged to register their interest in the project from the onset of the process undertaken by Savannah Environmental, the identification and registration of I&APs has been on-going for the duration of the EIA phase of the process.

» **Newspaper Advertisements**

In order to notify and inform the public of the proposed project and invite members of the public to register as interested and affected parties (I&APs), the project, and EIA process was advertised in the following newspapers:

- * Standerton Advertiser (English: 16 January 2015);
- * Volksrust Recorder Newspaper (Afrikaans & isiZulu: 16 January 2015).

A second advert was placed announcing the date and venue of the public meeting and the availability of the draft scoping report. This advert appeared in the following newspapers:

- * Standerton Advertiser (19 March 2015);
- * Volksrust Recorder Newspaper (20 March 2015).

During the EIA phase, a further round of newspaper adverts has been placed to inform the public of the availability of the Draft EIA report and the public meeting in the following newspapers:

- * Standerton Advertiser (1 April 2016)
- * Volksrust Recorder Newspaper (1 April 2016)

» **Consultation**

In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA process as outlined in the Table 4.3 below:

Table 4.3: Consultation undertaken with I&APs for the Majuba PV Facility

Scoping Phase	Activity	Date
	Distribution of the background information document and letters announcing the EIA process to I&APs. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups.	10 December 2014
	Placement of site notices on-site.	11 December 2014
	Placement of newspaper advertisements announcing the EIA process and inviting members of the public to register as I&APs on the project's database. The advertisements were placed in the following newspapers: <ul style="list-style-type: none"> * Volksrust Recorder * Standerton Advertiser 	16 January 2015
	Distribution of written notices announcing the availability of the Draft Scoping Report and details of the public meeting. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups. In addition, hard copy and CD copies of the Draft Scoping Report were sent to Organs of State departments via courier.	17 March 2015
	30-day review period for the Scoping Report	17 March 2015 – 20 April 2015
	The EIA process and the availability of the Scoping Report for review and venue of the public meeting was advertised as follows: <ul style="list-style-type: none"> * Standerton Advertiser * Recorder Newspaper 	19 March 2015 20 March 2015
	Focus Group Meeting with Dr Pixley Ka Isaka Seme Local Municipality	20 February 2015
	Focus Group Meeting with impacted and adjacent landowners	20 February 2015

	Public meeting	9 April 2015
EIA Phase	Distribution of written notices announcing the availability of the Draft EIA Report for review for a 30-day comment period and the details of the public meeting. These letters were distributed to organs of state departments, ward councillors, landowners within the study area, neighbouring landowners and key stakeholder groups. In addition, hard copy and CD copies of the Draft Scoping Report were sent to Organs of State departments via courier.	24 March 2016
	The availability of the EIA Report and the date of the Public Meeting was advertised as follows: * Standerton Advertiser * Recorder Newspaper	1 April 2016
	30-day review period of the EIA Report	24 March 2016 – 26 April 2016
	Public Participation meetings: » Focus Group meetings » Public Meeting	7 April 2016

Records of all consultation undertaken are included in **Appendix C**.

4.3.4 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into a Comments and Response Report. The Comments and Response Report includes responses from members of the EIA project team and/or the project proponent. This is included in **Appendix C**.

4.3.5 Assessment of Issues Identified through the Scoping Process

Issues which require investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 4.4.

Table 4.4: Specialist consultants appointed to evaluate the potential impacts associated with the Majuba PV Facility

Specialist	Area of Expertise	Appendix
Megan Diamond (Feathers Environmental Services)	Avifauna	Appendix D
Marianne Strohbach (Savannah Environmental) and Michael Cohen (external reviewer)	Ecology	Appendix E
Jaco van der Walt (Heritage Contracts and Archaeological Consulting CC (HCAC))	Heritage and Archaeology	Appendix F

Specialist	Area of Expertise	Appendix
Elize Butler (National Museum, Bloemfontein)	Palaeontology	Appendix G
John Marshall (Afzelia Environmental Consultants and Environmental Planning and Design)	Visual	Appendix H
Candice Hunter (Savannah Environmental) and Dr Neville Bews (external reviewer)	Social	Appendix I
Garry Paterson (ARC-Institute for Soil, Climate and Water)	Soils and Agricultural Potential	Appendix J
Rob Taylor (Limosella Consulting)	Wetlands	Appendix K

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed Majuba PV Facility Issues were assessed in terms of the following criteria:

- » The **nature**, a description of what causes the effect, what will be affected, and how it will be affected
- » The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high)
- » The **duration**, wherein it is indicated whether:
 - * The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
 - * The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
 - * Medium-term (5–15 years) – assigned a score of 3
 - * Long term (> 15 years) - assigned a score of 4
 - * Permanent - assigned a score of 5
- » The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
 - * 0 is small and will have no effect on the environment
 - * 2 is minor and will not result in an impact on processes
 - * 4 is low and will cause a slight impact on processes
 - * 6 is moderate and will result in processes continuing but in a modified way
 - * 8 is high (processes are altered to the extent that they temporarily cease)
 - * 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- » The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
 - * Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
 - * Assigned a score of 2 is improbable (some possibility, but low likelihood)

- * Assigned a score of 3 is probable (distinct possibility)
 - * Assigned a score of 4 is highly probable (most likely)
 - * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)
- » The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
 - » The **status**, which is described as either positive, negative or neutral
 - » The degree to which the impact can be reversed
 - » The degree to which the impact may cause irreplaceable loss of resources
 - » The degree to which the impact can be mitigated

The **significance** is determined by combining the criteria in the following formula:

$S = (E+D+M) P$; where

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- » **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
- » **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area)

As Eskom has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A draft EMP is included as **Appendix M**.

4.3.6 Assumptions and Limitations

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

- » All information provided by Eskom and I&APs to the environmental team was correct and valid at the time it was provided.
- » It is assumed that the development site identified by Eskom represents a technically suitable site for the establishment of the proposed Majuba PV Solar Energy Facility.
- » It is assumed correct that the proposed connection to the National Grid is correct in terms of viability and need.
- » Studies assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.
- » This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

Refer to the specialist studies in **Appendices D – K** for specialist study specific limitations.

DESCRIPTION OF THE RECEIVING ENVIRONMENT

CHAPTER 5

This section of the EIA Report provides a description of the environment of the greater farm portion as well as the specific site within the greater farm portion that may be affected by the proposed Majuba PV Solar Facility project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as site investigations, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices D – K**.

5.1 Regional Setting: Location of the Study Area

The Majuba PV Solar Energy Facility is proposed on portions 1, 2 and 6 of the farm Witkoppies 81 HS, in the jurisdiction of Gert Sibande District Municipality and Dr. Pixley Ka Isaka Seme Local Municipality within the Mpumalanga Province. The identified preferred site falls within the Majuba coal fired power station property boundary (refer to Figure 5.1.). The main access to the site will be directly from the R23 that runs along the western boundary of the proposed site, or alternatively from the N11 national road located approximately 10 km to the east of the study area.

5.2 Biophysical Characteristics of the Study Area

5.2.1 Climatic Conditions

The climate for the Majuba site has been derived from climatic data summarised for Amersfoort, located about 13 km south-west of the site. The area receives about 650 - 750 mm of rain on average per year. From May to September, rainfall is minimal, with most rainfall occurring from late October to March, peaking between November and January. Temperatures in summer peak during December and January at a daily average of 25.5°C, with an average of 16.5°C for June. During July, night temperatures are on average 0°C, with frosts during winter being common.

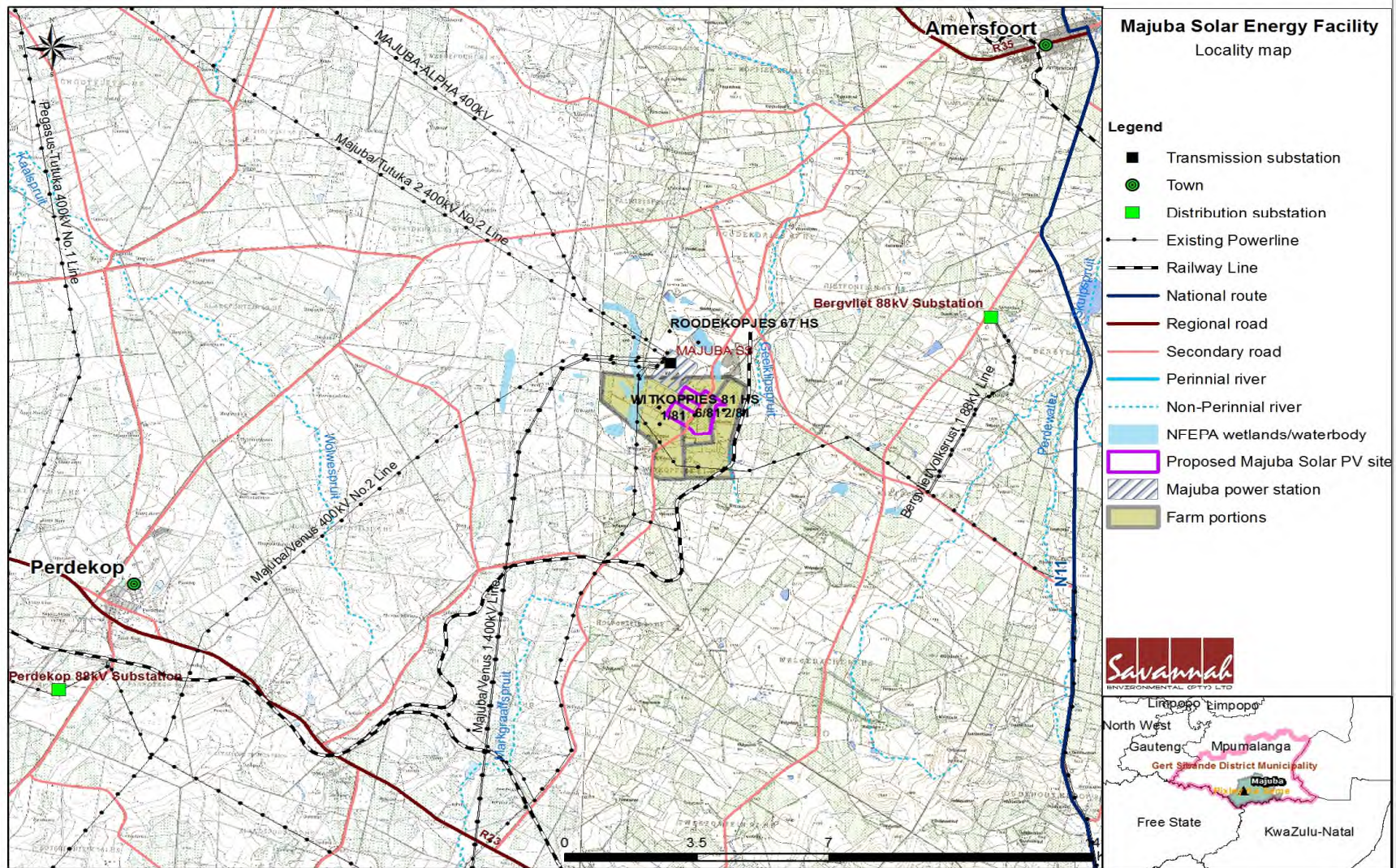


Figure 5.1: Regional context of the Majuba PV Solar Energy Facility project site showing the site location

5.2.2 Topography and Geology

The site is slightly undulating. Within close proximity of the site are several valley floor wetlands (vleis) and slope seepage areas. The proposed site has a ~2% north facing slope, with the altitude ranging from ~1740-1720 m.a.s.l.

The basin-fill sequence wedges out northwards over the adjacent Kaapvaal Craton. In the Main Karoo Basin of South Africa the Volksrust Formation is a predominantly argillaceous unit that interfingers (i.e., is transitional with and partially time equivalent to) the overlying Beaufort Group and the underlying Vryheid Formation. The formation consists of grey to black silty shale with thin, usually bioturbated, siltstone or sandstone lenses, particularly toward its upper and lower boundaries with the more sandstone-rich Adelaide Subgroup and Vryheid Formation respectively. To the south and south-east the Volksrust Formation grades laterally into undifferentiated, deep-water argillites of the Ecca Group.

The Volksrust Formation is one of sixteen (16) recognised stratigraphic units that constitute the Permian Ecca Group. During the deposition of the Ecca Group the basin was dominated by a large sea (the salinity levels of this water body remain unresolved). The exception to this model was the deposition of the coal-bearing strata of the Vryheid Formation along the northern margin during an episode of deltaic progradation into the basin. Genetically the Volksrust Formation represents a time of deep-water deposition of muds along the northern margin of the Main Karoo Basin following a rise in relative water level and the resultant inundation and drowning of the coal swamps and fluvial-lacustrine environments that deposited the underlying Vryheid Formation. Deposition of the Volksrust Formation was terminated by a progressive infilling of the basin and the resultant, widespread deposition of the terrestrially deposited, fluvio-lacustrine strata of the Beaufort Group.

5.2.3 Soils and Agricultural Potential

Soils

The soils occurring in the study area are brown to grey-brown, with high clay sub-soils, usually with a grey, mottled subsoil horizon indicating signs of wetness. A summary of the dominant soil characteristics is given in **Table 5.1**.

The soil analysis results showed that there is a clear texture increase from the top-soils to the sub-soils, which have a sandy clay loam to clay texture. The soils are slightly acidic to neutral, with moderate to low P and organic carbon levels (although the A horizon of site S1 is higher). The soils are moderately leached, which would be expected from the clay content and the climatic regime.

Table 5.1: Land types of Majuba PV Solar Facility

Map Unit	Dominant soils	Sub-dominant soils	Depth (mm)	Characteristics	Area (ha)
Gs	Glenrosa	Mispah	0-300+	Brown, apedal sandy clay loam A horizon overlying weathered rock	18.09
Ms	Mispah	Glenrosa	0-200+	Brown, apedal sandy clay loam A horizon over hard rock	10.73
Ss	Sterkspruit		300-900+	Brown apedal sandy clay loam A-horizon overlying B-horizon with dark brown clay cutans	18.48
Es	Escourt		300-1200+	Grey brown, weakly structured clay loam A horizon over grey, structureless E horizon abruptly overlying prismatic structured mottled sandy clay to clay (Duplex soil)	20.01
Se	Sepane	Tukulu	300-1200+	Grey brown, weakly structured clay loam A horizon with gradual transition to brown, moderately blocky structured clay B horizon on gleyed clay underlying horizon.	14.32
We	Westleigh		300-650+	Grey brown, weakly structured clay loam A horizon over mottled sandy clay loam to clay subsoil with signs of hydromorphy (wetness)	10.10
Bu	Buildings			Built up area with structures	0.93
Total					92.66

Agricultural Potential

The area consists of a mixture of soils ranging from clay soils with cutanic subsoils to shallow soils on rock. The depths vary somewhat, with zones of shallow, duplex soils or plinthite soils also occurring (as can be seen from the information contained in Table 5.1). The broad agricultural potential is summarised in **Table 5.2**. It can be seen that the whole study area has low agricultural potential.

Table 5.2 Agricultural potential of the proposed Majuba PV Solar Facility

Agric. Potential Class	Map Unit(s)	Limitations	Area (ha)
Low	Se, St, Es, We	B horizons with clay cutans and mottles which have a potential for waterlogging during rainy seasons.	62.91
Very Low	Gs, Ms	General shallow depth to underlying hard rock or weathering rock.	29.75
Totals			92.66

5.2.4 Surface Water

Regional Hydrology

Several wetlands and open water bodies are located to the north east of the site and an unchannelled valley bottom wetland to the immediate east of the site. One earthen dam forms the only NFEPA wetland that has been demarcated within the 500m buffer of the study site (Nel *et al.*, 2011).

Wetlands on site

Four wetlands were delineated on the study site comprising of an unchannelled valley-bottom wetland (7.3ha in extent) and three hillside seeps (the one hillside seep consisting of a series of small seeps lumped together for this assessment – 2.8ha, south-east seep – 6.3ha, north seep – 18.9ha). **Figure 5.2** shows the delineated wetlands together with the 30m wetland buffers. **Figure 5.3** shows a regional perspective on how the wetlands drain from the site.



Figure 5.2: The wetlands and wetland buffers on the study site.

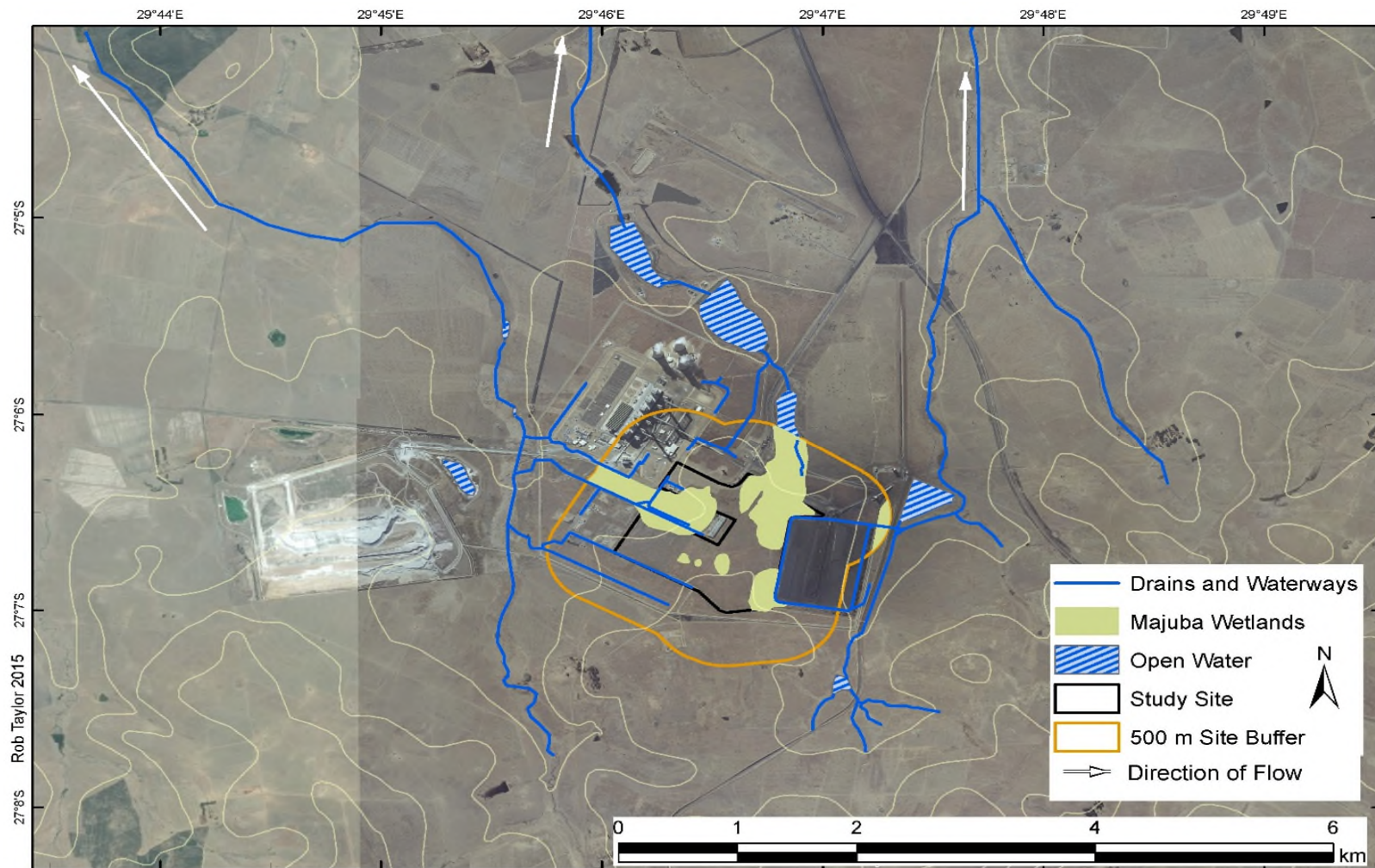


Figure 5.3: A regional perspective on the wetlands and how they drain from the site

Quaternary Catchments

The study site falls within the quaternary catchment C11J. In this catchment the mean annual precipitation is lower than the potential evapotranspiration and as such any wetlands in this catchment would rely largely on regional hydrology for their source of water (water supplied by rainfall is unlikely to be enough to support these wetlands). These wetlands are sensitive to any changes in the volume and duration of the water supplied by regional hydrology.

5.3 Ecological Profile

5.3.1 Flora

Vegetation overview

The site falls within the original extent of the Amersfoort Highveld Clay Grassland as defined by Mucina and Rutherford (2006), undulating plains with small scattered patches of dolerite outcrops (**Figure 5.4**). The vegetation consists of a short closed grass cover, largely dominated by a dense *Themeda triandra* layer, with a relatively high diversity of grasses, herbs and geophytes (Mucina and Rutherford 2006). Common patches of tall shrubs usually contain *Diospyros* species and a variety of lower shrubs, including *Anthospermum rigidum*, *Helichrysum melanacme*, *Chaetacanthus costatus* and *Gnidia* species.

Mucina and Rutherford (2006) regard this vegetation type as Vulnerable. Although it is not currently listed under NEMA: BA, none is currently protected, with some 25% already permanently transformed. Australian Black Wattle has already invaded many outcrop- and stream areas, while overgrazing has led to an invasion of *Seriphium plumosum* (Mucina and Rutherford, 2006).

The Mpumalanga Biodiversity Conservation Plan classified a small central portion of the study area as of Least Concern, whilst the remainder has been classified as having no natural habitat remaining. This was confirmed during the field study – with a small area of relatively diverse grassland remaining, whilst the largest portion of the study area consists of rehabilitated (semi-natural) grasslands. A total of 954 indigenous plant species have been recorded in the Majuba Area according to the SANBI database. Of these species recorded in the wider area, only 88 indigenous plant species in total could be identified on the site, which is relatively low for grasslands. Several more alien invasive species have been recorded.

At the time of the vegetation survey, the herbaceous layer overall was reasonably well developed, but additional species may occur in the area that were dormant at the time. Much of the grasslands are still in a state of rehabilitation, thus gradual future changes in species composition can still be expected.

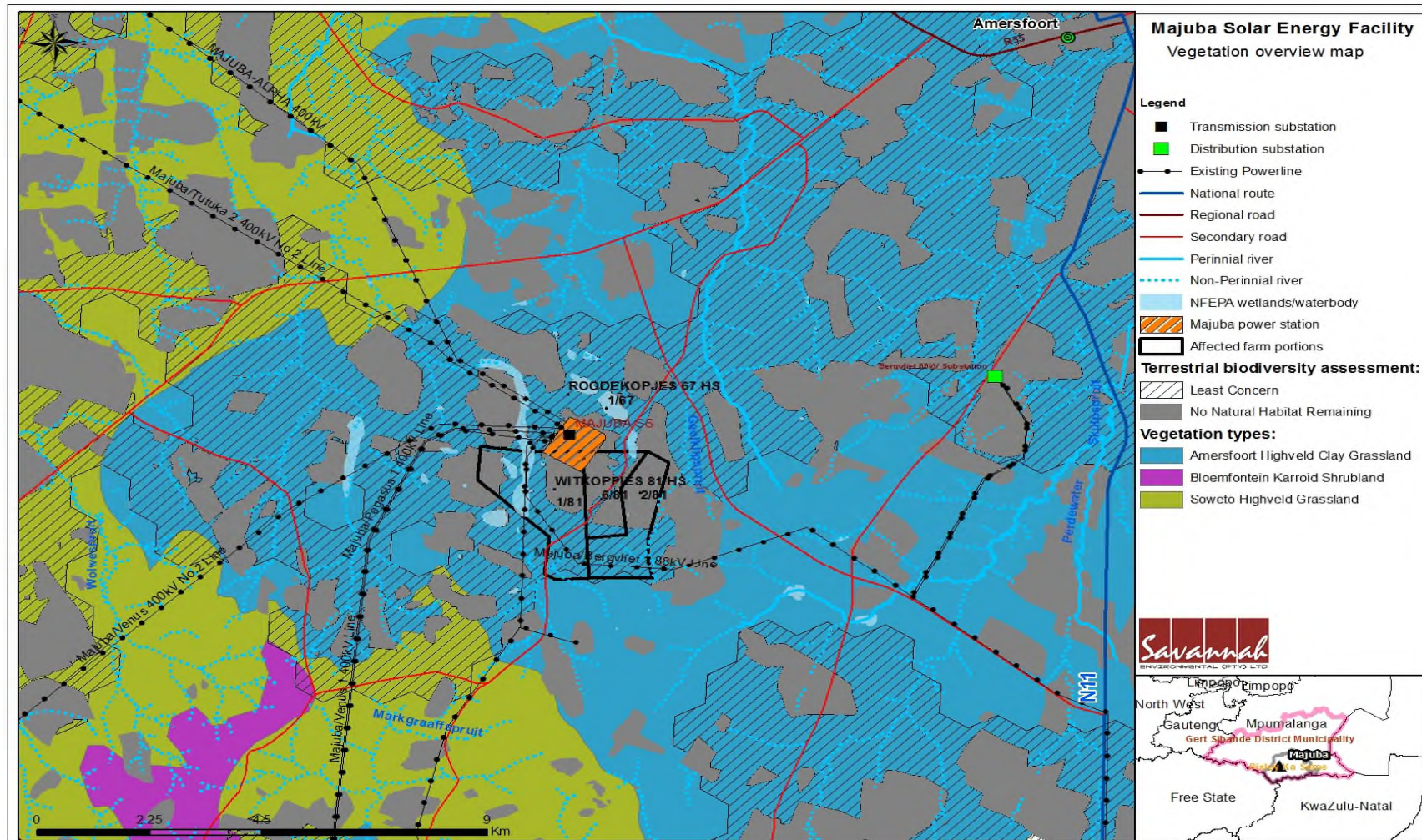


Figure 5.4: The original extent of the vegetation types on the proposed development site (after Mucina and Rutherford, 2006)

Fine-Scale Vegetation Patterns

During a detailed vegetation survey of the study area, three vegetation associations could be identified as follows:

- » Association 1: *Themeda triandra* – *Helichrysum pilosellum* Grasslands
 - Sensitivity: Medium
- » Association 2 : Semi-natural Grasslands
 - Sensitivity: Low
- » Association 3 : *Eucalyptus* – *Pennisetum clandestinum* Depression
 - Sensitivity: Medium

The distribution on site and sensitivity of the above associations is shown in **Figure 5.5**.

Invasive Plants

According to the SANBI-POSA species list, over 80 alien invasive plant species have been recorded up to date within the grid representative of the study area. 20 of these species could be confirmed on the study site (excluding exotic trees planted on the periphery of the study area).

The following listed alien invasive species have been recorded on the study area:
Category 1b:

- » *Cirsium vulgare*;
- » *Datura stramonium*;
- » *Solanum pseudocapsicum*;
- » *Verbena bonariensis*; and
- » *Verbena brasiliensis*

Category 2:

- » *Eucalyptus* species

Additional alien invasive species do occur in the surrounding area along major transport routes, which could be accidentally introduced to the project site during construction. Regular monitoring and early eradication should enable a cost-effective control of invasives.

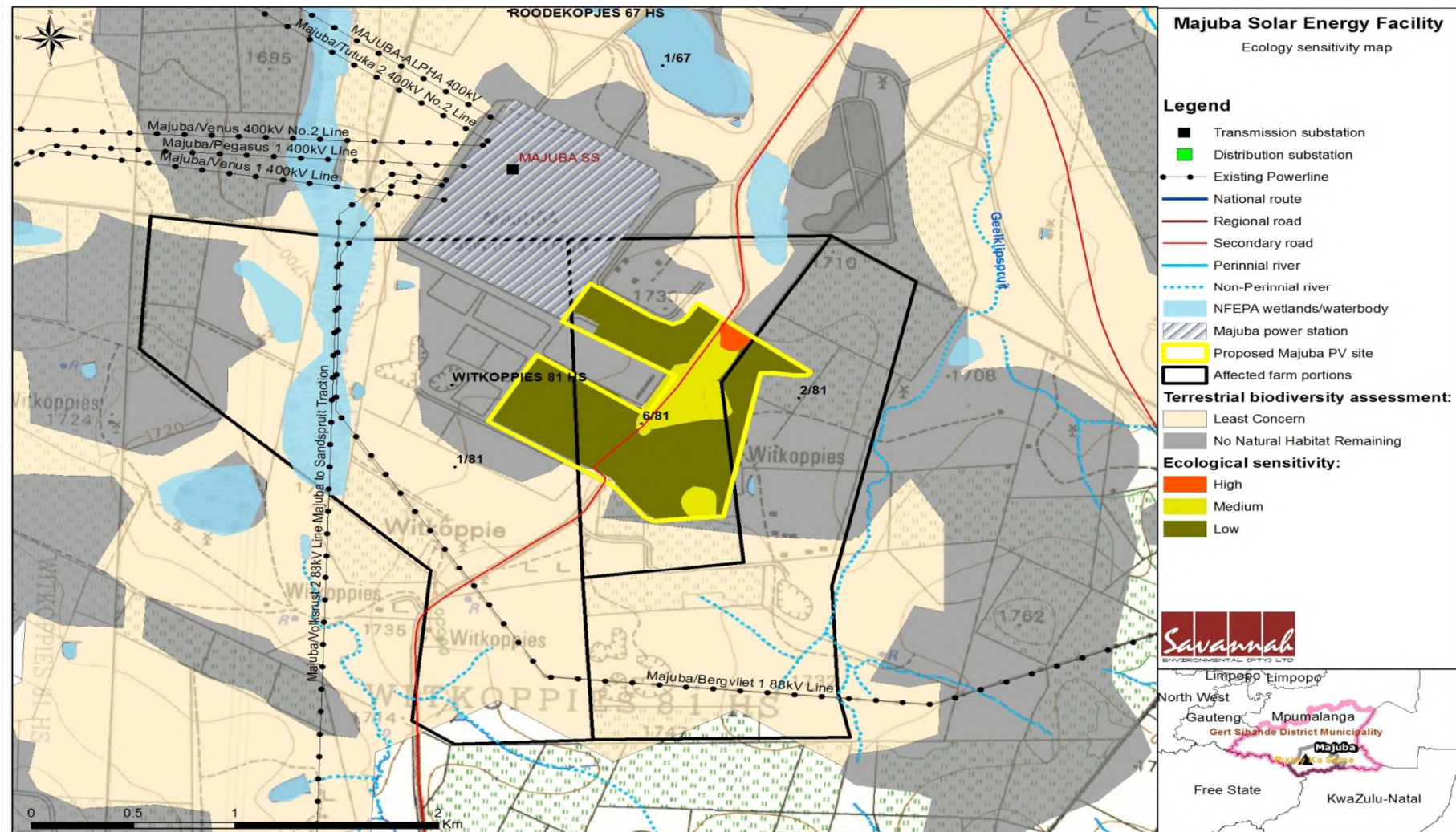


Figure 5.5: Ecological sensitivity of the study area

Plant species of Conservation Concern

None of the potential red data species have been confirmed on site, or are expected to occur there. However *Aloe ecklonis*, *Eucomis autumnalis* and *Gladiolus sericeovillosus* s. *Calvatus* were recorded in the study area and are protected by the Mpumalanga Nature Conservation Act (Act 10 of 1998) (**Figure 5.6**).



Figure 5.6: *Eucomis autumnalis* (left) and *Habenaria dives* (right)

5.3.2 Fauna

There are a number of amphibians, reptiles and mammal species of conservation concern that could occur in the study area according to various existing databases (SANBI, ADU) and Apps (2000). These are discussed below.

Amphibians, Reptiles and Mammals

A list of protected vertebrate species (reptiles, birds, and mammals) that could occur in the study area according to the ADU and SANBI databases, as well as Apps (2000) is presented in Appendix C of the ecology report.

During the survey, no terrestrial vertebrates were recorded, but there are some burrows in the grasslands, indicating the presence of either larger reptiles and/or small rodents. These groups of burrows could be from the Giant Girdled Lizard /Sungazer which is known to occur in the area. This was however not confirmed.

Species of conservation concern

The red data species presented in **Table 5.3** have been recorded from the area (2827) according to the red data species list of SANBI and the ADU database but were not observed onsite:

Table 5.3: Red data faunal species list of SANBI and the ADU database (2827)

Species	RD Status	Possibility of being present	Threat
Giant Girdled Lizard <i>Smaug (Cordylus) giganteus</i>	VU	Possible	Habitat destruction
Spotted Shovel-nosed Frog <i>Hemisis guttatus</i>	VU	Possible	Habitat destruction

5.3.3 Avifauna

Avifaunal Habitats within the study area

Whilst much of the distribution and abundance of bird species can be attributed to the broad vegetation types present in an area, it is the smaller spatial scale habitats (micro habitats) that support the requirements of a particular bird species that need to be examined in greater detail. Micro habitats are shaped by factors other than vegetation, such as topography, land use (CSIR, 2009), food availability and various anthropogenic factors, all of which will either attract or deter birds and are critically important in mapping the site in terms of avifaunal sensitivity and ultimately informing the mitigation requirements. Investigation of the development site revealed the presence of grassland habitat (disturbed to a fairly large extent) interspersed with wetland areas and small stands of trees (refer to Figure 5.7). Commercial dryland cultivation, wetlands, several drainage lines, small river systems, eucalyptus plantations as well as mines, quarries and industrial areas feature prominently within the immediate surrounds of the proposed development site.



Figure 5.7: Examples of the microhabitat observed, at the proposed site, during the site investigation

Relevant Bird Populations

- » Southern African Bird Atlas Project (SABAP) 1 and 2: A combined total of at least 168 bird species have been recorded within the relevant SABAP quarter degree square and pentad. The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur at the proposed development site. Of the 168 species, 12 are Red List species, five near-endemics, two regional endemics and three endemic species. Although Red List endemics (Blue Korhaan *Eupodotis caerulescens*, Agulhas Long-billed Lark Botha's Lark and Rudd's Lark) have been recorded in the broader study area, the report rates for each of the three lark species are low which suggests that these species may not in fact occur frequently within the quarter degree squares or pentads and are therefore unlikely to occur at the

identified site. The Red List bird species as well as those with a level of endemism, recorded in the study area by SABAP1 and 2 are presented in **Table 5.4.**

- » **Coordinated Avifaunal Roadcount (CAR) Data:** The Co-ordinated Avifaunal Roadcounts (CAR) project monitors the populations of 21 species of large 'terrestrial' birds in agricultural habitats (Young *et.al.* 2003). Although CAR road counts do not give an absolute count of all the individuals in a population, they do provide a measure of relative abundance in a particular area. CAR route MW05 has relevance to the study and runs to the south and east of the project area. The route falls within the Wakkerstroom Precinct. This precinct has an exceptional diversity of large terrestrial birds, including several Red Data Book species, namely all three crane species, Denham's Bustard, Blue Korhaan, White-bellied Korhaan, Black-bellied Bustard, Southern Bald Ibis and Secretarybird. However, only the following species were recorded along route MW05: Grey Crowned Crane, White Stork, Blue Korhaan and Southern Bald Ibis. Helmeted Guineafowl was the only large terrestrial species observed at the proposed development site during the data collection period.

- » **Coordinated Waterbird Count (CWAC) Data:** A CWAC site is any body of water, other than the oceans, which supports a significant number (set at approximately 500 individual waterbirds, irrespective of the number of species) of birds which use the site for feeding, and/or breeding and roosting (Harrison *et al.*, 2004). This definition includes natural pans, vleis, marshes, lakes, rivers, as well as a range of manmade impoundments (i.e. sewage works). There are no CWAC sites within close proximity (i.e. within 10 km) to the site. The closest sites are Fickland Pan and Wim Rabe Pan both of which are approximately 31km from Majuba Power Station and have recorded large number of Little Grebe, Black-headed Heron, Maccoa Duck, Glossy Ibis, Yellow-billed Duck, Red-billed Teal, Red-knobbed Coot and Little Stint. Of the species mentioned above, Red-knobbed Coot, Yellow-billed Duck and Red-billed Teal were recorded at the dam (Focal Site 1), located approximately 500m north east of the proposed development area, during the data collection period.

TABLE 5.4: Annotated list of bird species likely to occur within the development area and immediate surrounds of the proposed Majuba PV Solar Facility

COMMON NAME	SCIENTIFIC NAME	REGIONAL STATUS	GLOBAL STATUS	ENDEMISM	SABAP 1	SABAP 2	GRASSLAND	CULTIVATION	WETLANDS	HABITAT LOSS & DISTURBANCE	COLLISION	ELECTROCUTION
Bustard, Denham's	<i>Neotis denhami</i>	VU	NT		x		x			x	x	
Buzzard, Jackal	<i>Buteo rufofuscus</i>			Near Endemic	x		x				x	x
Cisticola, Cloud	<i>Cisticola textrix</i>			Near Endemic	x	x	x			x		
Crane, Blue	<i>Anthropoides paradiseus</i>	NT	VU		x		x	x	x	x	x	
Crane, Grey Crowned	<i>Balearica regulorum</i>	EN	EN		x		x	x	x	x	x	x
Duck, Maccoa	<i>Oxyura maccoa</i>	NT	NT		x	x			x		x	
Falcon, Lanner	<i>Falco biarmicus</i>	VU	LC		x		x			x	x	x
Flamingo, Greater	<i>Phoenicopterus ruber</i>	NT	LC		x				x		x	
Flycatcher, Fairy	<i>Stenostira scita</i>			Near Endemic	x		x			x		
Korhaan, Blue	<i>Eupodotis caerulescens</i>	-	NT	Regional Endemic	x	x	x			x	x	
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	VU	LC		x		x	x		x	x	
Lark, Agulhas Long-billed	<i>Certhilauda brevirostris</i>	NT	NR	Near Endemic	x		x	x		x		

Lark, Botha's	<i>Spizocorys fringillaris</i>	EN	EN	Endemic	x		x			x		
Lark, Cape Clapper	<i>Mirafra apiata</i>			Near Endemic	x		x			x		
Lark, Rudd's	<i>Heteromirafra ruddi</i>	EN	VU	Endemic	x		x			x		
Pratincole, Black-winged	<i>Glareola nordmanni</i>	NT	NT		x		x	x		x		
Secretarybird	<i>Sagittarius serpentarius</i>	VU	VU		x	x	x			x	x	
Starling, Pied	<i>Spreo bicolor</i>			Regional Endemic	x	x	x			x		
Stork, White	<i>Ciconia ciconia</i>	BONN			x		x	x	x		x	
Thrush, Karoo	<i>Turdus smithi</i>			Near Endemic	x		x			x		

- » *Important Bird Areas (IBAs):* The proposed development site is located on the boundary (within the buffer) of the Grassland Biosphere Reserve IBA (SA020). This IBA holds a significant portion of South Africa's population of the globally endangered White-winged Flufftail. In addition, Corn Crake, Little Bittern, Baillon's Crake, Red-chested Flufftail, African Rail, and breeding populations of African Marsh Harrier, Grey Crowned Crane and African Grass Owl also occur in the various wetland systems prevalent in the area. Approximately 85% of the global population of Rudd's Lark is thought to occur inside this IBA. Botha's Lark also occurs in this IBA and both species may occur in the grasslands that are also found within this site. The largest Southern Bald Ibis breeding colony in the world also occurs inside this IBA, with large numbers foraging and roosting throughout the area. Blue Crane, Denham's Bustard, White-bellied Korhaan, Short-tailed Pipit and Black-winged Lapwing are common at low densities. Black-winged Pratincole and White Stork occasionally occur in very large numbers during the summer months. Furthermore, the project site also lies approximately 14km south of the southern boundary of another IBA, the Amersfoort-Bethal-Carolina District (SA018). This IBA is known to hold a large proportion (>10%) of the global population of the endangered Botha's Lark (Barnes 1998). This species favours short dense, natural grassland found on plateaus and upper hill slopes. The globally threatened Wattled Crane was listed as a vagrant to this IBA, while other key listed species recorded in this IBA include Southern Bald Ibis, Lesser Kestrel, Blue Crane, African Grass Owl, Lanner Falcon and Black-winged Lapwing. None of the aforementioned species were recorded at the proposed site during the data collection period.

5.4 Land-Uses

The area around the Majuba PV Solar Facility site is characterised by three distinctive land uses, namely:

- » Heavy industrial development including the adjacent Majuba Power Station and associated conveyors and stockpiles. There are no other obvious industrial operations in the vicinity of the proposed site.
- » Urban development including the small settlements of Amersfoort and Perdekop which lie approximately 14km to the north east and 15km to the south west respectively.
- » Agricultural development is the main development type surrounding the proposed site. There is a mixture of arable agriculture and grazing land. Arable agriculture is more obvious in lower areas where water is more accessible. Grazing is the dominant use of higher areas.

5.5 Access and Transport Routes in the Region

Access to the site is provided directly from the R23 that runs along the west boundary of the proposed site or alternatively the N11 national road, located approximately 10km to the east of the study area. This National Route connects Amersfoort and Volksrust towns. Within the site itself, access is already established for use by the power station. As far as possible, these existing access roads will be utilised for construction purposes (and later limited access for maintenance).

5.6 Visual Quality of the Area

The different characteristics that contribute to the overall visual quality surrounding the proposed Majuba PV Solar facility is shown in **Figure 5.8** and explained below:

The **Industrial Landscape Character Area**, in which the proposed development is located is a functional area first and foremost. Its only importance is related to ensuring that the industry of power production functions efficiently. The main visual elements include power station, conveyors, buildings, coal stockpile and PFA dump. The natural landscape is highly degraded.

Urban Landscape Character Areas are possibly the most cohesive character areas, as once inside settlement areas, existing buildings and street / garden trees block the majority of views of surrounding areas. Consequently, views towards the site are only possible from the urban edge and from elevated areas particularly overlooking undeveloped or open areas within the urban structure.

The **Rural Landscape Character Areas** includes larger scale agricultural units and a diverse agricultural mix including both arable and livestock grazing. Other than road, rail and power line infrastructure, the area surrounding the plant is not heavily impacted by infrastructure associated with the power station. The focus is on agricultural production which means that most users of the areas are unlikely to view negatively a development that has no impact on production.

URBAN LANDSCAPE CHARACTER AREA



RURAL LANDSCAPE CHARACTER AREA



INDUSTRIAL LANDSCAPE CHARACTER AREA



Figure 5.8: Views of the different land characteristics within the project site

5.7 Social Characteristics of the Study Area and Surrounds

The purpose of the section is to provide an overview of the current socio-economic baseline environment and context in which the proposed project will take place within the Dr Pixley Ka Isaka Seme Local Municipality (DPKISLM), as part of the Gert Sibande District Municipality (GSDM) of the Mpumalanga Province. This section of the report will provide a strategic understanding of the

socio-economic profile of the study area, in order to develop a better understanding of the socio-economic dynamics as a background to the development of the project. The data presented in this section has been largely derived from the Mpumalanga Census 2011 Municipal Report, DM IDP 2015/2016, LM IDP 2012/13-2016/17, the Census Survey 2011 (Stats SA), as well as the local government handbook 2012.

5.7.1 Population

The population trends in a geographical area affect the rate of economic growth through the provision of labour and entrepreneurialism and the demand for goods and services. These trends also indicate the number of people who are likely to be impacted by the proposed project. Mpumalanga is the second-smallest province in South Africa after Gauteng with a surface area of only 76 495km²; taking up 6.3% of South Africa's land area and with a population of just over 4-million people. The proposed development will be constructed in the GSDM within the DPKISLM. The population of the DM in 2011 was approximately 1 043 194 people, of which 83 235 people reside in the LM. The average annual population growth rate in the study area is estimated by comparing data from 2001 to 2011.

5.7.2 Employment profile

The LM is largely populated by the potentially economically active population. In the LM the unemployment rate is 36.1% and there are approximately 7 871 people who are unemployed who are aged 15-64 years. This implies that there is a lot of human capital available for any kind of work, but also that there is space for training and developing economically active population in the relevant fields needed. This could increase the employment level and decrease the poverty level in the local area. Local workers should be utilised as much as possible for the proposed development in order to alleviate local unemployment.

5.7.3 Household income levels

Household income is one of the most important determinants of welfare in a region. The ability to meet basic needs, such as adequate food, clothing, shelter and basic amenities, is largely determined by the level of income earned by the households. Poverty is often defined as the lack of resources to meet these needs. Household income levels are one avenue for determining poverty levels in a community. Households that have either no income or low income fall within the poverty level (R0- R38 200 per annum); indicating the difficulty to meet basic needs requirements. A middle-income is classified as earning R38 201-R307 600, and a high income is classified as earning R307 601 or more per annum. The LM has a high number of households that fall within a low income category (73.1%) and the low percentage of the households that fall within the

middle and high income category. The high percentage of low income households indicates that there is a high demand for employment opportunities which will help decrease the dependence on forms of assistance either from government and or non-government organisations.

5.7.4 Education levels

Education plays a critical role in the development of communities and impacts greatly on economies. The type of education and training received by individuals equally determines the occupation or career they would eventually pursue. It provides a set of basic skills for development, creativity and innovative abilities. The level of education influences growth and economic productivity of a region. There is a positive correlation between a higher level of education and the level of development and standard of living. Education levels in any given population will influence economic and human development. It is clear that low education levels lead to low skills base in an area, while high education levels have the opposite effect, producing a skilled or highly skilled population. Household and personal income levels are also either positively or adversely affected by education levels. The availability of skills available indicates whether it is possible to employ local residents in the construction and operation phase of a project. **Table 5.5** demonstrates the level of education/skills availability in the study area.

Table 5.5: Education levels of population aged 20 years and older (Source: Census 2011 & Mpumalanga Municipal Report)

	No schooling	Some primary	Completed primary	Some secondary	Grade 12/Matric	Higher Education
Mpumalanga Province	14%	11.7%	4.1%	31.4%	28.9%	9.6%
Gert Sibande DM	13.3%	13%	4.4%	31.9%	27.9%	9.1%
Pixley Ka Seme LM	19.3%	14.8%	4.5%	29.2%	24.7%	7.2%

The education levels in the area are generally low. More than half of the population aged 20 years and older in the municipality have only some secondary education or less (in the LM this being 67.8% of the population); this indicates that the more than half of the local population are semi- skilled or unskilled. This reflects the rural nature of the region and relatively poor access to education. Only 24.7% of the LM have a matric and 7.2% have higher education; indicating that a relatively small proportion of the population are skilled or highly skilled.

The skills profile of the area indicates that the availability of local labour for the proposed project is largely limited to low-skilled construction workers and a small number of skilled workers.

5.7.5 Access to services

A large number of people in the local municipality have access to basic services. There is still room for improvement in the provision of basic services more specifically in the rural/farm areas, to expand basic services such as water, electricity and sanitation.

The Dr Pixley Ka Isaka Seme Local Municipality still has a huge legacy in terms of addressing the basic needs of its community, much has been done to accelerate the provisions of free basic services and more people are enjoying the benefits of a new democracy and access to basic services in the local municipality (Dr Pixley Ka Isaka Seme Local Municipality IDP 2013-2014). The Municipality, due to its spatial nature, the main challenge is on ensuring that rural communities also enjoy the same rights and benefits as urban communities in terms of basic services, much has been done to provide water (bore holes) and sanitation (VIP toilets). The level of access to key service facilities (clinics, schools, government services, etc.) needs attention as the municipal jurisdiction is rural by its spatial nature.

5.7.6 Economic trends

The Gert Sibande District Municipality was the second largest contributor to the provincial economy. In 2009, it was the main contributor to Mpumalanga's manufacturing (54.8%) and agriculture sectors (41.3%). This manufacturing was almost entirely due to SASOL's activities in Govan Mbeki local municipality.

The main industries in the LM include Agriculture, Forestry, Tourism and Mining. Volksrust together with Vukuzakhe form the largest urban settlement areas within the Dr Pixley Ka Isaka Seme municipal area. The main contributors to the local economy include Agriculture (20%), trade (19.9%), community services (16.4%), construction (12.1%), finance (5.9%), manufacturing (4.6%), transport (4.4%), utilities (3.8%) and mining (2.2%).

5.8 Heritage features of the region

5.8.1 Heritage and archaeology

Several previous heritage studies were conducted in the immediate vicinity of the study area (SAHRA report mapping project V1.0 and SAHRIS). Studies consulted

for this scoping study include Van Schalkwyk (2013), Becker (2008) and Seliane (2013). Becker recorded graves close to the Majuba Power Station and Seliane and van Schalkwyk also recorded graves as well as structures that could be older than 60 years and therefore protected by legislation. However, neither the Genealogical Society nor the monuments database at Google Earth (Google Earth also include some archaeological sites and historical battlefields) have any recorded sites in the study area.

The study area is characterised by typical Highveld grass veld and some portions was extensively ploughed in the past. Infrastructure like roads etc. also impacted on the study area and these activities would have destroyed surface indicators of heritage sites. The study area is slightly undulating with no major landscape features like pans or hills that would have been focal points in antiquity and lack raw material suitable for the manufacture of stone artefacts or for the construction of late Iron Age Stone walled settlements.

The study area was assessed in terms of the archaeological component of Section 35 of the NHRA and no surface indicators of archaeological (Stone or Iron Age) material was identified in the study area. In terms of the built environment of the area (Section 34), no standing buildings older than 60 years occur in the areas visited although some modern structures occur in the north western portion of the study area. These structures are associated with the operation of the power station and are not older than 60 years. No burial grounds or graves were recorded and no significant cultural landscapes or viewsapes were noted during the fieldwork.

5.8.2 Palaeontology (Fossils)

'Paleontological' means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

The study area is completely underlain by potentially fossiliferous sedimentary rocks of the Early Permian Volksrust Formation. This formation consists of middle to late Permian basinal mudrocks of the Ecca Group. The formation is characterised by the occurrence of plant fossils, e.g. *Phyllothea australis*; *Raniganjia kilburnensis*; *Schizoneura aficanana*; *Glossopteris spp.*, and represents the glassepterids, cordaitaleans and possibly other seed ferns. The formation is also known for its low diversity trace fossil assemblage and various organic microfossils. Macrofaunal remains include various insects. (Ponomarenko and Mostovski, 2005; Van Dijk, 1981). The occurrence of fossils within the geological record is commonly unpredictable and the chance of impacting a fossil at any particular point within the Vryheid Formation is moderate. The Vryheid Formation

strata has been extensively utilised for agricultural production (ploughed) and thus any fossils that may have been occurring at surface or near-surface will have historically been either destroyed, damaged or moved and their value lost.

ASSESSMENT OF POTENTIAL IMPACTS

CHAPTER 6

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed Majuba PV Solar Energy Facility and associated infrastructure. This assessment has considered the construction of a 65 MW facility and all related and ancillary infrastructure, including:

- » Solar panels (fixed/tracking technology).
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, or ground screws to support the PV panels.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation or switching station.
- » A power line to facilitate the connection of the solar energy facility from the on-site substation to Majuba Power Station or nearest grid access point.
- » Internal access roads.
- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

The Majuba PV Solar Energy Facility will have a development footprint of approximately 96.9 ha. The development of the facility will comprise the following phases:

- » *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation including implementation of a storm water management plan. The construction phase for the Majuba PV Solar Energy Facility is expected to take approximately 12-18 months.
- » *Operation* – will include operation of the facility and the generation of electricity for Eskom's own consumption at the Majuba Coal Fired Power station which will be fed via the on-site substation and an overhead power line. The operational phase of the Majuba PV Solar Energy Facility is expected to extend in excess of 20 - 25 years.
- » *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to

construction. Therefore, these impacts are not considered separately within this chapter.

6.1 Alternatives Assessment

As discussed in Chapter 2 of this report, at screening level, an assessment of 8 potential land areas at Majuba Coal Fired Power station was undertaken. It was concluded that most of these sites were located at a great distance away from the power station and point of connection (presenting both land and environmental issues). Therefore, there is only one proposed site for development. This site was chosen based on the fact that the site is within the power station immediate fence and the site is flat with some grassland.

Technology Alternatives

Impacts on the environment associated with the project can be influenced by the type of PV panel array to be used. Two solar energy technology alternatives are being considered for the proposed project and include:

- » Fixed mounted PV systems (static/fixed-tilt panels);
- » Tracking PV systems (with solar panels that rotate around a defined axis to follow the sun's movement).

The primary differences between technologies available which affect the potential for environmental impacts relate to the extent of the facility, or land-take (disturbance or loss of habitat), as well as the height of the facility (visual impacts). However, the two alternative PV technologies do not differ in any significant way as far as ecology, visual, and avifaunal impacts are concerned. Therefore, there is **no significant difference** in the potential impacts associated with the alternatives, and the impacts for the two alternatives are not comparatively assessed in the assessment sections that follow. The PV panels are designed to operate for 20-25 years, unattended and with low maintenance. The impacts associated with the operation and decommissioning of the facility will be the same irrespective of the technology chosen.

Potential impacts pertaining to the proposed PV site is assessed in the sections below.

6.2 Potential Impacts on Ecology (Flora, Fauna and Ecosystems)

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Majuba PV Solar Energy Facility and associated

infrastructure requires ~96.9 ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective will be loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** - Ecology Report for more details).

6.2.1 Results of the Ecological Study

A total of 954 indigenous plant species have been recorded in the Majuba area according to the SANBI database. Of these species recorded in the wider area, only 88 indigenous plant species in total could be identified, which is relatively low for grasslands. Several more alien invasive species have been recorded.

At the time of the vegetation survey, the herbaceous layer overall was reasonably well developed, but additional species may occur in the area that were dormant at the time. Much of the grasslands are still in a state of rehabilitation, thus gradual future changes in species composition can still be expected.

None of the grasslands are considered to be in a pristine or natural condition, but portions of the grassland appear to have been able to regenerate for a longer time and show a considerably higher biodiversity, including a few plants of conservation concern. This small portion of more diverse grasslands is classified by the Mpumalanga Biodiversity Conservation Plan as of Least Concern, whilst the remainder of the area has been recognised as rangelands with no Natural Habitat Remaining.

Vegetation association identified during this study are based on the overall similarity in species composition, vegetation structure and biophysical attributes that are part of an ecosystem, but smaller phytosociological differences within each vegetation unit are present. The ecological sensitivity of the site is mapped in **Figure 6.1**.

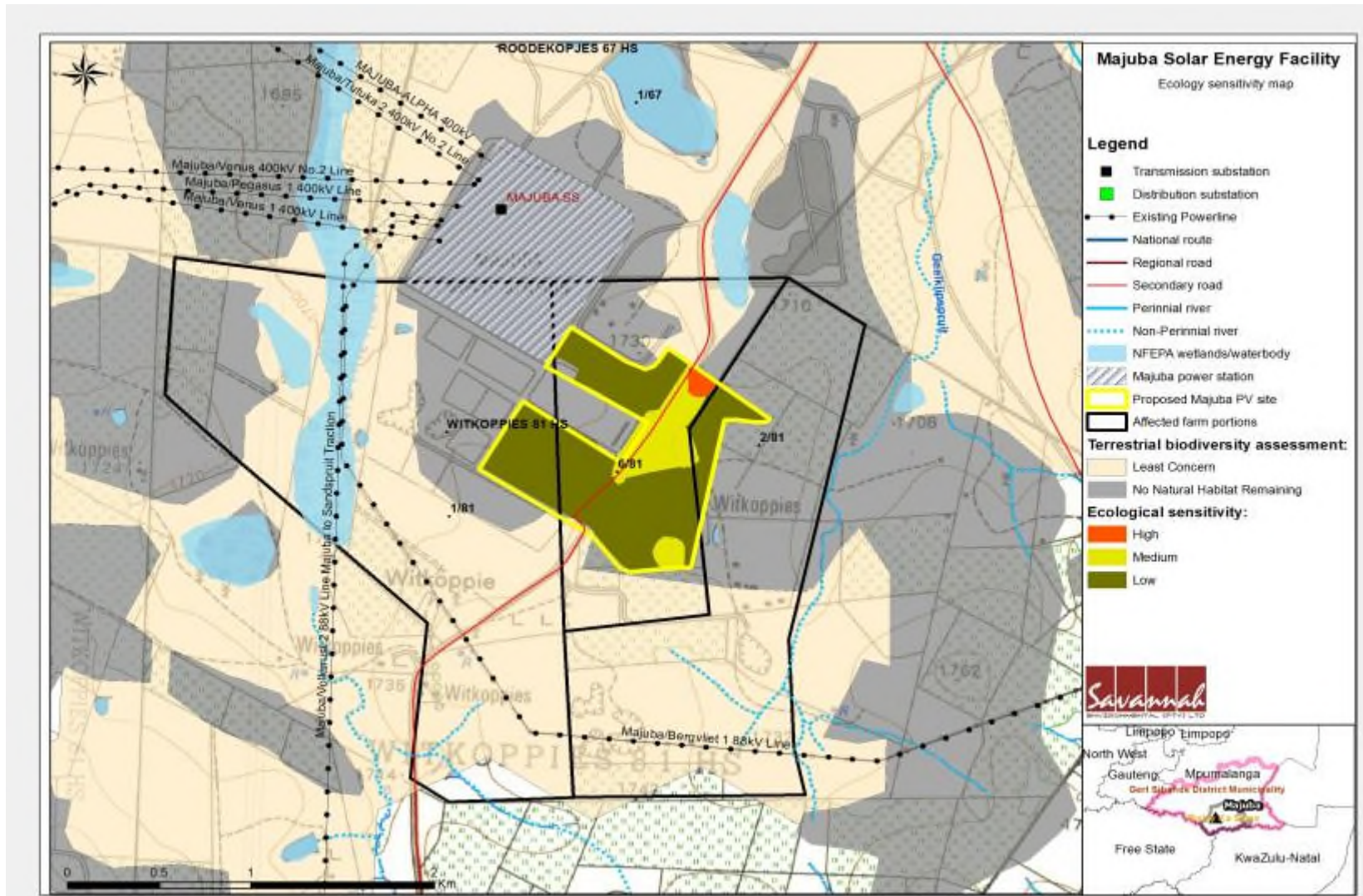


Figure 6.1: Sensitivity map indicating sensitive ecological areas within the proposed Majuba PV Solar Energy Facility

6.2.2 Impact tables summarising the significance of impacts on ecology during the construction and operation phases (with and without mitigation)

Nature of impact: Loss of indigenous (-ve) and alien invasive (+ve) vegetation, increase in runoff and erosion, possible increased distribution of alien invasive species, possible disturbance and reduction of habitat or injury to/loss of burrowing vertebrates, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of re-vegetation potential of soil surface.

Activity: Upgrading and/or creation of site access road and internal maintenance tracks

Environmental Aspect: Removal of vegetation, compaction and disturbance of soils, creation of runoff zone, possible destruction of animal burrows, impact on protected species, alteration of soil surface properties, increased coal-dust pollution

Note: The study area is surrounded by gravel and tar roads, and on-site access will thus be limited to service and construction tracks

Relevant Listed activities:

GN 544, activity 11(ii), 18(i), 22 (i) & 47 (ii)

GN 546, activity 14(a) (i).

	Without mitigation	With mitigation
Extent	Site specific (1)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	Medium (45)	Low (15)
Status	Negative	<i>Positive</i> where aliens invasive species will be cleared <i>Neutral</i> where roads exist or on transformed areas
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

- » Avoid wetland areas and high diversity grassland sections.
- » After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows:
 - Protected plant species: must be relocated or a permit obtained to destroy them;
 - Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- » During construction: create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas.
- » Keep the clearing of grasslands to a minimum.
- » If filling material is to be used, this should be sourced from areas free of invasive species.
 - It is recommended that sealed surfaces from Alternatives Site 2 be crushed and used as filling material where and if possible.
- » Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where

<p>necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material.</p> <ul style="list-style-type: none"> » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas. » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required). » Prevent leakage of oil or other chemicals or any other form of pollution. » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed. » After decommissioning, if access roads or portions thereof will not be of further use to Eskom, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable re-vegetation program.
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> » Possible erosion of areas lower than the access road. » Possible contamination of lower-lying wetlands due to oil or other spillage. » Possible spread and establishment of alien invasive species.
<p>Residual impacts:</p> <ul style="list-style-type: none"> » Altered vegetation composition and structure. » Altered topsoil conditions. » Potential barren areas. » Potential for erosion and invasion by weed or alien species.

<p>Nature of impact: Loss of indigenous (-ve) and alien invasive (+ve) vegetation, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion, temporary disturbance of burrowing animals, possible reduction of habitat and forage availability to terrestrial vertebrates by exclusion.</p> <p><u>Activity:</u> Fencing area – may also serve as maintenance track to PV panels</p> <p><u>Environmental Aspect:</u> Removal of vegetation, compaction of soils, creation of runoff zone, impact on protected species, impact on terrestrial vertebrates</p> <p><i>Note: Secure fencing already exists around the larger power station property</i></p>		
<p>Relevant Listed activities: GN 546, activity 14(a) (i).</p>		
	Without mitigation	With mitigation
Extent	Site specific (1)	Site specific (1)
Duration	Long-term (4)	Long term (4)
Magnitude	Minor (2),	Small (0)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)
Status	Negative	Positive where alien invasive species will be cleared

		<i>Neutral</i> where on transformed or highly degraded areas <i>Minimal new negative impacts expected</i>
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Reasonably well	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Avoid wetlands. » After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows: <ul style="list-style-type: none"> o Protected plant species: must be relocated or a permit obtained to destroy them; o Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor. » As part of the design phase, it must be made clear what vegetation will be permissible within the development area and how this will be kept in a state that is suitable for the development, e.g. regular mowing: <ul style="list-style-type: none"> o It will be important to maintain a fairly dense, low vegetation layer to protect erodible soils and prevent further wetland degradation. » During the design phase, the possible impact of burrowing vertebrates and rodents on the development must be determined, and fencing must be designed to either exclude such fauna if it will be detrimental or enable occasional migration of smaller vertebrates onto and across the site (which could be beneficial to small vertebrate populations). » Minimise area affected, especially during construction. » During construction: strictly prohibit any off-road driving or parking of vehicles and machinery outside the development footprint areas. » Prevent leakage of oil or other chemicals; strictly prohibit littering of any kind. » Monitor the establishment of alien and indigenous invasive species and remove as soon as detected, whenever possible <i>before</i> regenerative material can be formed. 		
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> » Possible erosion of cleared areas and associated accelerated erosion from surrounding areas. » Possible loss of ecosystem functioning due to increase in invasive species. » Increased fragmentation of rangelands. 		
<p>Residual impacts:</p> <ul style="list-style-type: none"> » Altered vegetation composition (temporary). » Possibility for erosion and invasion by alien invasive species. 		

Nature of impact : Significant decrease of weeds and alien invasive vegetation (+ve, if properly mitigated), loss of indigenous vegetation, site-specific altered distribution of rainfall and resultant runoff patterns, general increase in runoff from PV and/or bare areas and associated accelerated erosion, reduction of habitat for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased severe erosion or dust due to lower buffering capacity *if* vegetation remains sparse.

Activity: Construction and operation of PV panels on previously transformed/low diversity areas

Environmental Aspect: Removal of vegetation, compaction of topsoil, creation of new or altered runoff zone, redistribution and concentration of runoff from panel surfaces, artificial shading of vegetation, continued displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events, reduction of alien invasive species (+ve).

Note: tracking panels may occupy more land, but will have smaller sealed surfaces leading to smaller concentrated runoff volumes, which will cause less soil erosion. Also, smaller panels spaced wider allow a denser vegetation layer to re-establish to stabilise the soils and suppress weeds and invasives.

Relevant Listed activities:

GN 545 activity 1 & 15
 GN 546, activity 14(a) (i).

	Without mitigation	With mitigation
Extent	Site specific (1)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	Medium (45)	Medium (35)
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Highly Probable	Slight Probability
Can impacts be mitigated?	Yes	

Mitigation:

- » After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and active animal burrows:
 - Protected plant species: must be relocated;
 - Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- » Keep areas affected to a minimum; strictly prohibit any disturbance outside the demarcated footprint area.
- » As part of the design phase, it must be made clear what vegetation will be permissible and how this will be kept in a state that is suitable for the development, e.g. regular mowing
 - It will be important to maintain a fairly dense, low vegetation layer to protect erodible soils and prevent further wetland degradation
- » Weeds and alien invasive species must be eradicated or significantly reduced:
 - This is not only to stop the high reproduction and spreading of alien invasives, but also to reduce maintenance costs of the proposed development;
 - Continue monitoring and removing all invasive vegetation after construction up to decommissioning.
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr:
 - Use species that were part of the original indigenous species composition similar to the remaining intact natural vegetation as listed in the specialist report, or sow with *Eragrostis curvula*. It is expected that that several indigenous species will naturally re-establish due to existing seed banks. A strong grass layer will also suppress the re-emergence of weed species from existing seed banks.

- » If filling material is to be used, this should be sourced from areas free of invasive species.
- » Temporarily stored topsoil must be re-applied within 6 months; topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan and must as minimum be free of weeds and alien invasive species.
- » Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and re-vegetation efforts accordingly.
- » Prevent leakage of oil or other chemicals; strictly prohibit littering of any kind.

Cumulative impacts:

- » If mitigation measures are not strictly followed the following could occur:
 - erosion of areas around the panels and continued erosion of the development area with associated siltation and/or degradation of lower-lying wetlands and adjacent natural endangered vegetation
 - contamination of wetlands
 - spread and establishment of invasive species

Residual impacts:

- » altered topsoil characteristics.
- » altered vegetation composition (which will in this case be positive if indigenous grassland vegetation can be re-established).

Nature of impact: Loss and further fragmentation of species of conservation concern, altered vegetation cover, window of opportunity for the establishment of alien invasive species, site-specific altered distribution of rainfall and resultant runoff patterns, increase in runoff from PV panels and/or bare areas and accelerated erosion, loss of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. severe erosion or dust due to lower buffering capacity of sparser vegetation.

Activity: Construction and operation of any development component(s) on higher diversity grasslands

Environmental Aspect: Removal of or excessive damage to vegetation, compaction of soils, creation of runoff zone, redistribution and concentration of runoff from panel surfaces, artificial shading and resulting decimation of vegetation, displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events.

Note: tracking panels may occupy more land, but will have smaller sealed surfaces leading to smaller concentrated runoff volumes, which will cause less soil erosion. Also, smaller panels spaced wider allow a denser vegetation layer to re-establish to stabilise the soils and suppress weeds and invasives.

Relevant Listed activities:

GN 544, activity 11(ii), 18(i), 22 (i) & 47 (ii)
GN 545 activity 1 & 15
GN 546, activity 14(a) (i).

	Without mitigation	With mitigation
Extent	Site Specific (1)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Moderate (6)

Probability	Definite (5)	Definite (5)
Significance	High (65)	Medium (55)
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

- » After the final layout of permissible development components has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and active animal burrows:
 - Protected plant species: must be relocated or a permit obtained to destroy them;
 - Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- » Keep areas affected to a minimum; strictly prohibit any disturbance outside the demarcated footprint area.
- » Clear as little grassland vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr.
 - use only species that were part of the original indigenous species composition as listed in the specialist report.
- » As part of the design phase, it must be made clear what vegetation will be permissible within the development area and how this will be kept in a state that is suitable for the development, e.g. regular mowing.
 - It will be important to maintain a fairly dense, low vegetation layer to protect erodible soils and prevent further wetland degradation.
- » Remove all rubble and other foreign materials currently on the site. Prevent any further pollution.
- » Weeds and alien invasive species must be eradicated or significantly reduced:
 - This is not only to stop the high reproduction and spreading of alien invasive species, but also to reduce maintenance costs of the proposed development.
 - Continue monitoring and removing all invasive vegetation after construction up to decommissioning.
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMPr.
 - Use species that were part of the original indigenous species composition similar to the remaining intact natural vegetation as listed in the specialist report, or sow with *Eragrostis curvula*. It is expected that several indigenous species will naturally re-establish due to existing seed banks.
 - A strong grass layer will suppress the re-emergence of weed species from existing seed banks.
- » If filling material is to be used, this should be sourced from areas free of invasive species.
 - It is recommended that sealed surfaces from Alternative Site 2 be crushed and used as filling material where and if possible.
- » Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection

<p>measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. Excess removed topsoil's can be used for the rehabilitation of areas where sealed surfaces have been removed.</p> <ul style="list-style-type: none"> » Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan. » The rehabilitation plan for all temporarily affected areas and for the development area after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover. » Prevent leakage of oil or other chemicals; strictly prohibit littering of any kind. » Remove all alien invasive vegetation prior to construction. » Monitor the establishment of all invasive species and remove as soon as detected, whenever possible before regenerative material can be formed.
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> » If mitigation measures are not strictly adhered to the following could occur: <ul style="list-style-type: none"> o Loss of and further fragmentation of remaining portions of natural grassland and associated ecosystem services such as pollination. o Alteration of occupancy by terrestrial fauna, possible reduction of available habitat and food availability to terrestrial fauna. o Spread and establishment of invasive species and further associated degradation of remaining endangered vegetation.
<p>Residual impacts:</p> <ul style="list-style-type: none"> » altered topsoil characteristics. » altered vegetation composition. » fragmentation and loss of diversity of endangered vegetation.

<p>Nature of impact: Limited removal of vegetation, increase in runoff and erosion, disturbance of burrowing animals</p>		
<p><u>Activity:</u> Construction of a short power line as part of the grid connection</p>		
<p><u>Environmental Aspect:</u> Limited removal of vegetation, compaction of soils, temporary or permanent damage to animal burrows</p>		
<p>Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 15 GN 546, activity 14(a) (i).</p>		
	Without mitigation	With mitigation
Extent	Site and surroundings (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (15)
Status	Negative	Negative

Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation:		
<ul style="list-style-type: none"> » During the design phase, aim to have connection routes coinciding with existing tracks or fence lines to reduce the disturbance to vegetation and avoid creating new tracks and areas of compaction by construction and maintenance machinery. » Avoid crossing wetland areas as far as possible. » After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows: <ul style="list-style-type: none"> o Protected plant species: must be relocated where affected by pylons, maintenance tracks or construction, or a permit obtained to destroy them; o Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor. » During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas. » Limit clearing of indigenous vegetation to pylon positions only. » Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed. 		
Cumulative impacts:		
<ul style="list-style-type: none"> » Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna) 		
Residual impacts:		
<ul style="list-style-type: none"> » Very localised alteration of soil surface characteristics » Very localised alteration of species composition 		

Nature of impact: Loss of vegetation and/or species of conservation concern, significant decrease and possible eradication of weeds and alien invasive plants (+ve), loss of microhabitats, altered and reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in <i>concentrated</i> runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna		
<u>Activity:</u> Construction of substation and other associated buildings, workshops, offices, etc. on <i>transformed areas</i>		
<u>Environmental Aspect:</u> Removal of vegetation, compaction and alteration of topsoil, creation of runoff zone, redistribution and concentration of runoff from sealed surfaces, displacement of terrestrial vertebrates		
Relevant Listed activities:		
GN 544, activity 10 (i),11(ii), 18(i)		
GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Site specific (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)

Probability	Definite (5)	Definite (5)
Significance	Medium (40)	Low (25)
Status	Negative	Neutral on transformed or degraded grassland areas (<i>Negative on high diversity grassland areas.</i>)
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
<p>Mitigation:</p> <ul style="list-style-type: none"> » During the design phase, ensure that none of these development components are situated outside transformed areas. » A 30 m buffer must be implemented around the wetlands to protect wetland functionality. » After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows: <ul style="list-style-type: none"> ○ Protected plant species: must be relocated or a permit obtained to destroy them; ○ Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor. » Weeds and alien invasive species must be eradicated or significantly reduced: <ul style="list-style-type: none"> ○ Continue monitoring and removing all invasive vegetation after construction up to decommissioning. » Limit disturbance to footprint area as far as practically possible. » During construction: stay within demarcated footprint areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas. » Prevent spillage of construction material and other pollutants. Contain and treat any spillages immediately. » Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan. » If filling material is to be used, this should be sourced from areas free of invasive species. » Rehabilitate and revegetate all areas outside the footprint area that have been disturbed. » After decommissioning, remove all foreign material prior to starting the rehabilitation. » The rehabilitation plan for all temporarily affected areas and for the development area after decommissioning must aim to re-introduce non-weed indigenous species listed for the natural remaining grasslands as described in the specialist, taking the observed original cover percentages of intact grasslands as a guideline of acceptable vegetation cover. » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed 		
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> » If mitigation measures are not strictly followed the following could occur: <ul style="list-style-type: none"> ○ erosion of areas around sealed surfaces and continued erosion or degradation of the development area with associated degradation of lower-lying wetlands; ○ contamination of wetlands; 		

- o spread and establishment of invasive species.

Residual impacts:

- » Altered topsoil characteristics.
- » Possible removal of existing foreign materials from the environment (which would be desirable and positive).
- » Altered vegetation composition (which can be positive if invasive species are replaced by indigenous species).

Nature of impact: Loss of vegetation and/or species of conservation concern, loss of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed or compacted surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible contaminated topsoil, possible contaminated ground water or wetlands

Activity: Temporary construction camps and sites where materials, machinery and temporary staff facilities are kept during construction.

Environmental Aspect: Removal of vegetation, compaction of soils, creation of runoff zone, displacement of terrestrial vertebrates, possible contamination of topsoil and groundwater by chemicals or oils.

Note: within the power plant area there are already transformed areas that could possibly be utilised for storage of construction equipment

Relevant Listed activities:

GN 544, Activity 18(i);

GN 546, Activity 14(i).

	Without mitigation	With mitigation
Extent	Site specific (1)	Site specific (1)
Duration	Moderate-term (3)	Short-term (2)
Magnitude	Low (4)	Small (0)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (32)	Low (9)
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Exclude high diversity grasslands and wetlands from this activity.
- » After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows:
 - o Protected plant species: must be relocated or a permit obtained to destroy them;
 - o Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- » Stay within demarcated temporary construction areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas.
- » Prevent spillage of construction material and other pollutants. Contain and treat any spillages

- immediately, strictly prohibit any pollution/littering according to the relevant EMPr.
- » No fires may be lit on site for cooking or any other purposes.
 - » Facilities may not be used as staff accommodation.
 - » Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as full material. Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan.
 - » After construction is completed remove all foreign material prior to starting the rehabilitation.
 - » The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages of intact grasslands as a guideline of acceptable vegetation cover.
 - » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed.

Cumulative impacts:

- » If mitigation measures are not strictly followed the following could occur:
 - o erosion of the development area with associated siltation and/or erosion of lower-lying wetlands;
 - o contamination of drainage lines, lower-lying rivers, wetlands and ground water;
 - o spread and establishment of invasive species.

Residual impacts:

- » Altered topsoil characteristics.
- » Altered vegetation composition.

Nature of impact: Loss of vegetation and/or species of conservation concern, loss of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, possibly higher accelerated erosion, possible loss of topsoil resources, reduction of habitat and resource availability for terrestrial fauna.

Activity: Topsoil stockpiles that might be required during construction

Environmental Aspect: Removal of vegetation, compaction of soils, creation of runoff zone, displacement of terrestrial vertebrates

Relevant Listed activities:

GN 546, activity 14(a) (i).

	Without mitigation	With mitigation
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (40)	Low (15)
Status	Negative	Neutral to slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of	Probable	Not likely

resources?		
Can impacts be mitigated?	Reasonably	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Exclude wetlands from this development area. » After the final layout has been approved, conduct a thorough footprint investigation to detect and map any protected plant species and animal burrows: <ul style="list-style-type: none"> ○ Protected plant species: must be relocated or a permit obtained to destroy them; ○ Animal burrows: must be monitored by the EO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor. » Stay within demarcated areas and access routes for extraction and/or movement of materials. » Strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas. » Prevent spillage of pollutants, contain and treat any spillages immediately. Strictly prohibit any pollution. » Topsoil (the upper 25 cm of soil) is an important natural resource; it must be stripped, where necessary, and stockpiled separately from subsoil in a designated area. Topsoil protection measures must be implemented and handling minimised. Topsoil must only be re-used for rehabilitation of disturbed or exposed areas caused by construction activities and not as fill material. Temporarily stored topsoil must be re-applied within 6 months, topsoil stockpiles stored for longer need to be managed according to a detailed topsoil management plan. » Monitor erosion of areas and control where necessary. » After construction is completed remove all foreign material prior to starting the rehabilitation. » Backfill borrow pits that may be created first with overburden or subsoils, with an overlay of topsoil, following to a detailed rehabilitation plan. » The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover. » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed. 		
<p>Cumulative impacts:</p> <ul style="list-style-type: none"> » If mitigation measures are not strictly followed the following could occur: <ul style="list-style-type: none"> ○ continued erosion of the altered surfaces with associated siltation and/or erosion of lower-lying wetlands; ○ contamination of drainage lines, lower-lying rivers or wetlands; ○ spread and establishment of invasive species. 		
<p>Residual impacts:</p> <ul style="list-style-type: none"> » Altered topsoil characteristics. » Altered vegetation composition. 		

Nature of impact: Localised increase in runoff and accelerated erosion, possible contamination of soil and groundwater, possible contamination and damage to terrestrial fauna.

Activity: PV array *components* and their continued maintenance and eventual decommissioning: regular washing and possible breakage of panels.

Environmental Aspect: altered runoff and associated vegetation and erosion patterns.		
Relevant Listed activities: GN 545 activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Site and surroundings (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	Medium (50)	Low (15)
Status	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation:		
<ul style="list-style-type: none"> » Where panels need to be washed, no polluting chemicals may be used, and the use of water should be minimal. » Where water is used for washing, monitor areas around the PV arrays for signs of accelerated erosion and establishment of weeds or alien invasive species and manage according to the erosion- and invasive species management plan. » Prior to construction and up to decommissioning, clear instructions must be drafted and at all times available on site on how any breakages of PV panels will be dealt with, including: <ul style="list-style-type: none"> o Correct salvage, disposal and preferably also recycling methods (or possibilities) for any broken materials. 		
Cumulative impacts:		
<ul style="list-style-type: none"> » Possible pollution of surrounding areas if no mitigation is implemented. » Possible increase in and spread of alien invasive species beyond the site if no mitigation is implemented. 		
Residual impacts:		
<ul style="list-style-type: none"> » None expected if mitigation measures are implemented. 		

6.2.3 Assessment of the PV site

The photovoltaic facility development on the proposed site will not have significant impacts on the above-ground ecology of the site provided all mitigation measures are followed, especially if listed alien invasives can be reduced. If such currently present disturbances can be sufficiently mitigated, the impact may be to some extent beneficial for more sensitive surrounding areas. The low ecological sensitivity of the larger portion of the study area is due to the past land-use history, during which these areas were transformed or degraded. The impact on fauna is expected to be small to negligent. Presence of indigenous terrestrial vertebrates within the study area is low due to current land use. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. No restricted or specific habitat of vertebrates exists on the study area and will be affected by the proposed development;

especially if the proposed development remains outside the recommended buffers around wetland and seepage areas.

It is not expected that the development will compromise the survival of or significantly impact the conservation status of any flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be on ecosystem health and functionality and the associated integrity of surrounding wetlands, which should remain relatively intact if all mitigation recommendations are implemented.

The two alternative PV technologies do not differ in any significant way as far as the impacts on the ecological sensitivities are concerned. There is **no significant difference** in the potential impacts associated with the technology alternatives. Therefore, there is **no preference** between the alternative technologies, and both are considered to be viable for use at the site.

6.2.4 Implications for Project Implementation

- » The Mpumalanga Biodiversity Conservation Plan classifies a small central portion of the study area as of Least Concern, whilst the remainder has been classified as having no natural habitat remaining. This was confirmed during the field study – with a small area of relatively diverse grassland remaining, whilst the largest portion of the study area consists of rehabilitated (semi-natural) grasslands.
- » Overall, the species diversity of the study area is low, comprising less than 10% of the floral diversity recorded in the greater area. Nevertheless, a few species of conservation concern observed as well as wetlands in the area should be taken into account during the design of the layout and the future environmental management of the proposed development.
- » Small groups of burrows have been found within the area, which must be monitored prior to construction to ensure that no harm comes to amphibians, reptiles or small mammals living in these burrows.
- » Several alien invasive plants have been observed on the study site, with more species in close proximity. For all species, there is a very high risk of spread throughout the project area following disturbance. This implies that a detailed Invasive Plant Management Plan will have to be in place prior to commencement of activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.
- » It is not expected that the development will compromise the survival of or significantly impact any flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if, all mitigation recommendations are implemented; and the associated integrity of surrounding wetlands.

6.3 Potential Impacts on Avifauna

6.3.1 Results of the avifauna assessment

Solar energy facilities may impact birds and bird populations in several ways. These can be grouped as either lethal, direct mortality impacts (i.e. collisions with the PV panels and associated infrastructure) that affect individual birds; or the non-lethal, less direct impacts (i.e. displacement) as a result of habitat transformation and disturbance that are common to most forms of development (Drewitt & Langston, 2008). The potential impacts of solar facilities and associated infrastructure on avifauna are detailed below:

The potential impacts of solar facilities on avifauna include:

- » *Displacement as a result of habitat loss or transformation:* Although this impact is dependent on the location and the scale of the facility, this is potentially the most significant impact associated with the construction and operation (maintenance) of solar energy facilities. Extensive areas of vegetation (habitat) are cleared to accommodate the considerable amount of infrastructure required at these facilities, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013). This impact is likely to have significant consequences for the smaller grassland bird species (i.e. the larks) with small home ranges as entire territories could be removed during construction activities. The grassland and wetland vegetation present at the proposed development site is subject to significant existing disturbance. It is therefore unlikely to support the more sensitive species and any habitat destruction impacts that may occur are likely to only affect local bird populations. Unfortunately, due to the nature of this impact, it would be extremely difficult to mitigate and therefore the significance of the impact cannot be reduced to negligible levels.
- » *Displacement as a result of disturbance:* Excavation and construction activities at solar energy facilities are a source of significant disturbance particularly as a result of the machinery and construction personnel that are present on site for the duration of the construction and to a lesser degree the ongoing maintenance at the facility. For most bird species, construction activities are likely to be a cause of temporary disturbance and will impact on foraging, breeding and roosting behaviours or in more extreme cases, result in displacement from the site entirely. The study area is already subjected to a fairly significant degree of disturbance associated with the energy generation and industrial and agricultural activities in the immediate and surrounding vicinity of the proposed site. It is therefore difficult to predict at this stage how detrimental the disturbance impacts will be on local bird populations in the short or long-term. However based on the footprint of the PV facility and the bird species likely to occupy the study area, low impacts are probable.
- » *Mortality:* Although no distinct flight paths were recorded across the proposed site, it is likely that the smaller flocking species (recorded within the project development

site) and the water birds (recorded at the focal site) will utilize the airspace surrounding the development area, flying between roosting and foraging areas in the immediate surrounds of the development site. The PV arrays constructed in this area may confuse approaching birds, resulting in collisions with the panels. However, based on the footprint of the PV facility and the bird species likely to occupy the study area, medium impacts are probable.

The potential impacts of the associated infrastructure on avifauna include:

- » *Collisions with power line infrastructure:* Several existing power lines traverse through the study area and it is a proven fact that placing a new line next to an existing line reduces the risk of collisions to birds. The reasons for that are two-fold, namely it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and have learnt to avoid it (APLIC 1994).
- » *Electrocutions on power line and other electrical infrastructure:* Electrocution risk mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components. This risk is strongly influenced by the power line voltage and the design of the pole structure. The electrocution impact is rated to be of medium significance for the proposed power line but can be reduced to a low significance if an appropriate structure type is used in the construction of the power line.
- » *Habitat destruction and disturbance associated with the construction and maintenance of power line and other infrastructure:* During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat. The new line will undoubtedly destroy and modify a certain amount of habitat. However at a landscape level, is it unlikely to have a major impact on Red List species recorded in the area. Similarly, the above mentioned construction activities impact on avifauna through disturbance, particularly during breeding activities. This could lead to breeding failure if the disturbance happens during a critical part of the breeding season. In general the disturbance that will be caused by the construction activities will be temporary and this, coupled with the fact that there is currently considerable disturbance in the area, means that the construction of the substation and power line should not lead to a species being permanently displaced from the area. Large terrestrial species observed in the study area, particularly Secretary bird and the various water birds will be susceptible to collision with the power line infrastructure associated with this project. However given the project size, the existing infrastructure and the suite of mitigation measures available to reduce possible mortalities the significance of this impact can be reduced to acceptable levels.

6.3.2 Sensitivity Assessment

At both a landscape and site specific level, the avifaunal sensitivity of the site is considered to be medium to low. The only sensitive features present at the proposed development site are the wetland areas. The wetlands have been assigned a medium sensitivity rating. Ordinarily, wetland systems would be assigned a higher sensitivity rating given their importance in terms of avifauna. However, owing to the fact that the wetland system is modified, subject to existing disturbances of medium intensity, but still has some degree of connectivity with other ecosystems with intermediate levels of species diversity, a medium sensitivity has been allocated. The remainder of the site is fairly uniform and comprised of disturbed grassland with no topographical features, resulting in low species richness with no identifiable avifaunal flight paths and is therefore considered to be of low sensitivity.

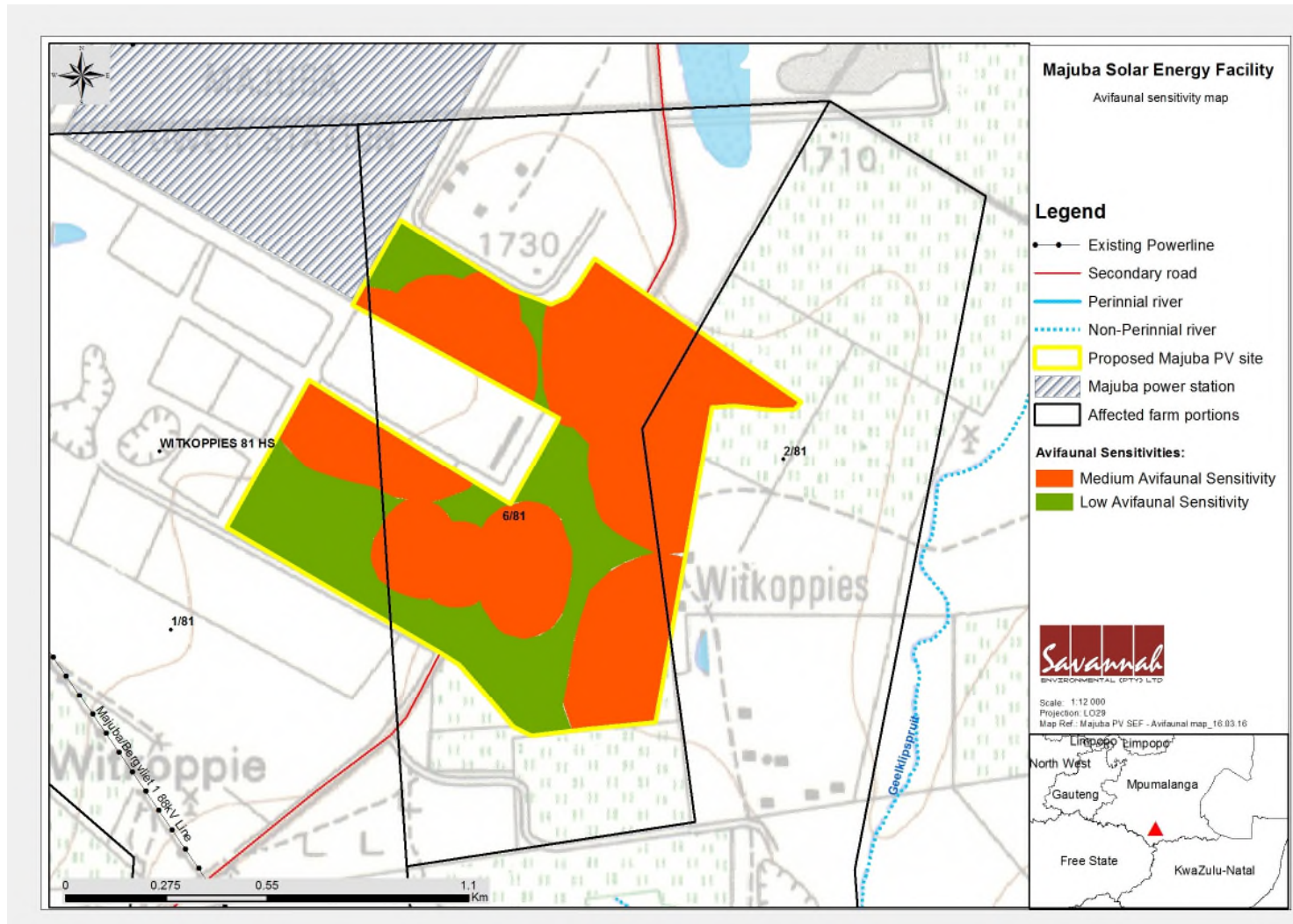


Figure 6.3: Avifaunal sensitivity map – the medium sensitivity areas (wetlands and associated buffers) are represented in orange and low sensitivity areas are represented by the green polygons.

6.3.3 Impact tables summarising the significance of impacts on avifauna (with and without mitigation)

Nature: Displacement as a result of habitat transformation associated with the construction of the facility (PV arrays and associated infrastructure) resulting in a negative direct impact on the resident avifauna, particularly Secretary bird and smaller passerine species.		
Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Site (1)	Site (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (48)	Low (24)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation: Restricting the construction footprint to a bare minimum and avoiding key vegetation types and wetlands identified within the botanical and wetland specialist studies.		
Cumulative impacts: The surrounding area is already heavily transformed as a result of energy generation and agricultural activities. However the areas that have been earmarked for development are not particularly sensitive and therefore the cumulative impact is deemed not to be significant.		
Residual Impacts: Smaller passerine species may return once the construction activity is completed and the site rehabilitated, but it is unlikely that the numbers will recover to those recorded prior to the development due to the significant habitat transformation that will take place.		

Nature: Displacement as a result of disturbance associated with noise and movement of construction and operational equipment and personnel, resulting in a negative direct impact on the resident avifauna, particularly smaller passerine species.		
Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1 & 15 GN 546, activity 14(a) (i)		
	Without mitigation	With mitigation
Extent	Site (1)	Site (1)
Duration	Short (2)	Short (2)
Magnitude	Moderate (6)	Low(4)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (36)	Low (21)

Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Partially	
Mitigation: . In addition construction activities must be confined to the site footprint to avoid any additional impacts on bird species residing in the broader area.		
Cumulative impacts: In addition to the proposed Majuba PV Solar Energy Facility, there are several activities (i.e. energy generation and agricultural) that feature prominently both within the impact zone and the broader study area and are a significant source of existing disturbance. These activities, coupled with the limited habitat diversity and degradation within the proposed development site are a likely cause of the absence of Red List species within the impact zone. Those species that have persisted have undoubtedly developed a tolerance for the current levels of disturbance and are likely to persist within the broader area despite the development of the solar facility.		
Residual Impacts: The majority of species observed in the development area may return once the construction activity is completed.		

Nature: Collisions of priority avifauna (water birds, doves, weavers, canaries, larks) with the solar panels, resulting in a negative direct mortality impact.		
Relevant Listed activities: GN 545 activity 1		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term(4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Medium (30)
Status	Negative	Negative
Reversibility	Low	Medium
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation measures: It is essential that a post construction monitoring programme, that includes carcass searches, be established to monitor the impact of collision on the resident avifauna.		
Cumulative impacts: An extensive power line network features prominently both on the proposed sites and within the broader study area. The addition of PV panels will undoubtedly increase the collision risk particularly for water bird species (present the broader study area) that are susceptible to power line collisions too. Collisions with the proposed PV panels will have a medium to low cumulative impact.		
Residual impacts: It is envisaged that mitigation, if required, will reduce but not eliminate collision mortality		

Nature: Collisions of priority avifauna with overhead power lines, resulting in a negative direct mortality impact, particularly large terrestrial species (Secretary Birds) and water dependent species (storks, ducks, geese, ibis)		
Relevant Listed activities: GN 544, activity 10 (i)		
	Without mitigation	With mitigation
Extent	Local (2)	Site (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (36)	Low (18)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation measures: Every effort must be made to select a route that poses the least risk to birds, preferably routing the proposed power line alongside existing power line infrastructure in an effort to increase conductor visibility. High risk sections of power line must be identified by a qualified avifaunal specialist during the walk through phase of the project, once the alignment has been finalized. If power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors (according to Eskom guidelines). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.		
Cumulative impacts: An extensive power line network features prominently both on the proposed sites and within the broader study area. Any additional power lines will undoubtedly increase the collision risk to power line sensitive species (i.e. large terrestrial species and waterfowl species) that may be present in the broader study area and therefore collisions with the proposed grid connection will potentially have a medium to high cumulative impact. However given the proximity of the proposed sites to the existing power line and substation infrastructure, the proposed grid connection is likely to be relatively short in length and installation of anti-collision devices on the conductors/earth wires will further reduce this impact.		
Residual Impacts: Mitigation will reduce but not entirely eliminate collision mortality.		

Nature: Electrocutions of priority avifauna on distribution (<132kV) power line tower/pole structures, resulting in a negative direct mortality impact, particularly large eagle species, herons and storks.		
Relevant Listed activities: GN 544, activity 10 (i)		
	Without mitigation	With mitigation
Extent	Local (2)	Site (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)

Significance	Medium (30)	Low (14)
Status	Negative	Negative
Reversibility	Low	Medium
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation measures: Only Eskom approved bird friendly tower/pole structures must be used for the entire length of the power line.		
Cumulative impacts: An extensive power line network features prominently within the immediate vicinity of the proposed development site and within the broader study area. Any additional power lines will undoubtedly increase the electrocution risk to power line sensitive species (i.e. large eagles, storks and herons) that may be present the broader study area and therefore electrocutions on the towers of the proposed grid connections will have a medium cumulative impact. However given the low reporting rates of these species in the area, the proximity of the proposed sites to the existing power line and substation infrastructure resulting in shorter grid connections with fewer towers and construction of Eskom approved bird friendly tower/pole structures will further reduce this impact.		
Residual impacts: Mitigation will reduce electrocution mortality to negligible levels.		

Nature: Electrocutions of priority avifauna at the substation/switching station, resulting in a negative direct mortality impact, particularly crows, small raptors and owls.		
Relevant Listed activities: GN 544, activity 10 (i)		
	Without mitigation	With mitigation
Extent	Local(2)	Site(1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Medium (30)	Low (14)
Status	Negative	Negative
Reversibility	Low	Medium
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	
Mitigation measures: Substation hardware is often too complex to warrant any mitigation for electrocution at this stage. It is rather recommended that if on-going impacts are recorded once operational, site specific mitigation be applied reactively. This is an acceptable approach since Red List bird species are unlikely to frequent the substation and be electrocuted.		
Cumulative impact: An extensive power line network features prominently within the immediate vicinity of the proposed development site and within the broader study area. Any electrical infrastructure in the form of substations and switching stations will undoubtedly increase the electrocution risk to those species (i.e. owls, crows, weavers, swallows) that are attracted to these structures and installations as a result of the roosting and nesting opportunities that they provide. Additional		

substations and switching stations will have a medium cumulative impact. Reactive mitigation as discussed above will reduce this impact.

Residual impacts:

Mitigation will reduce electrocution mortality to negligible levels.

Nature: Nest building by birds on PV infrastructure (i.e. electrical boxes associated with each array) would result in a negative direct impact on maintenance activities.

Relevant Listed activities:

GNR 545 Activity 1

	Without mitigation	With mitigation
Extent	Site (1)	Site (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	Low (21)	Low (10)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation measures:

Similarly to the impacts associated with the substation, it is recommended that if ongoing impacts are recorded once operational, that these are assessed by a suitably qualified avifaunal specialist and site specific mitigation (e.g. commercial bird deterrent options) is applied reactively. Assessment of this impact should be included in the monitoring and maintenance schedules of the EMP.

Cumulative impacts:

None

Residual impacts:

None

6.3.4 Assessment of the PV site

In general, the site has been determined to have medium to low sensitivity in terms of avifauna, based on the micro-habitats available within the confines of the proposed site and the species these habitats are likely to support. Given the presence of existing habitat degradation and disturbance associated with the mining, energy generation and industrial and agricultural activities that are prevalent in the study area, it is anticipated that the proposed Majuba Solar Photovoltaic Facility can be constructed at the proposed site with acceptable levels of impact on the resident avifauna.

The two alternative PV technologies do not differ in any significant way as far as avifaunal habitat which they will affect, or the interaction between birds and the infrastructure is concerned. There, is **no significant difference** in the potential impacts on avifauna associated with the alternative technologies. Therefore, there is **no**

preference between the alternative technologies, and both are considered to be viable for use at the site.

6.3.5 Implications for Project Implementation

There will undoubtedly be some impact on avifauna but it is the specialist's professional opinion that the impact will be acceptable provided the following conditions are met:

- » Adherence to the site specific EMP. Of particular concern is the layout of the power line infrastructure. Ideally an avifaunal walk down should be conducted once the power line towers have been surveyed and marked. Input must be given into micro siting as well as which sections of power line require marking with bird flight diverters. This walk down should also ground truth all other project component final layouts.

6.4 Assessment of Impacts on Surface Water Resources

6.4.1 Results of the Surface Water Resources Assessment

Soil Indicators:

Soils were used extensively for delineating the wetlands on site. Wetland soil types found on site included: Katspruit (Orthic A /G horizon), Westleigh (Orthic A / soft plinthic B), Longlands (Orthic A / E horizon / Soft plinthic B, Ehorizon "grey" when moist) and Kroonstad (Orthic / E horizon/ G horizon). Signs of wetness that were used to delineate the wetland boundary included red and yellow mottles, bleached E-horizons and soft and hard plinthic nodules.

Vegetation Indicators

Wetland plants are an important indicator for the delineation process. *Typha capensis* (Bulrush) was found in ponding water on the site, while a community of wetland species indicated the extent of the permanent, seasonal and temporary zones. Some common obligate and facultative wetland species used to delineate the wetlands were: *Agrostis lachnantha*, *Leersia hexandra* (Rice grass), *Andropogon eucomus* (Snowflake grass), *Kyllinga erecta*, *Cyperus longus*, *Cyperus denudatus* and *Verbena bonariensis*. For the most part wetland plant community correlated with the soils except for where disturbance had altered the plant community.

6.4.2 Sensitivity Assessment

Four wetlands were delineated on the study site comprising of an unchannelled valley-bottom (7.3ha) wetland and three hillside seeps (the one hillside seep consisting of a

series of small seeps lumped together for this assessment – 2.8ha, south-east seep – 6.3ha, north seep – 18.9ha,) (Refer to Figure 6.4). The wetlands have been exposed to varying degrees of impact. The hillside seeps draining south-east and north-west (wetland units C and D) are the least impacted still showing a high level of natural ecological state. The unchannelled valley-bottom (wetland unit A) and the seep draining north (wetland unit B) are both largely modified with the valley-bottom wetland impacted on by large concrete drains and the seep has been impeded by gravel roads.

Present Ecological Status (PES)

The wetlands in the study site vary in ecological status.

The unchannelled valley bottom wetland has been extensively drained and modified by gravel roads. Where infrastructure has been built in the wetland, the wetland has been drained and raised on a gravel bed. The disturbance has led to an invasion of alien plants. Unless actively controlled, the area and density of alien plants will increase in future years. The PES score for this wetland is a C_↓ - a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.

Flows from the north draining seep are impeded by one active gravel road and several unused roads. Large sections of this wetland have been colonised by alien invasive vegetation. The PES score for this wetland is also a C_↓, a moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact. Conditions are expected to deteriorate in a five year timeframe.

Both the south-east draining seep and the series of seeps draining north-westwards are relatively undisturbed. Although both these wetlands are cut by unused old roads that might impede flow, their ecological state and functioning appears natural. The PES score for both of these wetlands is an A_→, near natural conditions.

The scores are summarised in **Table 6.1**.

Table 6.1: Summary of hydrology, geomorphology and vegetation health assessment for the wetlands on the study site (Macfarlane *et al*, 2009).

Wetland Unit	Extent (%)	Hydrology		Geomorphology		Vegetation		Overall health score	PES Score
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score		
B: Hillside seep - north draining	47	3.5	-1	1	0	5.4	-1	3.33	C↓
C: Hillside seep - south-east draining	10	0	0	0	0	0.8	0	0.23	A→
D: Hillside seep - north-west draining	4	0	0	0	0	1	0	0.29	A→
A: Unchannelled valley-bottom	39	6.5	-1	1.42	-1	2.6	-1	3.93	C↓
Total	100	4.18	-0.86	1.0238	-0.39	3.672	-0.86		



Figure 6.4: The wetlands and wetland buffers on the study site; **A:** the unchannelled valley-bottom wetland, **B:** a hillside seep draining northwards, **C:** a hillside seep draining south-eastwards, **D:** a cluster of hillside seeps draining north-westwards. All wetlands within a 500m buffer of the construction are prescribed by the DWS as relevant to the Water Use License application process.

Ecological Importance and Sensitivity (EIS)

An EIS score of 1.67 was calculated for the wetlands, placing them in the moderate importance and sensitivity category. Wetlands in this category are considered to be ecologically important and sensitive on a provincial or local scale (DWAF, 1999). The wetlands have been modified and as such no important or sensitive biota were found.

Impacts

The solar PV facility will have several impacts on the surrounding environment and wetlands. The earth works, construction and operation of the facility will change habitats and the ecological environment, infiltration rates, amount of runoff and runoff intensity of storm-water, and therefore the hydrological regime of the site.

Potential impacts to be taken into account include:

- » Loss and disturbance of wetland habitat and fringe vegetation.
- » Introduction and spread of alien invasive vegetation.
- » Changes in the amount of sediment entering the system.
- » Changes in water quality due to toxic contaminants and increased nutrient levels entering the system.
- » Changes in water flow regime due to the alteration of surface characteristics.

This impact evaluation will assess and rate the extent, magnitude, duration and significance of each potential impact together with possible mitigation measures

6.4.3 Impact tables summarising the significance of impacts on Surface Water Resources (with and without mitigation)

Nature: Loss and disturbance of wetland habitat and fringe vegetation due to direct development on the wetland as well as changes in management, fire regime and habitat fragmentation.		
Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1,15 GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Moderate (3)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (10)	Slight (4)
Probability	Highly probable (4)	Improbable (2)
Significance	High (72)	Low (20)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation:		

- » The development footprint should be designed around current wetland and wetland buffers.
- » Where wetlands will be lost to the development footprint, those wetlands that are least disturbed and show near natural conditions and functionality should be given priority for conservation.
- » Where wetlands are lost, compensation should be made to protect the remaining wetlands and their catchments, increase their buffers and rehabilitate their condition and functionality.

Cumulative impacts:

Any loss of wetlands will add to the overall loss of wetlands in the region.

Residual impacts:

Once lost it is unlikely that a wetland can be rehabilitated to its original state and functionality.

Nature: Introduction and spread of alien invasive vegetation due to both opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien invasive species can impact on hydrology, by reducing the quantity of water entering a wetland, and out compete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment.

Relevant Listed activities:

GN 544, activity 10 (i),11(ii), 18(i)

GN 545 activity 1,15

GN 546, activity 14(a) (i).

	Without mitigation	With mitigation
Extent	Medium (3)	Low (1)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Moderate (6)	Small (0)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (56)	Low (8)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- » Implement appropriate weed control throughout project development.
- » Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area and returning it where possible afterwards.
- » Rehabilitate or re-vegetate disturbed areas as soon as possible after construction is completed.
- » Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish.

Cumulative impacts:

If allowed to seed before control measures are implemented alien plants can easily colonise and impact on downstream users. Alien plants can form dense thickets which replace indigenous wetland habitats and their natural flow regime. This will result in a loss of wetland species and wetland functioning.

Residual impacts:

After clearing of invasive plants their seeds may remain dormant in the soil for many years and will require extensive follow-up control measures.

Nature: Changes in the amount of sediment entering the system due to earthworks and soil disturbance as well as the removal of natural vegetation. This could result in sedimentation of the wetland and increase the turbidity of the water.

Relevant Listed activities:

GN 544, activity 10 (i),11(ii), 18(i)

GN 545 activity 1,15

GN 546, activity 14(a) (i).

	Without mitigation	With mitigation
Extent	Moderate (3)	Low (1)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Moderate (6)	Slight (4)
Probability	Very probable (4)	Improbable (2)
Significance	Medium (56)	Low (16)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- » Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas.
- » Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area.
- » A vegetation rehabilitation plan should be implemented. As a recommendation, grassland can be removed as sods and stored within transformed vegetation. The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other or within sensitive environs. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.
- » Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.
- » Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.
- » Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.
- » Runoff from roads must be managed to avoid erosion and pollution problems.
- » Maintain 30 m buffer zones around wetlands to trap sediments.

Cumulative impacts:

Additional sediments would lead to increase turbidity downstream which will put additional stress on aquatic life and loss of sensitive biota. Downstream dams and weirs will face a reduction in capacity due to sedimentation.

Residual impacts:

Once sensitive biota are lost from a system it can take many years to re-colonize.

Nature: Changes in water quality due to toxic contaminants and changes in nutrients is largely caused by discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage. This could result in the loss of sensitive biota in the wetlands and a reduction in wetland function.

Relevant Listed activities:

GN 544, activity 10 (i)

GN 545 activity 1

	Without mitigation	With mitigation
Extent	Moderate (3)	Low (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	Medium (48)	Low (12)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- » After construction, the land must be cleared of waste, surplus materials, and equipment, and all parts of the land should be left in a condition as close as possible to that prior to use.
- » Ensure that maintenance work does not take place haphazardly, but, according to a fixed plan, from one area to the other.
- » Maintenance of construction vehicles must be undertaken off site or within appropriately controlled areas to avoid hydraulic or diesel spills.
- » Control of waste discharges.
- » Maintenance of buffer zones around wetlands to trap sediments with associated toxins.
- » All potentially polluting and hazardous substances used and stored on site should be stored in clearly demarcated areas away from storm water.

Cumulative impacts:

The addition of toxic contaminants will impact on downstream ecosystems resulting in the loss of sensitive biota. Bioaccumulation of toxins in the food chain can be harmful especially to predators higher up in the food chain. Nitrification can lead to algal blooms that reduce the oxygen levels in the water causing anaerobic conditions.

Residual impacts:

Once sensitive biota are lost from a system it can take many years to re-colonize. Once in the system it may take many years for some toxins to be eradicated.

Nature:

Changes in water flow regime due to the alteration of surface characteristics (the compaction of soil, the removal of vegetation, surface water redirection and infrastructure) is likely to increased peak flows and decrease flood attenuation. Increased storm water discharge could result in soil erosion.

Relevant Listed activities: GN 544, activity 10 (i),11(ii), 18(i) GN 545 activity 1,15 GN 546, activity 14(a) (i)		
	Without mitigation	With mitigation
Extent	Moderate (3)	Low (1)
Duration	Permanent (5)	Medium-term (3)
Magnitude	Moderate (6)	Slight (4)
Probability	Very probable (4)	Improbable (2)
Significance	Medium (56)	Low (16)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Maintain 30 m buffer zones around wetlands » Stormwater should be managed and stormwater discharge points must be suitably protected against erosion.		
Cumulative impacts: A reduced infiltration of water into the soil may reduce low flows that sustain wetlands during dry periods.		
Residual impacts: Once topsoil is lost it is hard to replace and re-vegetate. The disturbance caused by erosion will create a window of opportunity for alien invasive plants to colonise.		

6.4.4 Assessment of the PV site

Overall the wetlands on site are moderately modified. The wetlands were found to have a moderate importance and sensitivity to changes in flow regime and lacked sensitive biota. It is recommended that a 30m buffer is set to protect wetland functionality.

Although the seepage wetlands on the southern section of the site are in the least impacted state, the most sensitive wetland is considered to be the valley bottom wetland (wetland unit A indicated on Figure 6.4). This wetland unit is hydrologically directly connected to downstream watercourses. Any impact to this wetland or its associated buffer zone will negatively affect regional hydrology.

6.4.5 Implications for Project Implementation

It is important that the following mitigation measures be carefully implemented in order to prevent impacts to regional hydrology:

- » The footprint of the development should not encroach onto wetland areas or their associated buffer zones. Boundaries of these sensitive areas should be clearly

marked and access prevented. Where wetlands will be lost to the development footprint, those wetlands that are least disturbed and show near natural conditions and functionality should be given priority for conservation. Where wetlands are lost, compensation should be made to protect the remaining wetlands and their catchments, increase their buffers and rehabilitate their condition and functionality.

- » A stormwater management system must ensure that the quality and quantity of stormwater resulting from the development (construction and operational phase) is the same as the stormwater characteristics prior to development.
- » Continuous monitoring during construction of downstream water quality should be done to verify that the development does not negatively affect water quality
- » Continuous monitoring during the construction and the operation phase should be undertaken to identify any erosion, also downstream from the site. If erosion is observed, it should be rehabilitated effectively.
- » Should wetland areas be directly impacted by the development, a suitably qualified vegetation specialist should visit these wetlands prior to construction activities to identify and potentially relocate conservation-worthy plants.
- » A water use license must be obtained for construction within a wetland area, should this be required.

Further general potential impacts of the construction and operational phase of the proposed solar PV facility include:

- » Clearing/removal of natural vegetation. Clearing vegetation upland from wetlands may result in increased energy of surface flows resulting in erosion and sedimentation. Plants hold soils in place and trap sediments and attenuate water flow, functions that are lost when vegetation clearing occurs.
- » Mobilization of sediments. Soil erosion could lead to increased sedimentation and turbidity downstream of the activity, which in turn reduces the water storage capacity thereof, smothers vegetation, and decreases oxygen concentration. If sedimentation is allowed to continue, wetlands will lose their function and likely become invaded by alien invasive plant species.
- » Compaction of wetland soils. Construction activities may compact soils from heavy equipment access which could inhibit seed germination, reduce water infiltration, inhibit root establishment, and result in bare soil exposure. In particular, soil compaction can lead to an increase in runoff during rainy events. It is therefore necessary that the smallest possible footprint be identified, especially in terms of vehicle access and support crew. As far as possible work should occur in the dry season when soil compaction is less critical.
- » Changing or impeding the flow of water. This impact can be avoided by limiting the activities to the area outside of the wetlands or their buffer zones. The dispersive quality of soils, slopes and volume and energy of water flows should form part of the design in order to prevent damage to downstream areas resulting from the activity.
- » Exposure to erosion. Removal of wetland vegetation, vegetation against slopes and compaction of soils, expose the resulting bare soils to erosion during rainfall events.

Erosion removes the top soil layer, thereby preventing the successful establishment of indigenous vegetation on eroded soils. Eroded areas are likely to be colonised by alien invasive and pioneer plants, or in severe cases, no vegetation will establish causing high velocity runoff during rainfall events and continuous erosion. The occurrence of erosion resulting from the proposed activities should be closely monitored and addressed effectively.

- » Mobilisation of pollutants. Accidental pollution or illegal disposal and dumping of construction material such as cement or oil, as well as disposal or discharge of human (including partially treated and untreated sewage) into water resources will influence the water quality of watercourses, thereby influencing its functionality and the persistence of vegetation. Water is expected to seep into any area of excavation that goes through a wetland area. It is likely that water could be contaminated within these trenches. During high rainfall events, this polluted water could be washed into the wetlands – especially if vegetation cover is not sufficient to slow down water and filter pollutants.

6.5 Assessment of Potential Impacts on Heritage Sites and Palaeontology

6.5.1 Results of the Heritage Survey

The study area is characterised by typical Highveld grass veld and some portions was extensively ploughed in the past. Infrastructure such as roads also impacted on the study area and these activities would have destroyed surface indicators of heritage sites. The study area is slightly undulating with no major landscape features like pans or hills that would have been focal points in antiquity and lack raw material suitable for the manufacture of stone artefacts or for the construction of late Iron Age Stone walled settlements.

The study area was assessed in terms of the archaeological component of Section 35 of the NHRA and no surface indicators of archaeological (Stone or Iron Age) material was identified in the study area. In terms of the built environment of the area (Section 34), no standing buildings older than 60 years occur in the areas visited although some modern structures occur in the north western portion of the study area. These structures are associated with the operation of the Majuba Power Station and are not older than 60 years. No burial grounds or graves were recorded and no significant cultural landscapes or viewsapes were noted during the fieldwork.

Based on the results of the study there are no significant archaeological risks associated with the proposed solar facility. However graves can be expected anywhere on the landscape and the low archaeological visibility during the survey could result in graves not identified in the study area. Therefore it is recommended that a chance find procedure is incorporated into the EMPr for this project.

6.5.2 Paleontological impacts

The development area is underlain by fossiliferous sedimentary rocks of the Early Permian Volksrust Formation. This Formation is known for the occurrence of fossil plants such as *glossopterids*, *cordaitaleans* and possibly other seed ferns. However the absence of potentially fossiliferous gulleys and appropriate exposures suggest fossils are absent from this site. The impact on paleontological material is negligible and regarded as insignificant.

6.5.3 Impact table summarising the significance of impacts on heritage resources (with and without mitigation)

Nature: Pre Construction and Construction activities can have a negative impact on heritage resources. Activities result in disturbance of surfaces and/or sub-surfaces containing heritage / paleontological artefacts resulting in the destruction, damage, excavation, alteration, removal or collection from its original position, of any archaeological material or object.		
Relevant Listed activities: GN 544, activity 10 (1), 22 (i) & 47 (ii) GN545, activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (3)	Low (2)
Probability	Improbable (1)	Improbable (1)
Significance	Low (10)	Low (8)
Status	Negative	Negative
Reversibility	Irreversible	irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation:: Mitigation measures include monitoring of the site while construction is in progress. In the instance of a chance find, the following procedures and management actions will be required for inclusion in the EMPr including: <ul style="list-style-type: none"> » If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any grave site, artefact of cultural significance, fossil or rock engraving on the site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager. » It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area. » The senior on-site Manager will inform the ECO/EO of the chance find and its immediate impact on operations. The ECO/EO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA. 		
Cumulative impacts: None		

Residual Impacts:

Once heritage resources are lost, they cannot be replaced.

6.5.4 Impact table summarising the significance of impacts on Paleontological resources (with and without mitigation)

Nature: Pre Construction and Construction activities can have a negative impact on paleontological resources.

Activities resulting in disturbance of surfaces and/or sub-surfaces containing fossil materials resulting in the destruction, damage, excavation, alteration, removal or collection from its original position, of any fossil material or object.

Relevant Listed activities:

GN 544, activity 10 (1), 22 (i) & 47 (ii)
 GN545, activity 1 & 15
 GN 546, activity 14(a) (i).

	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Small (1)
Probability	Improbable (2)	Improbable (2)
Significance	Low (18)	Low (16)
Status	Negative	Neutral
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation measures are not considered necessary as the study area has been extensively modified by human activity. Accordingly there appears to be little chance of undamaged or in situ fossil materials existing at the surface. However, the following damage mitigation protocols are, recommended:

- » The EO should be trained to identify the types of fossils that may be expected to occur within the Vryheid Formation.
- » If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any fossil material this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- » It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area.
- » The senior on-site Manager will inform the ECO/EO of the chance find and its immediate impact on operations. The ECO/EO will then contact a professional palaeontologist for an assessment of the finds who will notify the SAHRA.

Cumulative impacts:

Where any palaeontological contexts occur the impacts are once-off permanent destructive events. Multiple projects in an area can contribute to a cumulative impact on fossil materials.

Residual Impacts:

Where any palaeontological contexts occur the impacts are once-off permanent destructive events. Low Impact on Fossil heritage is expected because of low occurrence of fossils in the development area and absence of fossiliferous outcrops.

6.5.5 Assessment of the PV site

Based on the results of the study there are no significant archaeological risks associated with the proposed solar facility. However graves can be expected anywhere on the landscape and the low archaeological visibility during the survey could result in graves not identified in the study area. Therefore it is recommended that a chance find procedure is incorporated into the EMP for this project.

From a palaeontological perspective the absence of potentially fossiliferous gulleys and appropriate exposures suggest that fossils are absent from this site. The impact on paleontological material is negligible and regarded as insignificant.

6.5.6 Implications for Project Implementation

From an archaeological, heritage and paleontological perspective the proposed project area is considered to be acceptable. If the above recommendations are adhered to and based on approval from SAHRA, it is concluded that the development can continue as the impact of the development on heritage and paleontological will not impact negatively on the archaeological record of Mpumalanga. If during the pre-construction phase or during construction, any archaeological or paleontological finds are made (e.g. graves, stone tools, fossils and skeletal material), the operations must be stopped, and the archaeologist or palaeontologist (depending on the find) must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological and palaeontological material and graves the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded, but can be easily mitigated by preserving the sites *in-situ* within the development.

6.6 Impacts on Soils, Land-Use and Agricultural Potential

6.6.1 Results of the Soils Survey

The study area consists of a mixture of soils ranging from clay soils with cutanic subsoils to shallow soils on rock. The northern and eastern parts of the study area consist of soils with high clay content in the subsoil which may be waterlogged during rainy seasons, while the southern and western parts consist of shallow soils. The depths vary with zones of shallow, duplex soils or plinthite soils also occurring. The whole study area has low agricultural potential.

6.6.2 Impacts on Soils and Agricultural Potential

The major impact on the natural resources of the study area would be the loss of arable land due to the construction of the various types of infrastructure. With the lack of high potential soils in the vicinity, this impact would in all probability have a limited significance. At the end of the project life, it is anticipated that removal of the structures would enable the land to be returned to more or less a natural state following rehabilitation, with little impact.

6.6.3 Impact tables summarising the significance of impacts on soils and land use (with and without mitigation)

Nature: Loss of agricultural potential		
Relevant Listed activities: GN 544, activity 10 (1) & 47 (ii) GN545, activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Low (2)	Low (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Slight (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Low (24)	Low (16)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: No mitigation is required.		
Cumulative impacts: Little or none due to the low potential of the soils		
Residual Risks: Little or none, due to the low potential of the soils.		

Nature: Erosion caused during construction and post construction phase due to decreased vegetation cover and increased water run-off		
Relevant Listed activities: GN 544, activity 10 (1) & 47 (ii) GN545, activity 1 & 15 GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Medium (39)	Low (12)

Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation:		
<ul style="list-style-type: none"> » Care must be taken with the ground cover during and after construction on the site. » If it is not possible to retain a good plant cover during construction, technologies should be employed to keep the soil covered by other means, i.e. straw, mulch, erosion control mats, etc., until a healthy plant cover is again established. Care should also be taken to control and contain storm water run-off. » Rehabilitate construction sites by using indigenous grasses. » Minimise activity on steep slopes / the side of slopes. » Implement effective erosion control measures and Erosion Management Plan. » Keep to existing roads, where practical, to minimise impact on undisturbed ground. » Ensure stable should not exceed 2m in height. » Stockpiles not used slopes of stockpiles/excavations to minimise slumping. » Stockpiles » in three (3) months after stripping must be seeded to prevent dust and wind erosion, only if natural seeding does not occur. » Limit soil disturbance to dry season. » Dust suppression measures and appropriate erosion control should be implemented. 		
Cumulative impacts:		
Removal of topsoil by wind would mean that the removed dust would be deposited on neighbouring properties.		
Residual Risks:		
Loss of topsoil would cause a drop in the natural fertility of the area, even in the ability to provide for grazing of livestock.		

Nature: Dust generation - The movement of vehicles and the effects of construction activities will increase the amount of dust generated in the area.		
Relevant Listed activities:		
GN 544, activity 10 (1) & 47 (ii)		
GN545, activity 1 & 15		
GN 546, activity 14(a) (i).		
	Without mitigation	With mitigation
Extent	Local (2)	On site (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (3)
Significance	Medium (39)	Low (12)
Status	Negative	Negative
Can it be reversed	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- » Use dust suppression methods/material/chemicals
- » Care should also be taken to control and contain storm water run-off.
- » Minimise activity on steep slopes / the side of slopes.
- » Implement effective erosion control measures and Erosion Management Plan.
- » Keep to existing roads, where practical, to minimise impact on undisturbed ground.
- » Ensure stable slopes of stockpiles/excavations to minimise slumping.
- » Topsoil Stockpiles should not exceed 2m in height
- » Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion, only if natural seeding does not occur.

Cumulative Impacts:

The cumulative impact of dust generation in the area is considered low if mitigating measures are adhered to.

Residual Impacts:

Minor

6.6.4 Assessment of the PV sites

Within the broader study area around Majuba Power Station, the loss of the land where the PV facility is proposed would not have a significant effect on agricultural production or potential. In addition, due to the fact that the various infrastructure of the Majuba Power Station has already impacted on the environment and the low agricultural potential of the soils on the site, there would not be a meaningful cumulative impact.

The two alternative PV technologies do not differ in any significant way as far as the impact on soils and agricultural potential is concerned. Therefore, there is **no preference** between the alternative technologies, and both are considered to be viable for use at the site.

6.6.5 Implications for Project Implementation

There are no fatal flaws associated with the soils and agricultural potential on the site and the project can be developed with the use of good soil management measures during all phases of development of the project.

6.7 Assessment of Potential Visual Impacts

6.7.1 Visual Character of the landscape

Landscape Character is a composite of a number of influencing factors including;

- » Landform and drainage.

- » Nature and density of development.
- » Vegetation patterns.

The affected landscape can be divided into the following general character areas that are largely defined by development.

- » **Industrial Landscape Character Areas** are located around the heavy industrial features of the power station. The structures associated with the power station dominate the local landscape. The main obvious structures include;
 - o The cooling towers, chimneystacks and main generating facility;
 - o The conveyors that transfer coal and waste pulverised fuel ash;
 - o The pulverised fuel ash dump; and
 - o The coal stockpile;

These existing industrial structures are likely to provide significant screening and from middle distance and distance views could provide a backdrop to the development making it appear as part of the overall plant. The relatively low elements that are proposed are therefore likely to have little or no influence on the nature of the areas. The industrial area is not likely to be sensitive to the proposed development and industrial elements are likely to provide significant visual absorption capacity, either by screening the development or by ensuring that it is seen against an industrial backdrop.

- » **Urban Landscape Character Areas:** those are generally residential in nature. These areas are in excess of 10km from the proposed development and so it is unlikely that these areas will be impacted. These areas are generally inward looking; hence it is only on the edges of the LCA that external influences impact on character.
- » **Rural Landscape Character Areas:** This is a productive mixed pasture and arable agricultural landscape. It is open with small groups of mainly alien trees located around small settlements and farmsteads. This character area might be subdivided into the more rugged components to the north and south of the proposed development area and the valley bottom in which the proposed development is sited. Whilst there are differences in the areas in terms of agricultural practices, in reality there are numerous small ridgelines that punctuate the landscape and divide this character area based on relatively minor slope and elevation changes is difficult and serves no practical purpose. The ridgelines and landform are the main elements that provide a degree of visual absorption capacity helping to screen elements of the power station from view.

6.7.2 Visual Assessment

This section is intended to highlight possible Receptors within the landscape which due to use could be sensitive to landscape change. They include the following:

- » Area Receptors which include:

- Urban areas including Amersfoort, Daggakraal and Perdekop. Should there be a significant impact on these areas, it is possible that there could be significant objection from residents; however, the landscape analysis has indicated that it is unlikely that the proposed development will be visible to these areas.
- Areas that are likely to be important for recreational use such as a local recreational area adjacent to a dam just east of the N11.
- » Linear Receptors which include main routes through the area. It is likely that these routes will be mainly used by local people although the N11 and R23 are regional routes and are likely to carry a proportion of tourism / recreational related traffic. It is thought that local roads to the north and east of the proposed development are likely to carry mainly local traffic.
- » Point Receptors that include isolated and small groups of homesteads that are generally associated with and located within the Agricultural Landscape that surrounds the proposed development site.
- » Glare receptors: Due to the orientation of the proposed arrays to the north and azimuth of the sun glare impacts can only occur in an northerly arc from 245° to 115° (0° = true north).

Within this arc the following areas could be sensitive to glare:

- a) A landing strip to the north of the power station that is aligned in an approximate east / west direction.
 - » The flight path to the West will not be affected by glare. The flight path from the East will be experience Glare from 2 miles and beyond to one and a quarter miles from the threshold of the airstrip between 17h00 and 18h00, beginning of October to the end of March each year. During March and October there is likely to be potential for a temporary after image to be experienced.
Pilots on the flight path to the east of the airstrip could experience minor nuisance as well as temporary disruption of vision in early evenings between the beginning of October and the end of March each year from more than 2.0miles to 1.25 miles from the end of the airstrip.
- b) A local road to the east of the site that links to the N11.
 - » Glare will be experienced on this road between 17h00 and 18h30, mid September to mid March each year. There is low potential for a temporary after image to be experienced. Drivers on the local road to the east could experience minor nuisance from glare in the early evening between mid-September and mid-March each year.

The closest homesteads (point receptors) and the closest sections of affected regional routes (linear receptors) are likely to be most sensitive to possible landscape change. None of the identified area receptors will be impacted. This was confirmed during the site visit.

Possible visual receptors that may be sensitive to landscape change are indicated in **Figures 6.6** (Zones of Theoretical Visibility). This figure indicates that:

- i. The visual impact of the proposed development will be limited by the numerous minor ridgelines that surround the proposed site.
- ii. The Power Station structures surround the site to the north, east and west. These will at least part screen the proposed development from these directions.
- iii. A minor ridgeline bounds the site to the south. This limits visibility from this direction.
- iv. Points ii and iii above mean that the proposed development will be viewed within the context of existing industrial features associated with the power station and is unlikely to extend the existing visual impact of the power station.

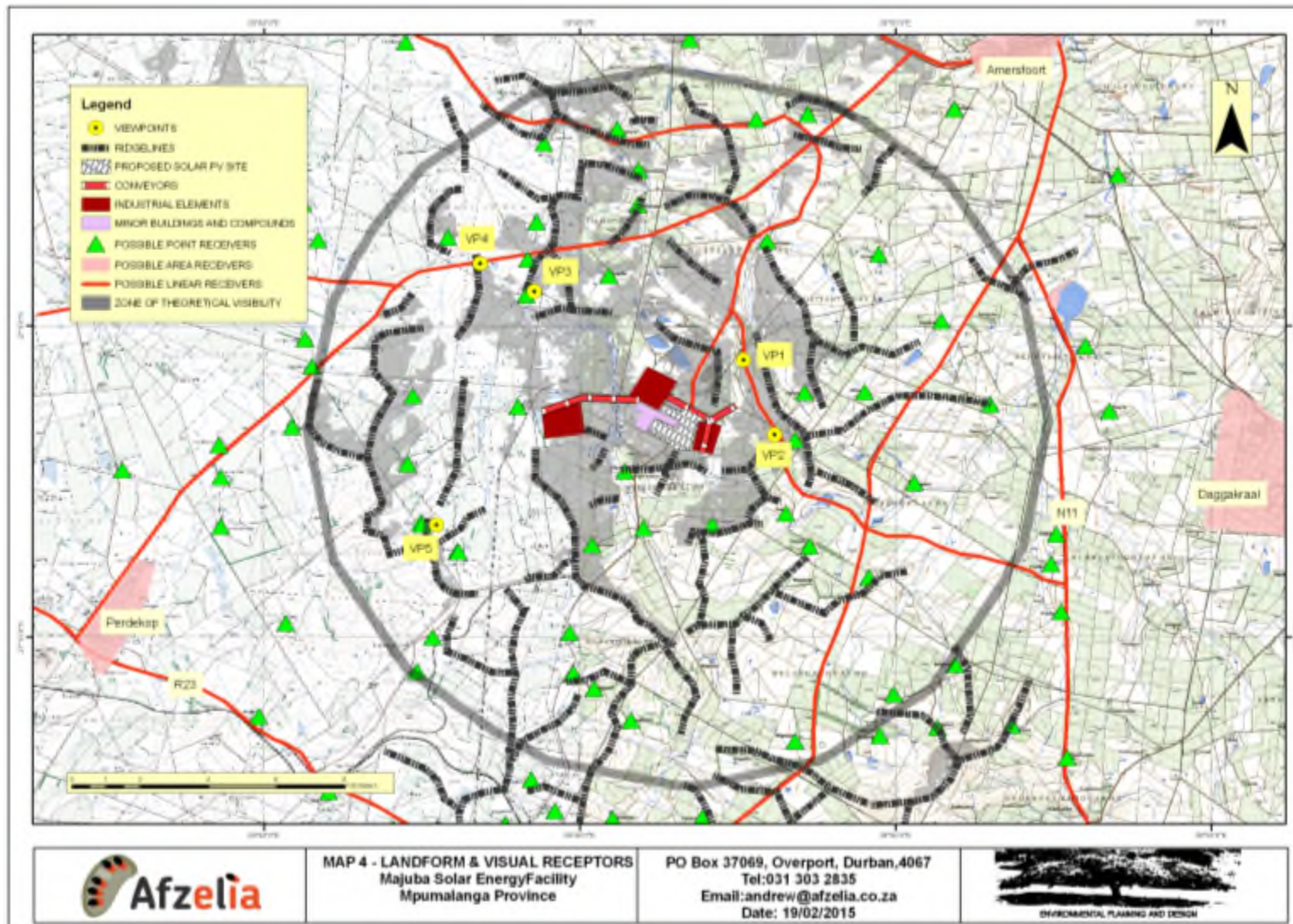


Figure 6.6: Zones of Theoretical Visibility – PV Alternative Site 1

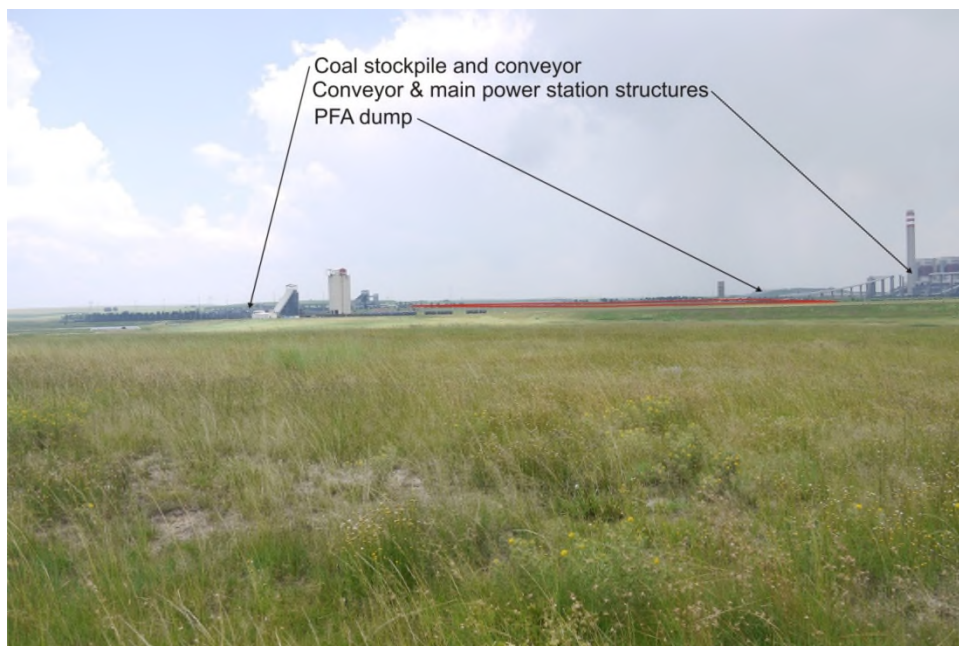


Figure 6.7: VP 1. View from local road to the north east.

The site is seen between conveyors, the coal stockpile, PFA dump and main power station structure.



Figure 6.8: VP 2. View from local road / farmstead to the east.

The site is largely screened by conveyors and the coal stockpile. The section of site visible is seen in the context of conveyors and the main power station structure.



Figure 6.9: VP 3. View from farmstead to the north west.

The site is just visible over an adjacent ridgeline and is seen between the main power station structure and the PFA dump.



Figure 6.10: VP 4. View from local road to the east.

The site is partly screened by the power station. The section of site visible is seen in the context of the main power station structure and the PFA dump.



Figure 6.11: VP 5. View from farmstead and un-surfaced road to the south west. The site is screened by the PFA dump and adjacent ridgelines.

6.7.3 Impact table summarising the significance of visual impacts (with and without mitigation)

Impacts associated with development alternatives fall into three categories including;

1. Landscape degradation,
2. Change of view for visual receptors,
3. Ocular impacts associated with glare.

Landscape degradation

Nature of impact: Degradation of the Rural LCA		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	With mitigation
Extent	Site and immediate surroundings (2)	No mitigation possible
Duration	Long term (4)	No mitigation possible
Magnitude	The proposed development will be viewed in the context of	No mitigation possible

	the existing power station from most viewpoints (0)	
Probability	Improbable (1)	No mitigation possible
Significance	Very low (5)	No mitigation possible
Status	Neutral to Negative (5)	No mitigation possible
Irreplaceable loss	The project can be dismantled. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	No	
Mitigation / Management: No mitigation necessary		
Cumulative impacts As the development will be located within the confines of major an existing industrial development and will not impact on surrounding rural areas, no cumulative impact is expected.		
Residual impacts The project can be dismantled after decommissioning, thereby removing the impact.		

Change of view for visual receptors

The viewpoint analysis undertaken during the site visit and presented in Figures 6.7 to 6.11 indicates that only a limited number of possible visual receptors identified will be affected. These include:

- » Two farmsteads, one to the north and one to the east of the power station.
- » Two local roads, one to the north and one to the east of the power station.

Nature of impact: Further Industrialisation and reduction in rural character		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	With mitigation
Extent	Site and immediate surroundings (2)	No mitigation is possible
Duration	Long term (4)	No mitigation is possible
Magnitude	The proposed development is unlikely to be highly visible from the northern farmstead and development will be seen against the backdrop and within the power station complex from the east. (0)	No mitigation is possible
Probability	This impact is improbable (2)	No mitigation is possible
Significance	Low (12)	No mitigation is possible

Status	Neutral to negative	n/a
Irreplaceable loss	The project can be dismantled after decommissioning. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Mitigation is not possible due to relative levels nor is it necessary.	
Mitigation / Management: Due to distance and relative levels no mitigation measures are possible or necessary as the development will be seen within the context of the already existing industrial complex.		
Cumulative impacts: As the development will be seen in the context of major existing industrial development this impact is not cumulative.		
Residual impacts The project can be dismantled after decommissioning, thereby removing the impact		

Nature of impact: Impacts on two local roads one to the north and one to the east.		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	With mitigation
Extent	Site and immediate surroundings (2)	n/a
Duration	Long term (4)	n/a
Magnitude	The proposed development will be highly visible from the eastern side but will be seen against the backdrop and within the power station complex from the east. From the north it will be largely screened by the power station. (2)	n/a
Probability	Significant impact is improbable (2)	n/a
Significance	Low (16)	n/a
Status	Neutral to Negative	n/a
Irreplaceable loss	The project can be dismantled after decommissioning. Therefore there will be no irreplaceable loss.	n/a

Can impacts be mitigated?	Mitigation is not necessary.
Mitigation / Management: The majority of the proposed array will be visible from only a short length of local road (VP1). From the other identified viewpoints, the array will be largely screened by the power station and associated elements. In all cases the array will be seen within the industrial LCA. Whilst the array will be visible it is therefore not likely to change the nature of the view for visual receptors. Due to distance and relative levels no mitigation measures are possible or necessary as the development will be seen within the industrial complex.	
Cumulative impacts: As the development will be seen in the context of major existing industrial development this impact is not cumulative.	
Residual impacts The project can be dismantled after decommissioning, the low impact identified will be residual, thereby removing the impact	

Nature of impact: Glare impacting on adjacent roads and flight paths.		
Relevant Listed activities: GN 545, activity 1		
	Without mitigation	With mitigation
Extent	Site and immediate surroundings (2)	n/a
Duration	Long term (4)	n/a
Magnitude	<u>Adjacent road to the east</u> Glare from the proposed development will have a low impact on drivers on this road. (4) <u>Eastern flight path</u> Glare from the proposed development could be problematic for pilots approaching the air strip. (8)	<u>Adjacent road to the east</u> (2) <u>Eastern flight path</u> (4)
Probability	<u>Adjacent road to the east</u> Significant impact is improbable (2) <u>Eastern flight path</u> Significant impact is probable (3)	N/A
Significance	<u>Adjacent road to the east</u> Low (16)	<u>Adjacent road to the east</u>

	Eastern flight path Medium (42)	Low (12) Eastern flight path Low to Medium (30)
Status	Negative.	Negative
Irreplaceable loss	The project can be dismantled. Therefore there will be no irreplaceable loss.	The project can be dismantled. Therefore there will be no irreplaceable loss.
Can impacts be mitigated?	Yes	
Mitigation / Management:		
<ul style="list-style-type: none"> » The use of a textured glass with anti-reflective coatings on the face of panels will help but probably will not totally mitigate the impact. » Screening is not possible due to elevation and adjacent uses. » The impact will occur some way from the airstrip threshold (1.25 miles – 2.00 miles); whilst this may be uncomfortable, there is sufficient distance between the area of impact and the runway to rectify an error due to a temporary impairment of the pilots' vision. » Pilots using the airstrip should be advised of the timing and extent of possible glare problems. 		
Cumulative impacts:		
As far as the assessor is aware there are no other major reflective surfaces that could affect these receptors. The impacts identified are therefore unlikely to be cumulative.		
Residual impacts		
The project can be dismantled after decommissioning, thereby removing the impact		

6.7.4 Assessment of the PV site

The proposed development is unlikely to have any noticeable impact on landscape character. The orientation of the Majuba Power Station, its coal storage area, PFA dump, conveyors and other associated structures serve to screen the proposed solar array from the majority of surrounding roads and farmsteads. The impact on visual receptors is therefore expected to be negligible to small. The proposed array will have a minor impact on the road to the east of the site. It is also likely to have a more significant impact on a flight path into the airstrip to the north of the power station with a temporary impairment of vision likely due to glare.

In terms of visual impacts arising there is **no significance** difference in the potential impacts associated with the two technology alternatives. Therefore, there is **no preference** between the alternative technologies

6.7.5 Implications for Project Implementation

The assessment has shown that the visual impacts are likely to be negligible given the existing industrial context within which the views will be seen.

6.8 Assessment of Potential Social Impacts

The key social issues associated with the **construction phase** include the following **potential positive impacts**:

- » Creation of employment and business opportunities and opportunity for skills development and on-site training.

The key social issues associated with the **construction phase** include the following **potential negative impacts**:

- » Impacts associated with the presence of construction workers on site.
- » Threat to safety and security of farmers associated with the presence of construction workers on site.
- » Increased risk of stock theft, poaching and damage to infrastructure associated with presence of construction workers on the site.
- » Increased risk of veld fires associated with construction-related activities.
- » Impact of heavy vehicles, including damage to roads, safety, noise and dust.
- » Potential loss of grazing land associated with construction-related activities.

The key social issues affecting the **operation phase** include the following potential **positive** impacts:

- » Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training.
- » The establishment of renewable energy infrastructure.

The key social issues affecting the **operation phase** include the following potential **negative** impacts:

- » The visual impacts and associated impact on sense of place.

6.8.1 Impact tables summarising the significance of social impacts associated with the construction phase (with and without mitigation measures)

Impacts associated with the construction phase of a project are usually of a short duration, temporary in nature, but could have long-term effects on the surrounding social environment if not managed appropriately. The proposed Majuba 65 MW solar energy facility is expected to extend over a period of 18-24 months.

Direct employment and skills development

The construction of the proposed project will require a workforce and therefore direct employment will be generated. The proposed development will create employment opportunities for the local community. This is therefore a positive social impact. Although the exact number of employment opportunities has not been determined at this stage, it is estimated that during the construction phase of the proposed Majuba 65 MW solar energy facility is likely to create approximately 250-300 employment opportunities, for approximately 18-24 months. However this number is likely to vary depending on the final designs of the proposed project. In terms of skills requirements, it is common that approximately 45% of the opportunities will be available to low-skilled workers (construction labourers, security staff etc.), 22% will be available to semi-skilled workers (drivers, equipment operators etc.), and 33% will be available to skilled personnel (engineers, land surveyors, project managers etc.). The total wage bill for the construction for the 65 MW facility is estimated to be in the region of R12 million. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.

Nature: The creation of employment opportunities and skills development opportunities during the construction phase for the country and local economy		
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1		
	Without enhancement	With enhancement
Extent	Local- Regional (2)	Local- Regional (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly probable (4)
Significance	Low (24)	Medium (40)
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement measures: In order to enhance the local employment, skills development and business		

opportunities associated with the construction phase the following measures should be implemented:

- » It is recommended that local employment policy is adopted to maximise the opportunities made available to the local labour force. Eskom should make it a requirement for contractors to implement a 'locals first' policy, especially for semi and low skilled job categories. Enhance employment opportunities for the immediate local area, Dr Pixley Ka Isaka Seme Local Municipality, if this is not possible, then the broader focus areas should be considered for sourcing workers.
- » In the recruitment selection process; consideration must be given to women during recruitment process
- » It is recommended to set realistic local recruitment targets for the construction phase
- » Training and skills development programmes should be initiated prior to the commencement of the construction phase

Cumulative impacts

Opportunity to upgrade and improve skills levels in the area

Residual impacts

Improved pool of skills and experience in the local area

Economic multiplier effects

There are likely to be opportunities for local businesses to provide services and materials for the construction phase of the development. The local service sector will also benefit from the proposed development. The site is located approximately ~15km north east of Amersfoort. Given the relative proximity of the site to town, no on-site accommodation construction camp is envisaged. Off-site accommodation in the nearest town would be required for contract workers and certain employees. The economic multiplier effects from the use of local goods and services opportunities will include, but is not limited to, construction materials and equipment and workforce essentials such as services, safety equipment, ablution, accommodation, transportation and other goods.

The total construction capital expenditure associated with the establishment of the 65 MW solar energy facility is estimated to be in the region of R1.6 billion for the solar energy facility. In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. The increase in demand for new materials and services in the nearby area may stimulate local business and local economic development (however locally sourced materials and services will be limited due

to availability). There is likely to be a direct increase in industry and indirect increase in secondary businesses. The proponent or contractors should source services needed from the local area as much as possible. These necessities should be sourced from nearby towns and local service providers within the Dr Pixley Ka Isaka Seme Local Municipality where feasible.

Also the injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. Through the stimulation of employment and income is the creation of new demand within the local and regional economies. With increased income comes additional income for expenditure on goods and services supplied. The intention is to maximise local labour employment opportunities, this is likely to have a positive impact on local communities and have downstream impacts on household income, education and other social aspects. The implementation of the enhancement measures below can enhance the opportunities for local area.

Nature: Significance of the impact from the economic multiplier effects from the use of local goods and services		
	Without enhancement	With enhancement
Extent	Local- regional (2)	Local- Regional (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly probable (4)
Significance	Low (24)	Medium (40)
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement		
<ul style="list-style-type: none"> » It is recommended that a local procurement policy is adopted by Eskom to maximise the benefit to the local economy, where feasible (Dr Pixley Ka Isaka Seme Local Municipality) » Eskom should develop a database of local companies, specifically Historically Disadvantaged (HD) which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors; these companies should be notified of the tender process and invited to bid for project-related work where applicable » It is a requirement to source as much good and services as possible from the local area; engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible 		
Cumulative impacts		

Opportunity for local capital expenditure, potential for the local service sector

Residual impacts

Improved local service sector, growth in local business

Safety and security impacts

An increase in crime is often associated with construction activities. The perceived loss of security during the construction phase of the proposed project due to the influx of workers and/or outsiders to the area (as influxes of construction workers, newcomers or jobseekers are usually associated with an increase in crime) may have indirect effects, such as increased safety and security issues for neighbouring properties and damage to property, such as the risk of veld fire, stock theft, crime and so forth. The perception exists that construction related activities (influx of jobseekers, and construction workers and so forth) is a contributor to increased criminal activities in an area.

Apart from the construction crew that poses a potential increased risk there may also be an influx of people looking for economic opportunities (job seekers). Safety and security impacts are a reality in South Africa which needs to be addressed through appropriate mitigation measures. The adjacent landowners were interviewed and safety and security concerns were discussed; it was concluded that the adjacent landowners / tenants do not have concerns with safety and security in terms of possible crime, damage to property or stock theft for either of the proposed sites. Therefore the impact is assessed to be of low significance. Nevertheless, precautions will still need to put in place to limit any possible negative impacts associated with safety and security.

Nature: Temporary increase in safety and security concerns associated with the influx of people during the construction phase		
	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Low(24)	Low (16)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation		
» Access in and out of the construction area should be strictly controlled by a security company		
» The appointed EPC contractor must appoint a security company and appropriate security procedures are to be implemented		

- » The contractor must ensure that open fires on the site for heating, smoking or cooking are not allowed except in designated areas
- » Contractor must provide adequate fire fighting equipment on site and provide fire fighting training to selected construction staff.
- » A comprehensive employee induction programme would cover land access protocols, fire management and road safety. This must be addressed in the construction EMPr as the best practice.
- » A Community Liaison Officer should be appointed as a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process

Cumulative impacts

Possible increase in crime levels (with influx of people) with subsequent possible economic losses.

Residual impacts

None anticipated

Impacts on daily living and movement patterns

An increase in traffic due to heavy vehicles could create short-term disruptions and safety hazards for current road users. Transportation of project components and equipment to the proposed site will be transported using vehicular / trucking transport. The existing secondary access road is off the N11, the same access road that is utilized to access the Majuba Power Station. This secondary road will be the primary access road to the proposed site. There are regular daily movement patterns on the N11 and secondary roads from employees of Eskom that work at the Majuba Power Station and adjacent landowners/ farmers that utilize these roads. Increased traffic due to heavy vehicles could cause disruptions to the local community and increase safety hazards. The use of local roads and transport systems may cause road deterioration and congestion.

An increase of traffic from the rise in construction vehicles is a potential safety concern for road users and local communities in the area. However the roads are currently utilised by trucks and vehicles travelling to and from the Majuba Power Station. The N11 and the secondary access roads would mainly be affected by increase in traffic for a short duration of time. The use of un-roadworthy vehicles, drivers disobeying traffic rules and the obstruction of motorist's views will contribute to this potentially negative impact. Noise, vibrations, dust and visual pollution from heavy vehicle traffic during the construction phase could cause increased temporary disruptions in daily living, movement patterns and quality of life for local community. However, the adjacent landowners that we interviewed indicated that this would not a great concern as they are already used to the vehicle/truck movement from the Majuba Power station. Therefore the impact is assessed to have a low significance.

Nature: Temporary increase in traffic disruptions and movement patterns during the construction phase		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (36)	Low (27)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation		
<ul style="list-style-type: none"> » 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. » Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance to traffic rules. » Avoid heavy vehicle activity during 'peak' hours (when people are driving to and from work) » The developer and engineering, procurement and construction (EPC) contractor's must ensure that any damage / wear and tear caused by construction related traffic to the roads is repaired » A comprehensive employee induction programme to cover land access protocols and road safety. This must be addressed in the construction EMPr as the best practice. » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process 		
Cumulative impacts		
Possible increased traffic and traffic disruptions impacting local communities movement patterns and increased risks for road users		
Residual impacts		
None anticipated		

Pressure on economic and social infrastructure impacts from an in-migration of people

The in-migration of people to the area as either non-local workforce of construction workers and/or jobseekers could result in pressure on economic and social infrastructure due to in-migration of construction workers and jobseekers and pressure on local population (rise in social conflicts and social dynamics). Influx of people into the area, especially by job seekers, could further lead to a temporary increase in the level of crime, cause social disruption and put pressure on basic services. Adverse impacts could occur if a large in-migrant workforce, culturally different from the local indigenous group, is brought in during construction. This influx of non-local work force could also strain the existing

community infrastructure and social services. The local municipalities already have a large indigence population that relies on free basic services from the municipality, which has constrained the municipalities' bulk infrastructure due to a lack of funding. The proposed development will create a range of employment possibilities and thus it will attract jobseekers. The proposed development will create approximately 250-300 job opportunities. An influx of people looking for economic opportunities could result in pressure on economic and social infrastructure on the local population (rise in social conflicts and change in social dynamics). Influx of jobseekers into the area, could lead to a temporary increase in the level of crime, cause social disruption and put pressure on basic services. A further negative impact that could result due to an inflow of jobseekers is that local unemployment levels could raise due to an oversupply of an available workforce. Influx of in-migrants as either a non-local workforce or jobseekers could potentially create conflict between locals and outsiders mainly due to difference in racial, cultural and ethnic composition. The high unemployment rates and expectations of job creation is already a source of competition among locals and could be exacerbated through outsiders coming into the area resulting in conflict. Another consequence of a bringing in an outside workforce is that they often remain in the area after completion of the project, thereby posing a negative long-term impact on services and infrastructure. Not only will jobseekers be an issue but if the proponent decides to bring in an outside workforce instead of employing people from the local area, it will create more conflicts, tensions and possible long-term impacts. Therefore it is strongly encouraged that as many employees as possible are to be sourced from the local area. Also it is important that the tender document stipulates the use of local labour as far as possible to avoid the influx of job seekers.

Nature: Added pressure on economic and social infrastructure during construction as a result of in-migration of people		
	Without mitigation	With mitigation
Extent	Local-regional (2)	Local- regional (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (30)	Low (16)
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation		
<ul style="list-style-type: none"> » A 'locals first' policy should be advertised for construction employment opportunities, especially for semi and low-skilled job categories. Enhance employment opportunities for the immediate local area, Dr Pixley Ka Isaka Seme Local Municipality, if this is not possible, then the broader focus areas should be considered for sourcing employees. » Recruitment of temporary workers at the gates of the development should not be 		

<p>allowed. A recruitment office located in town with a Community Liaison officer should be established to deal with jobseekers.</p> <ul style="list-style-type: none"> » Have clear rules and regulations for access to the proposed site to control loitering. » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process
<p>Cumulative impacts</p> <ul style="list-style-type: none"> » Additional pressure on infrastructure due to additional people in the area » Possible increase in criminal activities and economic losses in area for property owners
<p>Residual impacts</p> <p>Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure</p>

Nuisance Impacts (noise & dust)

Impacts associated with construction related activities include noise, dust and disruption to adjacent properties is a potential issue. Experience from other Solar energy facilities projects and other developments indicate that site clearing does increase the risk of dust being generated, which can in turn impact on adjacent properties. The potential impacts can be addressed by implementing effective mitigation measures. The movement of heavy construction vehicles during the construction phase also has the potential to create noise, damage to roads and dust. The primary sources of noise during construction would be from the construction equipment and other sources of noise include vehicle traffic. Generation of dust would come from construction activities. Short-term increases in the use of local roads would occur during the construction period. Heavy equipment would most likely remain at the site for the construction period. The proposed site is located within the boundary of the Majuba Power Station, so the impact will be less significant. The adjacent landowners/ tenants that were interviewed also indicated that these nuisance impacts would not be of concern during the construction phase (see minutes of meetings in Appendix B of the Social Impact Assessment). The noise, dust and increased use of the local roads are expected to be a negative but a short term impact.

Nature: Nuisance impacts in terms of temporary increase in noise and dust, and the wear and tear on private farm roads for access to the site		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Low (15)	Low (10)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	

Irreplaceable loss of resources	No
Can impacts be mitigated	Yes
Mitigation	
<p>The potential impacts associated with construction and heavy vehicles can be effectively mitigated. The mitigation measures include:</p> <ul style="list-style-type: none"> » Dust suppression measures must be implemented for heavy vehicles. » Vehicles used to transport sand and building materials must be fitted with tarpaulins or covers. » Ensure that drivers adhere to speed limits. » Ensure all vehicles are road worthy; drivers are qualified and are made aware of the potential noise and dust issues. » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process 	
Cumulative impacts	
<ul style="list-style-type: none"> » Other construction activities in area will heighten the nuisance impacts, such as noise, dust and wear and tear on roads. 	
Residual impacts	
None anticipated.	

6.8.2 Impact tables summarising the significance of social impacts associated with the operational phase (with and without mitigation measures)

The solar energy facility will be operational for approximately 20-25 years. The potential positive and negative impacts which could arise as a result of the operation of the Project include the following:

Direct employment and skills development

The operation phase (20-25 years) of the proposed development will require a workforce and therefore direct employment will be generated. Although the exact number of construction workers is not confirmed at this stage, it is estimated that approximately ~50 jobs will be generated during the operation phase for the 65 MW solar energy facility. Given that solar energy facilities are relatively new in South Africa, a number of highly skilled personnel may need to be recruited from outside the local municipal area. The employees would include skilled engineers (specialised in both electrical and mechanical engineering) as well as less skilled services such as safety and security and engineering assistants. Routine activities would include operation of the solar facility to produce power, and regular monitoring and maintenance activities to ensure safe and consistent operation. Maintenance will be carried out throughout the lifetime of the solar energy facility. Typical activities during maintenance include washing solar panels routinely (in the evening) and vegetation control and maintenance.

Employment opportunities will be created during the operation phase and is rated as positive impact although limited.

Nature: The creation of employment opportunities and skills development opportunities during the operation phase for the country and local economy		
	Without enhancement	With enhancement
Extent	Local- Regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low(4)
Probability	Probable (3)	Highly Probable (4)
Significance	Low (30)	Medium (40)
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement		
<ul style="list-style-type: none"> » It is recommended that a local employment policy is adopted by the developer to maximise the project opportunities being made available to the local community. Enhance employment opportunities for the immediate local area, Dr Pixley Ka Isaka Seme Local Municipality, if this is not possible, then the broader focus areas should be considered for sourcing employees. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible » The developer should establish vocational training programs for the local employees to promote the development of skills 		
Cumulative impacts		
Opportunity to upgrade and improve skills levels in the area		
Residual impacts		
Improved pool of skills and experience in the local area		

Development of clean, renewable energy infrastructure

Bringing in the renewable energy sector to the Metsimaholo economy may contribute to the diversification of the local economy and provide greater economic stability. The growth in the renewable energy sector could introduce skills and development into the area. The development of the solar energy facility could therefore add to the stability of the economy, and even though this proposed development is small scale in comparison to the overall potential of the sector, it could contribute to the local economy. The proposed 65MW facility will help contribute to offset the total carbon emissions associated with energy generation in South Africa. Internationally there is an increase in the deployment of renewable energy technologies for the generation of electricity due to concerns such as climate change and exploitation of non-renewable resources. Through the Integrated Resource Plan (IRP), the South African Government has set a target

for renewable energy of 17 GWh renewable energy contributions to final energy consumption by 2030, to be produced mainly from biomass, wind, solar and small-scale hydro. Eskom has already successfully installed PV systems at offices and parking lots within Eskom-owned property to promote renewable energy awareness and to diversify their own energy mix. Furthermore, Eskom is looking at further reducing their self-consumption at their various owned or utilised sites by introducing Eskom's Ilanga PV Project Portfolio which aims to install 150 MWp at their various power stations, offices and substations, which includes the proposed Majuba Photovoltaic solar energy facility. The solar PV facilities will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme.

Nature: Development of clean, renewable energy infrastructure		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without enhancement	With enhancement
Extent	Local- Regional- National (4)	Local- Regional- National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	Medium (48)	Medium (48)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	Yes (impact of climate change)	
Can impacts be enhanced	No	
Enhancement None anticipated		
Cumulative impacts Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming		
Residual impacts Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming		

6.8.3 Impact tables summarising the significance of social impacts associated with the decommissioning phase (with and without mitigation measures)

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the adjacent landowners who are directly affected, the communities within which they

live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in 20-25 years post commissioning. The decommissioning phase is therefore likely to create additional, construction type jobs, as opposed to the job losses typically associated with decommissioning however for a limited period of time.

Given the relatively small number of people employed during the operation phase for the proposed 65MW solar energy facility (approximately ~50), the social impacts at a community level associated with decommissioning are likely to be low. In addition, potential impacts associated with the decommissioning phase can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low.

Nature: Social impacts associated with retrenchment including loss of jobs and source of income		
	Without Mitigation	With Mitigation
Extent	Local- district (2)	Local- district (2)
Duration	Short term (1)	Short Term (1)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	Low (28)	Low (21)
Status	Negative	Negative
Reversibility	Yes, assumes retrenchment packages are paid to all affected employees	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation		
<ul style="list-style-type: none"> » Eskom should ensure that retrenchment packages are provided for all staff retrenched when the plant is decommissioned. » All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning. » There should be a decommissioning/ rehabilitation fund established as part of the environmental management programme, allocated to rehabilitate disturbed areas. 		

Cumulative impacts

Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses.

Residual impacts

Loss of jobs and associated loss of income, can impact on local economy and other businesses.

6.8.4 Assessment of the PV site

The proposed Majuba solar energy facility and associated infrastructure is unlikely to result in permanent damaging social impacts. From a social perspective it is concluded that the project can be developed subject to the implementation of the recommended mitigation measures and management actions contained in the report.

6.8.5 Implications for Project Implementation

- » In terms of employment related impacts, it is important to consider that job opportunities for the unskilled and semi-skilled are scarce commodities in the study area and could create competition among the local unemployed. Introducing an outside workforce will therefore most likely worsen local endeavours to obtain jobs and provoke discontent as well as put pressure on the local services available. Local labour should be utilised to enhance the positive impact of employment creation in the area. Local businesses should be involved with the construction activities where possible. It is imperative that local labour be sourced to ensure that benefits accrue to the local communities. Preference should thus be given to the use of local labour during the construction and operational phases of the project as far as possible.
- » Locals should also be allowed an opportunity to be included in a list of possible local suppliers and service providers, enhancing the multiplier effect. This aspect would serve to mitigate other subsequent negative impacts such as those associated with the inflow of outsiders to the area, the increased pressure on the infrastructure and services in the area, as well as the safety and security concerns.
- » Impacts associated with the construction period should be carefully mitigated to minimise any possible dust and noise pollution.
- » Safety and security concerns should be taken into account during the planning and construction phases of the proposed project.

6.9 Assessment of the Do Nothing Alternative

The 'Do-Nothing' alternative is the option of not constructing the proposed Majuba PV Solar Energy Facility. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a solar energy facility.

a) Socio-economic impact

Social: The impacts of pursuing the No-go Alternative are both positive and negative as follows:

- » The benefits would be that there is no disruption from nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.
- » There would also be an opportunity loss in terms of job creation, skills development and associated economic business opportunities for the local economy.

Foregoing the proposed development would not necessarily compromise the development of renewable energy facilities in South Africa. However, the socio-economic benefits for local communities would be forfeited.

New Business: The wage bill for the construction of the proposed PV facility will be in the region of R12 million. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area. Some of the positive spin off effects that are to ensue from the project expenditure will be localised in the communities located near the site. The local services sector and specifically the trade, transportation, catering and accommodation, renting services, personal services and business services are expected to benefit the most because of project activities during the construction phase. These new business sales that will be stimulated as a result of the establishment of the project, albeit for a temporary period, will be lost if the no go alternative is pursued.

Employment: Employment opportunities for approximately 8-12 months will be created during construction. At least a third of these jobs will become available for the local communities.

Skills development: The establishment of the project will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. In terms of skills requirements, it is common that approximately 45% of the opportunities will be available to low-skilled workers (construction labourers, security staff etc.), 22% will be available

to semi-skilled workers (drivers, equipment operators etc.), and 33% will be available to skilled personnel (engineers, land surveyors, project managers etc.).

The no-go alternative will therefore result in the above economic benefits **not being realised** and a subsequent loss of income and opportunities to local people. From this perspective the no-go alternative is not preferred.

b) Regional scale impact

Benefits of renewable energy at a regional scale include:

- » **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing Eskom's consumption at the Majuba Coal Fired Power station.
- » **Exploitation of South Africa's significant renewable energy resource:** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
- » **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows Eskom to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for ~1 % of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO₂ emissions.
- » **Support for international agreements:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
- » **Employment creation:** The sale, development, installation, maintenance and management of a renewable energy facility have significant potential for job creation skills development and associated economic multipliers for the local economy.
- » **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

At a project-specific scale, the pursuit of the no go alternative will eliminate the benefits of the proposed PV Facility at Eskom's Majuba Coal Fired Power Station in enabling Eskom to diversify their energy mix and reduce their relative carbon footprint. Given South Africa's reliance on Eskom as a power utility, and on Eskom non-renewable energy sources, the benefits associated with Eskom also producing renewable energy is regarded as an important contribution to meeting national renewable energy, and climate change targets as well as enable Eskom to support the demand side management energy efficiency programme.

The "Do Nothing" alternative is therefore not preferred as Eskom and South Africa needs to diversify electricity generation sources, to which this project will contribute.

ASSESSMENT OF CUMULATIVE IMPACTS

CHAPTER 7

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN R543) as meaning “the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area”. For cumulative effects analysis to assist the decision-maker and inform interested parties, it must be limited to effects that can be evaluated meaningfully (DEAT, 2004). Boundaries must be set so analysts are not attempting to measure effects on everything. Therefore, the cumulative impacts associated with the proposed Majuba PV Solar Energy Facility have been viewed from two perspectives within this report:

- » Cumulative impacts associated with the scale of the project.
- » Cumulative impacts associated with other generation facilities within 30 km radius of the proposed facility.

Most development impacts are indirect, subtle, and cumulative or unfold over several years following construction or commencement of the operation of the development. While a possible mechanism for an impact to occur can usually be identified, the actual likelihood of occurrence and its severity are much harder to describe (Hill and Arnold, 2012).

The alignment of renewable energy developments with South Africa’s Integrated Resource Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The social and economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

Due to the growth in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and minimised where required and possible. This chapter considers whether the proposed project’s potential impacts become more significant when considered in combination with the other impacts associated with other generation / industrial development within the area.

7.1 Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking

in the area⁴. Cumulative impacts associated with other generation facilities within 30 km radius of the proposed facility were assessed (refer to Figure 7.1). The proposed Majuba PV Solar Energy Facility is not located within a 30 km radius of any renewable project development sites. Other industrial developments within close proximity of the development site include:

- » The Majuba Power Station
- » Bergvliet 88 kV Eskom Substation
- » Various power lines

Significant cumulative impacts that could occur due to the development of the solar energy facility and its associated infrastructure in proximity to other industrial development include impacts such as:

- » Loss of vegetation and impacts on ecology;
- » Impacts on avifauna;
- » Impacts on soils and agricultural potential;
- » Impacts on heritage resources;
- » Visual impacts; and
- » Social impacts.

In the sections below the potential impacts associated with other generation facilities within the vicinity of the facility/development are explored. The discussion and associated conclusions must be understood in the context of the uncertainty associated with the proposed developments and the qualitative nature of the assessment.

⁴ Definition as provided by DEA in the EIA Regulations.

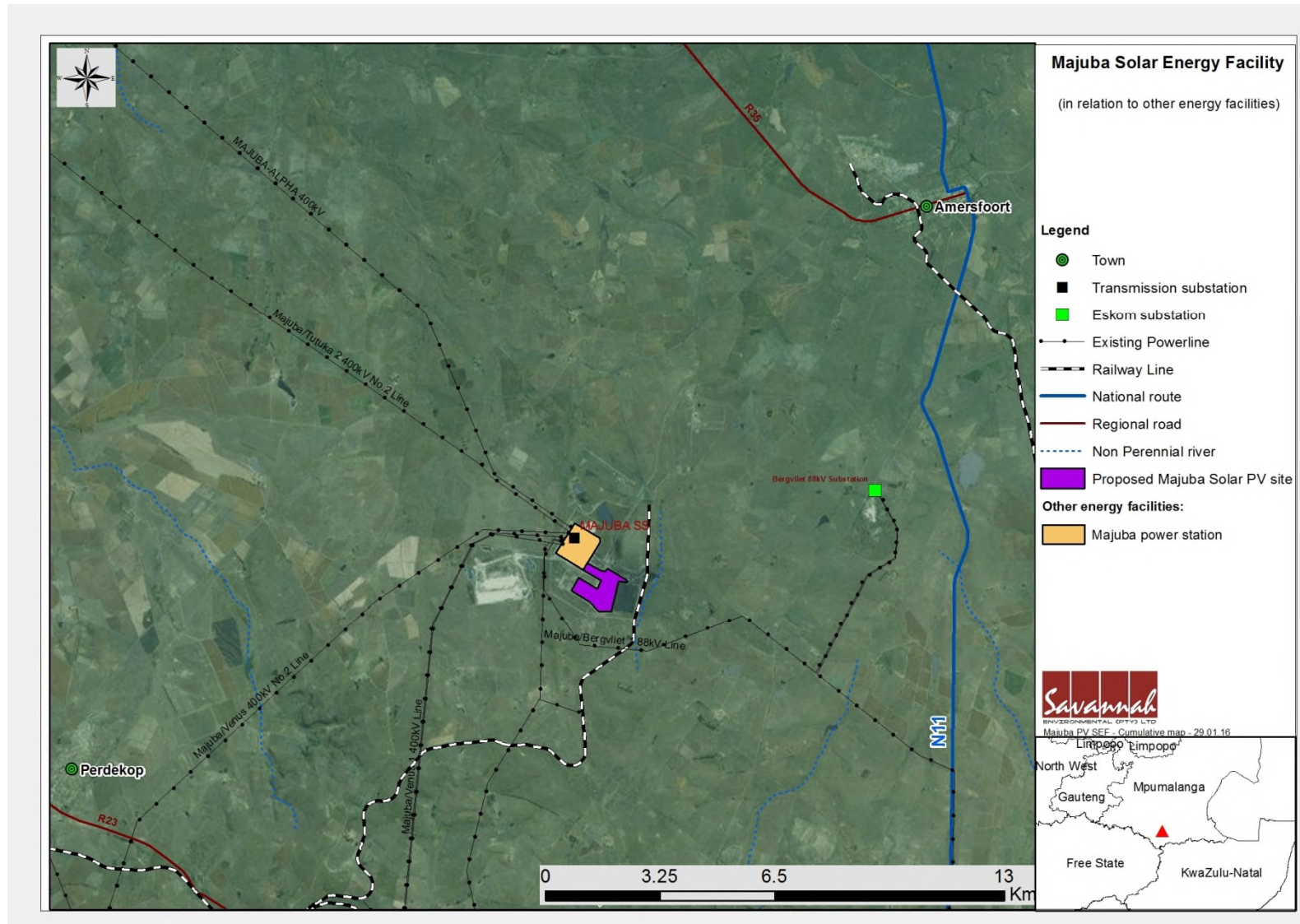


Figure 7.1: The Majuba PV Solar Energy

7.1.1 Ecological Processes (flora and fauna)

The identified study area falls within the original extent of the Amersfoort Highveld Clay Grassland (Unit Gm13) as defined by Mucina and Rutherford (2006). This site is characterised by undulating plains with small scattered patches of dolerite outcrops. The Mpumalanga Biodiversity Conservation Plan classified a small central portion of the study area as being of Least Concern, whilst the remainder has been classified as having no natural habitat remaining. This was confirmed during the field study – with a small area of relatively diverse grassland remaining, whilst the largest portion of the study area consists of rehabilitated (semi-natural) grasslands.

The cumulative loss of habitat resulting from the proposed PV facility are not likely to impact the country's ability to meet conservation targets and objectives as the affected vegetation types are widespread and have been impacted little by transformation to date.

Cumulative negative impacts on ecology related to transformation of land, disturbance and habitat loss may occur during construction as well as impacts on fauna. With the implementation of good environmental management practise during the life cycle of the project, cumulative impacts on ecology as a result of the establishment of similar industrial development will be to an acceptable level. Cumulative impacts on Ecology are summarised in **Table 7.2** and discussed below:

- » Excessive clearing of currently declining species in the area could significantly impact local and regional population dynamics, as well as microhabitats and resources associated with these species available to other fauna and flora species. For the development, protected species should be relocated as far as possible.
- » Excessive clearing of vegetation and landscaping will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of areas around sealed surfaces and continued erosion or degradation of the development area with associated degradation of lower-lying wetlands, contamination of wetlands and spread and establishment of invasive species.
- » Rehabilitation and re-vegetation of all surfaces disturbed or altered during construction is desirable. Runoff from sealed surfaces or surfaces that need to be kept clear of vegetation to facilitate operation of a development needs to be monitored regularly to ensure that erosion control and stormwater management measures are adequate to prevent the degradation of the surrounding environment.

- » Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent rangelands.

Table 7.2: Cumulative impacts on Ecology

Nature: Transformation of land, disturbance and habitat loss may occur during construction as well as impacts on fauna and flora		
	Without mitigation	With mitigation
Extent	Local- regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	Medium (52)	Low-Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impacts be enhanced	Yes	
Mitigation measures:		
With the implementation of good environmental management practise during the life cycle of the project, as described in chapter 6 of this report, cumulative impacts on ecology as a result of the establishment of similar industrial development will be to an acceptable level.		

7.1.1 Cumulative impacts on Avifauna

In addition to the proposed Majuba PV Solar Energy Facility, there are several activities (i.e. mining, energy generation, industrial, urban, agricultural and pastoral) that feature prominently both within the impact zone and the broader study area and are a significant source of existing disturbance to avifauna. These activities, coupled with the limited habitat diversity and existing degradation within the proposed development site, are a likely cause of the absence of Red List species within the impact zone. Those species that have persisted have undoubtedly developed a tolerance for the current levels of disturbance and are likely to persist within the broader area despite the development of the solar facility.

The surrounding area is already heavily transformed as a result of mining, energy generation, and urban, agricultural and pastoral activities. However the areas that have been earmarked for development are not particularly sensitive and therefore the cumulative impact is deemed not to be significant. Cumulative impacts on avifauna are summarised in **Table 7.3.**

Table 7.3: Cumulative impacts on Avifauna (with and without mitigation)

NATURE: Cumulative impact of the proposed Solar Photovoltaic (PV) project (i.e. PV panels and associated electrical infrastructure) and the existing developments and operations (i.e. mining, energy generation, industrial activities and residential developments) within the study area.		
	Without mitigation	With mitigation
Extent	Local (2)	Site bound (1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (36)	Low (18)
Status	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation measures: It is important to note that very little empirical evidence exists that quantifies the current level of impact within the study area and the effect that mitigation (if any) has had on reducing these impacts. It is therefore speculated that the significance of the cumulative impact, as a result of the addition of the solar PV facility may either be reduced if the mitigation measures, as discussed in Chapter 6, for each impact associated with the solar facility are implemented.		

7.1.2 Cumulative impacts on Surface water resources

Any loss of wetlands will add to the overall loss of wetlands in the region. Although the seepage wetlands on the southern section of the site are in the least impacted state, the most sensitive wetland is considered to be the valley bottom wetland (wetland unit A). This wetland unit is hydrologically directly connected to downstream watercourses. Any impact to this wetland or its associated buffer zone can negatively affect regional hydrology.

Alien invasive weeds can easily colonise and impact on downstream users if allowed to seed before control measures are implemented. Alien invasive weeds can form dense thickets which replace indigenous wetland habitats and their natural flow regime. This will result in a loss of wetland species and wetland function. Additional sediments would lead to increased turbidity downstream which will put additional stress on aquatic life and loss of sensitive biota. It was recommended that a 30m buffer is set to protect wetland functionality. Cumulative impacts on Surface Water Resources are summarised in **Table 7.4**.

Table 7.4: Cumulative impacts on Surface Water Resources (with and without mitigation)

Nature: Loss of Habitat, establishment of alien vegetation, changes to sediment and stormwater regimes, downstream erosion, deterioration of water quality		
	Without mitigation	With mitigation

Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Medium term (3)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Probable (4)
Significance	High (80)	Medium (48)
Status (positive or negative)	Negative	Positive
Reversibility	No	
Irreplaceable loss of resources	Yes	
Can impacts be enhanced	Yes	
Enhancement: Ensure that the development footprint is as small as possible and does not encroach onto wetland boundaries or buffers. Ensure that stormwater management is in place so that no net change to stormwater energy enters the wetland. Monitoring for erosion on site and downstream should form part of an EMP. If erosion is recorded it should be rehabilitated. An alien vegetation management plan should form part of the EMP		

7.1.3 Cumulative impacts on Soils and Agricultural Potential

The loss of the land where the PV facility is proposed would not have a significant effect on agricultural production due to the low potential of the soils on the affected site.

7.1.4 Cumulative Heritage Impacts

Archaeological and palaeontological sites are non-renewable and impact on any archaeological/palaeontological context or material will be permanent and destructive. Very sparse heritage and fossil traces were found on the site and from an archaeological and palaeontological heritage perspective the observed resources may be regarded as being of generally low significance. Therefore, any impact in this regard is unlikely to add significantly to the impact of other developments in the area. It still remains important for each development to observe mitigation measures and to incorporate any sensitive heritage features into the layout plans where possible.

7.1.5 Visual impacts

The proposed development will take place within a landscape that is already heavily impacted by large-scale industrial development including mining operations and the Majuba Power Station. Cumulative impacts of this new

development to the larger area will have low or no influence on the nature of the area due to existing heavy industrial area located next to the project site. Existing industrial structures are likely to provide significant screening of the PV facility particularly from middle distance and distance views. From a distance small-scale development may also be viewed against a backdrop of larger industry which is also likely to make it less obvious. Visual Cumulative impacts on are summarised in **Table 7.5**.

Table 7.5: Impact table summarising the Visual cumulative impacts (with and without mitigation)

Nature: Impacts associated with development include Landscape degradation, Change of view for visual receptors and ocular impacts associated with glare.		
	Without mitigation	With mitigation
Extent	Site and immediate surroundings (2)	No mitigation possible
Duration	Long term (4)	No mitigation possible
Magnitude	Small (0)	No mitigation possible
Probability	Very improbable (1)	No mitigation possible
Significance	Low (6)	No mitigation possible
Status (positive or negative)	Neutral	
Reversibility	Yes	
Irreplaceable loss of resources	The project can be dismantled. Therefore there will be no irreplaceable loss.	
Can impacts be mitigated	No mitigation measures are necessary	
Mitigation: No mitigation measures are necessary		

7.1.6 Socio-economic impacts

The proposed Majuba PV Solar Energy Facility has the potential to result in significant positive cumulative impacts; specifically with the establishment of other industrial developments within the Dr Pixley Ka Isaka Seme Local Municipality which will create a number of socio-economic opportunities for the area, and which, in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many renewable energy facilities and other industrial developments proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore at municipal level, the cumulative impact could be positive and could

incentivize operation and maintenance companies to centralize and expand their activities towards education and training.

Table 7.6.: Impact table summarising the Socio-Economic cumulative impacts (with and without mitigation)

Nature: An increase in employment opportunities, skills development and business opportunities with the establishment of more than one solar energy facility		
	Without mitigation	With mitigation
Extent	Local- regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	Medium (33)	Medium (52)
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources	N/A	
Can impacts be enhanced	Yes	
Enhancement: The establishment of a number of solar energy facilities and industrial developments in the area does have the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted and local services providers are utilised by the developers to maximise the project opportunities available to the local community.		

7.2 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

In general, Cumulative impacts of the proposed Majuba PV Solar Energy Facility, to the larger area is likely to have low or no influence on the nature of the area due to heavy industrial areas located next to the project site and the general low sensitivity of the proposed development area. The overall cumulative impact on wetlands, however, is likely to be of a High significance prior to mitigation if wetland areas are not avoided by the development. This could be reduced to medium negative significance with the implementation of the proposed mitigation measures.

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 8

Eskom is proposing to establish the Majuba PV Solar Energy Facility of up to 65 MW and associated infrastructure on portions 1, 2 and 6 of the farm Witkoppies 81 HS, located in the jurisdiction of Gert Sibande District Municipality and Dr. Pixley Ka Isaka Seme Local Municipality within the Mpumalanga Province.

The proposed facility will require a development footprint area of approximately ~96.9 ha, and will be comprised of the following primary elements:

- » Solar panels (fixed/tracking technology) with an export capacity of up to 65 MW.
- » Mounting structures for the solar panels to be rammed steel piles or piles with pre-manufactured concrete footings, alternative making use of ground screws to support the PV panels.
- » Cabling between the structures, to be lain underground where practical.
- » Central inverter/transformer stations to collect all energy generated from the PV panels. The inverter's role is to convert direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- » An on-site substation and overhead power line to facilitate the connection between the solar energy facility and the existing Majuba Power Station.
- » Internal access roads.
- » Associated buildings including a workshop area for maintenance, storage, and control facility with basic services such as water and electricity.

The purpose of the proposed facility is to contribute towards Eskom's target to reduce self-consumption at their various owned or utilised sites by installing 150 MWp at their various power stations, offices and substations. The project is proposed as part of Eskom's plans to further reduce its self-consumption. The solar PV facilities will promote the reduction of Eskom's carbon footprint and support the demand side management energy efficiency programme.

Need and desirability: Solar PV is one of the most cost-effective, reliable and proven approaches for generating solar power. These systems emit no emissions and create no waste. PV facilities are considered to be a sustainable power solution for both the short and long-term. Solar power has numerous advantages over fossil-fuelled power generation and other renewable technologies, including the fuel source, sunlight, is delivered to the site for free; there is no waste, and therefore there is no need to contain or store waste products; and solar PV has the benefit of not requiring large amount water during the power production cycle.

Selection of the Project Area and development site: An internal investigation/screening process was undertaken by Eskom to assess the potential for installing PV facilities at Eskom power stations in Gauteng, Free-State, Mpumalanga and KwaZulu-Natal regions. This study provided an indication of the potential capacity, land availability, environmental constraints and electrical connection options for each of the power stations including Arnot, Duvha, Kendal, Kriel, Majuba, Majuba, Matimba, Tutuka, Camden, Komati and Ingula. The sites within the Arnot, Duvha, Majuba, Majuba and Tutuka power stations were selected as the first sites for consideration within EIA processes.

The following factors have been considered in determining a preferred site for PV solar development including:

- » Land availability and environmental constraints (i.e. ecological sensitive areas); and
- » Technical feasibility – taking into account all electrical considerations including point of connection and electrical infrastructure available.

At screening level, it was concluded by Eskom that the Majuba Power Station has land available for a large PV facility. In assessing the 8 potential land areas identified at Majuba Power Station (as indicated in Figure 2.1), the analysis of the land was separated into 3 criteria being preferred, potential, and problematic/restricted land sites. In each of the criteria the land parcel was analysed for the land availability (current and future), environmental issues in and around each site, point of electrical connection and future planned power station projects around the site. The proposed site for development was identified as the preferred site based on the fact that the site is within the power station immediate fence and the site is flat with some grassland. This proposed site is supported by the power station operational staff.

Based on the above considerations, Eskom considers the proposed site as a highly preferred site for the development of a PV Solar Energy Facility.

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the planning of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Eskom requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Mpumalanga Department of Economic Development, Environment and Tourism) for the establishment of the Majuba PV Solar Energy Facility. In terms of Sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a

Scoping and an EIA process have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken. The following key phases have been undertaken to date.

- » *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed project using adverts, site notices, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.
- » *Scoping Phase* – identification of potential issues associated with the proposed project and environmental sensitivities as well as the extent of studies required within the EIA Phase were defined.
- » *EIA Phase* – potentially significant biophysical and social impacts⁵ and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of the Environmental Management Programme (EMPr) (refer to **Appendix M**).

The Conclusions and Recommendations of this EIA for Majuba PV Solar Energy Facility are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area. A summary of the recommendations and conclusions for the proposed Majuba PV Solar Energy Facility are provided in this Chapter.

8.1. Summary of Majuba PV Solar Energy Facility and Associated Infrastructure

The preceding chapters of this report together with the specialist studies contained within **Appendices D-K** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for the Majuba PV Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, sensitive areas within the development footprint area were identified and flagged for consideration and avoidance by the facility layout. Potential impacts which could

⁵ Direct, indirect, cumulative that may be either positive or negative.

occur as a result of the proposed project are summarised in the sections which follow.

The environmental impacts identified and assessed to be associated with the proposed PV facility include:

- » Impacts on wetlands.
- » Impacts on ecology and habitats occurring on the site.
- » Impacts on heritage and paleontological resources.
- » Impact on avifauna.
- » Visual impacts
- » Social and economic impacts.

The sections which follow provide a summary of the environmental impacts associated with the proposed project, as identified through the EIA, as well as a mitigation strategy in order to reduce the impacts.

Impacts on Surface water resources

Four wetlands, one unchannelled valley-bottom and three seeps, were found on the site. The wetlands have been exposed to varying degrees of impact. The hillside seeps draining south-east and north-west (wetland units C and D) were the least impacted still showing a high level of natural ecological state. The unchannelled valley-bottom (wetland unit A) and the seep draining north (wetland unit B) are both largely modified with the valley-bottom wetland impacted on by large concrete drains and the seep has been impeded by gravel roads. Overall the wetlands on site were moderately modified. The wetland was found to have a moderate importance and sensitivity to changes in flow regime and lacked sensitive biota. Although the seepage wetlands on the southern section of the site are in the least impacted state, the most sensitive wetland is considered to be the valley bottom wetland (wetland unit A). This wetland unit is hydrologically directly connected to downstream watercourses. Any impact to this wetland or its associated buffer zone can negatively affect regional hydrology. Impacts to the seepage wetlands, although still not desirable, should be mitigated.

In order to mitigate the potential impacts it is recommended that development within these wetland areas are avoided and that a 30m buffer is set to protect wetland functionality. From the conclusions of the detailed Wetland study undertaken the overall impact on wetlands is likely to be of a High to medium significance prior to mitigation. This could be reduced to low negative significance following the implementation of mitigation measures. Overall and with the suggested mitigation measures implemented, the **wetland** impacts of the development are likely to be of **moderate significance** and no impacts of high significance are likely with mitigation. As a result, there are no fatal flaws or

impacts that cannot be mitigated that should prevent the development from being approved.

Impacts on Ecology

The overall impact on the ecology (including flora and fauna) is likely to be of a medium negative significance prior to mitigation. This impact could be reduced to low significance following the implementation of mitigation measures, and safe rescue and relocation of protected species (including *Aloe ecklonis*, *Eucomis autumnalis* and *Gladiolus sericeovillosus* s. *Calvatus*, *Habenaria dives*). It is not expected that the development will compromise the survival of or significantly impact any flora or terrestrial vertebrate species on the study area or beyond. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all mitigation recommendations are implemented; and the associated integrity of surrounding wetlands maintained. Overall and with the suggested mitigation measures implemented, the **ecological** impacts of the development are likely to be of **moderate to low significance**. As a result, there are no fatal flaws or impacts that cannot be mitigated that should prevent the development from being approved.

Impacts on Avifauna

The overall impact on **Avifauna** is likely to be of a **medium negative** significance **prior to mitigation**. This could be reduced to **low significance** following the **implementation of mitigation measures**, which includes a buffer around the wetlands. Given the presence of existing habitat degradation and disturbance associated with the mining, energy generation and industrial activities that are prevalent in the study area and surrounds, and due to the relatively low importance of the site for many bird species, it is anticipated that the Majuba Solar Photovoltaic Facility can be constructed at the proposed site with acceptable levels of impact on the resident avifauna.

Impacts on Soils, Land Capability and Agricultural Potential

The overall impact on Soils and Agricultural Potential is likely to be of a **medium to low negative significance prior to mitigation**. This could be reduced to **low significance following the implementation of mitigation** measures. Within the broader study area around Majuba Power Station, the loss of the land where the PV facility is proposed would not have a significant effect on agricultural production due to the low agricultural potential of the site. There are **no fatal flaws** associated with the soils and agricultural potential on the site and the project can be developed with the use of good soil management measures during all phases of development of the project.

Impacts on Heritage and Paleontological Resources

The overall impact on the heritage and paleontological resources is likely to be of a **low significance**. If the recommendations made through this EIA process are adhered to, and based on approval from SAHRA, it is concluded that the development can continue as the impact of the development on heritage and paleontological resources will not impact negatively on the heritage record of Mpumalanga. If during the pre-construction phase or during construction, any archaeological or paleontological finds are made (e.g. graves, stone tools, fossils and skeletal material), the operations must be stopped, and the archaeologist or palaeontologist (depending on the find) must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological and palaeontological material and graves, the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded, but can be easily mitigated by preserving the sites *in-situ* within the development.

Impacts on Visual quality of the area

The overall visual impact is likely to be of a **low significance**. The proposed development is unlikely to have any noticeable impact on landscape character. The orientation of the power station, its coal storage area, PFA dump, conveyors and other associated structures serve to screen the proposed solar array from the majority of surrounding roads and farmsteads. The impact on visual receptors is therefore expected to be negligible to small. The proposed array will have a minor impact on the road to the east of the site. It is also likely to have a more significant impact on a flight path into the airstrip to the north of the power station with a temporary impairment of vision likely due to glare.

Social and Economic Impacts

The overall social impact is likely to be of a medium significance in terms of positive impacts, and a low medium significance in terms of the negative impacts. From a social perspective it is concluded that the proposed Majuba Solar Energy Facility can be developed subject to the implementation of the recommended mitigation measures and management actions. The proposed development represents greater positive social potential than negative implications due to the development being located in an industrial area.

Evaluation of the Potential Issues with Associated Infrastructure - Invertors, and Internal Access Roads

In order to connect the Majuba PV Solar Energy Facility to the power grid, the Eskom intends on building on-site substation and power line, which follows the existing access road, for which will connect into the existing substation located on the site. Potential issues identified to be associated with a proposed overhead power line, substation, access roads and invertors include impacts on flora, fauna and ecological processes, impacts on avifauna as a result of collisions and

electrocutions, heritage and visual impacts. There are no fatal flaws associated with the associated infrastructure of the Majuba PV Solar Energy Facility site.

8.2. Assessment of Potential Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

There are no renewable project development sites within a 30km radius of the proposed Majuba PV Solar Energy Facility. In general, Cumulative impacts of the proposed Majuba PV Solar Energy Facility, to the larger area is likely to have low or no influence on the nature of the area due to heavy industrial areas located next to the project site and the general low sensitivity of the proposed development area. The overall cumulative impact on wetlands is likely to be of a High significance prior to mitigation. This could be reduced to medium negative significance with the implementation of the proposed mitigation measures.

8.3 Environmental Sensitivity and Micro-siting

In response to the identified need to adequately manage impacts within sensitive areas identified on the site development footprint, and in order to demonstrate the ability of the project to adhere to recommended mitigation measures, Eskom has developed a best practice mitigation strategy with regards to the facility layout.

The EIA recommendations have been taken into account by Eskom, and the PV facility layout has been refined to avoid encroachment into the wetlands in order to maintain optimal wetland functionality. The refinement of the layout has resulted in a decrease in the net generating capacity, from 65 MW to 30 MW. This refined layout will still be able to meet the main objective of supplementing Eskom's self consumption at the Majuba Power station. **The required mitigation measures are illustrated in Figure 8.1 and Figure 8.2** and represent a positive outcome in terms of impact reduction and mitigation and the optimal layout for the facility.

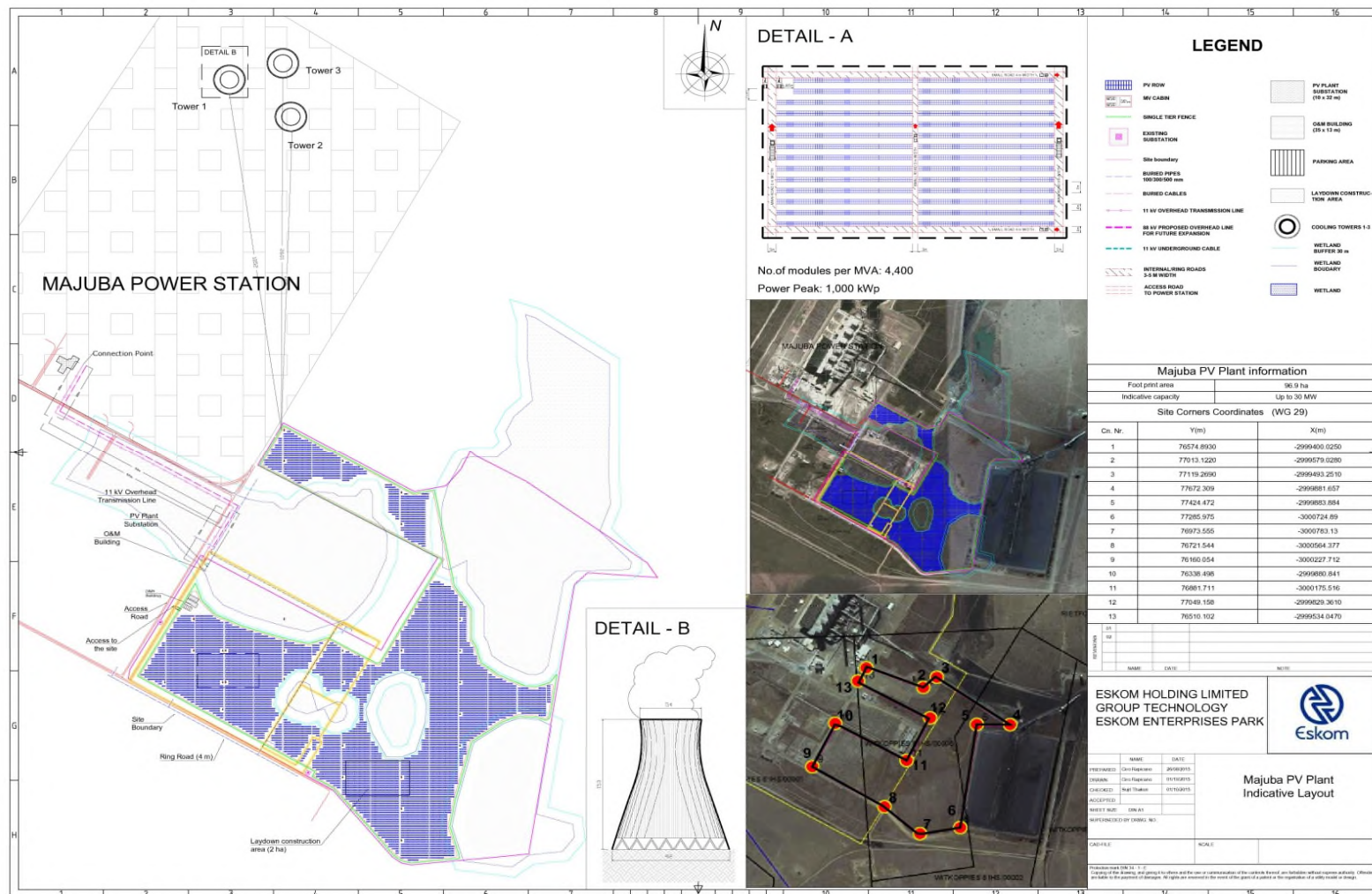


Figure 8.1: The optimised Layout development footprint of the proposed Majuba PV Solar Energy Facility

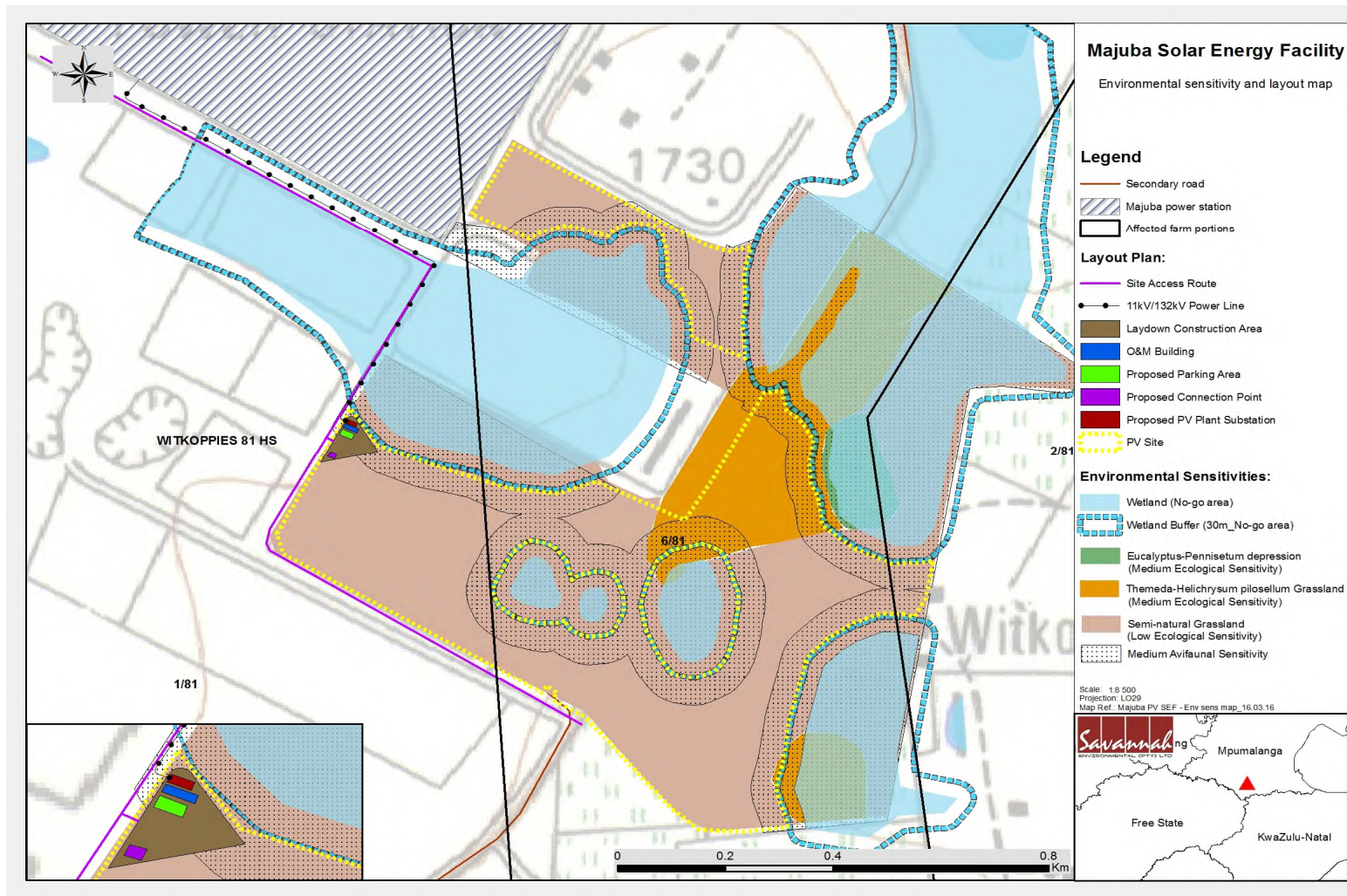


Figure 8.2: The final/optimised layout map superimposed (overlain) on the environmental sensitivity for the proposed Majuba PV Solar Energy Facility

8.4 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise from the project proceeding. This could include:

- » Direct loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the PV project. The cost of loss of biodiversity must be minimised on the Majuba PV site through the careful location of the development..
- » Direct loss of wetland habitat due to the construction and utilisation of land for the PV project. The cost of loss of wetland habitat must be minimised on the Majuba PV site through the implementation of 30 m buffers around the wetland and careful location of the development. to.
- » Visual impacts associated with the PV panels and power line. The cost of loss of visual quality to the area is reduced due to the area already being visually impacted by the Majuba Power Station and associated infrastructure, power lines and surrounding mines.
- » Change in land-use and loss of land available for grazing on the development footprint.

These costs are expected to occur at a local and site level and are considered acceptable provided that the mitigation measures as outlined in the EMPr are adhered to.

Benefits of the project include the following:

- » The main benefit of the proposed PV facility at Eskom's Majuba Power Station is to enable Eskom to diversify their energy mix and reduce their relative carbon footprint.
- » The project is poised to bring about important economic benefit at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will transpire during the preconstruction/ construction and operational phases.
- » South Africa's per capita greenhouse gas emissions being amongst the highest in the world due to reliance on fossil fuels, the proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW PV project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

8.5. Overall Conclusion (Impact Statement)

The technical viability of establishing a solar energy facility on portions 1, 2 and 6 of the farm Witkoppies 81 HS, located in the jurisdiction of Gert Sibande District Municipality and Dr. Pixley Ka Isaka Seme Local Municipality within the Mpumalanga Province has been established by Eskom. The positive implications of establishing the Majuba PV Solar Energy Facility on the identified site include the following:

- » To enable Eskom to diversify their energy mix and reduce their relative carbon footprint at the Majuba Power Station.
- » The potential to harness and utilise solar energy resources within the Mpumalanga Province.
- » The project will assist the South African government in reaching their set targets for renewable energy.
- » The project will assist the South African government in the implementation of its green growth strategy and job creation targets.
- » The project will assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business.
- » Promotion of clean, renewable energy in South Africa.
- » Creation of local employment, business opportunities and skills development for the area.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. These mitigation measures have been taken into account and an optimised layout has been produced (**Figure 8.1 and Figure 8.2**). Environmental specifications for the management of potential impacts are detailed within the Environmental Management Programme (EMPr) for the Lethabo PV Solar Energy Facility included within **Appendix M**. With reference to the information available at this planning approval stage in the project cycle, the confidence in the environmental assessment undertaken is regarded as high.

8.6. Overall Recommendation

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South

Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the impacts associated with the development of the Majuba PV Solar Energy Facility project can be mitigated to an acceptable level. As per the requirements of the NEMA (Act 107 of 1998), this EIA has identified and assessed project alternatives and the potential environmental impacts associated with the proposed PV facility. In terms of this conclusion, the EIA project team support the decision for environmental authorisation on the proposed site. The optimised layout shown in **Figure 8.1 and Figure 8.2** is acceptable and the following conditions would be required to be included within an authorisation issued for the project:

The following conditions would be required to be included within an authorisation issued for the project:

- » All mitigation measures detailed within this report and the specialist reports contained within Appendices D to K must be implemented.
- » Following the final design of the facility to include the 30 m buffer around the identified wetlands, a final layout must be submitted to DEA for review and approval prior to commencing with construction.
- » The Environmental Management Programme (EMPr) as contained within Appendix M of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be the main key in achieving the appropriate environmental management standards as detailed for this project.
- » An independent Environmental Control Officer (ECO) must be appointed by Eskom prior to the commencement of any authorised activities. The ECO should remain employed for the duration of the construction phase to monitor compliance with the requirements of the EMPr and Environmental Authorisation.

- » If any protected plant or tree species are required to be removed/destroyed as part of the construction of the development, a collection/destruction permit to be obtained from DAFF for the protected trees and Mpumalanga Department of Economic Development, Environment and Tourism for other protected plants.
- » A water use license must be obtained as the proposed facility is within 500m of a wetland. The viability and sustainability of this resource should however first be investigated in consultation with DWS.
- » It is recommended that weeds and invasives in the remaining natural veld on the eastern portion of the study area be eradicated and controlled, but that the area is excluded as much as possible from the development. All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended. A rigorous alien invasive plant monitoring and management plan must therefore be implemented right up to the decommissioning phase.
- » Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
- » All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
- » Site rehabilitation of temporary laydown and construction areas to be undertaken immediately after construction.
- » Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.
- » Develop emergency preparedness plan for the construction and operation phase, in line with that of the Majuba Power Station, to deal with any event of contamination, pollution, or spillages.
- » Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation.
- » All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
- » Applications for all other relevant and required permits required to be obtained by the developer and must be submitted to the relevant regulating authorities.

REFERENCES

CHAPTER 9

Ecology Specialist Study

- Apps, P. (ed). 2000. *Smither's Mammals of Southern Africa. A field guide.* Random House Struik, Cape Town, RSA
- Bromilow, C. 2010. *Problem plants and alien weeds of South Africa.* Briza Publications, Pretoria, RSA.
- Ferrar, A.A. & Lötter, M.C. 2007. *Mpumalanga Biodiversity Conservation Plan Handbook.* Mpumalanga Tourism & Parks Agency, Nelspruit.
- Germishuizen, G. and Meyer, N.L. (eds). 2003. *Plants of southern Africa: an annotated checklist.* Strelitzia 14. South African National Biodiversity Institute, Pretoria.
- Henderson, L. 2001. *Alien weeds and invasive plants: A complete guide to declared weeds and invaders in South Africa.* Agricultural Research Council, Paarl Printer, Cape Town.
- Hennekens, S. T. and J. H. J. Schaminée. 2001. "TURBOVEG, a comprehensive data base management system for vegetation data." *Journal of Vegetation Science* 12: 589-591.
- Hill, D. and R. Arnold. 2012. *Building the evidence base for ecological impact assessment and mitigation.* *Journal of Applied Ecology* 49(1): 6-9.
- Hoffman, T. & Ashwell, A. 2001. *Nature divided: Land degradation in South Africa.* University of Cape Town Press, Cape Town.
- Kremen, C. 2005. *Managing ecosystem services: what do we need to know about their ecology?* *Ecology Letters* 8: 468-479.
- Limosella Consulting. 2015. *Wetland delineation and functional assessment for the Majuba Solar PV facility, Mpumalanga.* Internal Report prepared for Savannah Environmental.
- Mucina, L. & Rutherford, M.C. (Eds.) 2006. *The vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Mucina, L., Bredenkamp, G.J., Hoare, D.B. & McDonald, D.J. 2000. *A National vegetation database for South Africa.* *South Africa Journal of Science* 96:497-498.
- Mueller-Dombois, D. & Ellenberg, H. 1974. *Aims and methods of vegetation ecology.* Wiley, New York.

- Raimondo, D., Von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C. Kamundi, D.A. & Manyama, P.A. (Eds.). 2009. Red list of South African plants 2009. *Strelitzia* 25:1-668.
- Tichý, L. 2002. JUICE, software for vegetation classification. *Journal of Vegetation Science* 13:451-453.
- Tsoutsos, T., Frantzeskaki, N. & Gekas, V. 2005. Environmental impacts from the solar energy technologies. *Energy Policy* 33 (3): 289-296.
- Turney, D. & Fthenakis, V. 2011. Environmental impacts from the installation and operation of large-scale solar power plants. *Renewable and Sustainable Energy Reviews*, 15: 3261-3270.
- UNCCD: United Nations Convention to Combat Desertification, 1995.
- Westhoff, V. & Van der Maarel, E. 1978. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) *Classification of plant communities*. W. Junk, The Hague.

Websites:

SANBI: <http://bgis.sanbi.org/website.asp>
<http://posa.sanbi.org/searchspp.php>

ADU data bases: <http://vmus.adu.org.za>

Climate: <http://en.climate-data.org/loaction/189526/>

CJB (Conservatoire et Jardin botaniques de la Ville de Genève): AFRICAN PLANT DATABASE: <http://www.ville-ge.ch/musinfo/bd/cjb/africa/recherche.php>

Heritage Scoping Study

Archaeological Database Wits University 2009

Barnard, C. 1975. *Die Transvaalse Laeveld. Komee van 'n Kontrei*.

Becker, E. 2008. Majuba-Venus 765 kV Transmission Power Lines (EIA: 12/12/20/1157), Turn-in at the Majuba Sub- Sub-station (EIA 12/12/20/1161) Heritage Resources Specialist Report. Unpublished station (EIA 12/12/20/1161), Extension of the Majuba Sub-station (EIA 12/12/20/1161), Turn-in at the Venus Sub-station (EIA 12/12/20/1158), Extension of the Majuba report.

Bornman, H. (red.) 1979. Nelspruit: 75 in '80. Stadsraad van Nelspruit.

Du Preez, S. J. 1977. Peace attempts during the Anglo Boer War until March 1901. Magister Artium thesis in History. Pretoria: University of Pretoria.

Delius, P. 2007. Mpumalanga History and Heritage. University of KwaZulu-Natal Press.

Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies. Edited by J. S. Bergh. 1999. Pretoria: J. L. van Schaik Uitgewers.

Massie, R. H. 1905. *The Native tribes of Transvaal. Prepared for the General Staff War Office.* London: His Majesty's Stationery Office.

Mucina, L. & Rutherford, M.C. 2006. The vegetation map of South Africa, Lesotho and Swaziland. SANBI, Pretoria.

National Heritage Resources Act NHRA of 1999 (Act 25 of 1999)

Readers Digest. 1992. Illustrated history of South Africa. The Real Story. Expanded second edition: completely updated. Cape Town: Readers Digest Association.

Ross, R. 2002. *A concise history of South Africa.* Cambridge: Cambridge University Press.

SAHRA Report Mapping Project Version 1.0, 2009

Seliane, M. 2013. Amersfoort Coal Mine Phase I Cultural Heritage Impact Assessment. Unpublished Report.

South African Heritage Information System (SAHRIS)

Van der Walt, J. 2013. Heritage Feasibility study for the Proposed Witbank Dam Development on portions of the farm Rhenosterfontein 318 JS and Naauwpoort 335 JS. Unpublished report.

Van Schalkwyk, J.A. 2013. Cultural Heritage Assessment Report For The Underground Coal Gasification Project And Associated Infrastructure In Support Of Co-Firing Of Gas At The Majuba Power Station, Amersfoort, Mpumalanga. Unpublished Report

Archival Sources (National Archive, Pretoria):

GOOGLE MAPS: Rebellion Tree Memorial.

National Archives Of South Africa - Maps: 2/443_Gordonia Map_Date: 1900.

National Archives Of South Africa - Maps: 2/444_Gordonia_Map_Date: 1900.

National Archives Of South Africa - Maps: 2/444_Gordonia_Map_Date: 1900.

National Archives Of South Africa - Maps: 2/573_Upington Map_Date: 1908.

National Archives Of South Africa - Maps: 3/2460_Kenhardt_Map_Date:
Unknown.

National Archives Of South Africa - Maps: M.M.11/1639_General Plan Of Orange
River Islands Around Great Water Falls_Kenhardt And Gordonia Divisions_J.M.
Connan_Date: Sept 1923.

National Archives Of South Africa: Sab_Mlw_114_307/33.

National Archives Of South Africa: Sab_Mnw_971_Mm661/29.

National Archives Of South Africa: Sab_Nts_2823_253/302.

National Archives Of South Africa: Sab_Pmg_257_2f1b/16375/63.

National Archives Of South Africa: Sab_Uru_1743_2394.

National Archives Of South Africa: Sab_Uru_1792_1289.

National Archives Of South Africa: Sab_Uru_1893_2473.

National Archives Of South Africa: Sab_Uru_2106_1549.

National Archives Of South Africa: Sab_Uru_2159_921.

National Archives Of South Africa: Sab_Uru_2186_2390.

National Archives Of South Africa: Sab_Uru_2639_1269.

National Archives Of South Africa: Sab_Uru_2683_1517.

National Archives Of South Africa: Sab_Uru_2888_1759.

National Archives Of South Africa: Sab_Uru_3810_1406.

National Archives Of South Africa: Sab_Uru_4105_2674.

National Archives Of South Africa: Sab_Uru_4446_2029.

National Archives Of South Africa: Sab_Vwr_17_B645/44/15.

Legislation:

National Heritage Resources Act NHRA of 1999 (Act 25 of 1999)

Agricultural Scoping Study

Geological Survey, 1981. 1:250 000 scale Geological Map of 2528 Pretoria. Department of Mineral and Energy Affairs, Pretoria.

Kotze, A.V., 1986. Climate data. In: *Land types of the maps 2628 East Rand and 2630 Mbabane. Mem. Agric. Nat. Res. S. Afr.* No 5. Dept. Agric & Water Supply, Pretoria.

Soil Classification Working Group, 1991. Soil classification. A taxonomic system for South Africa. Institute for Soil, Climate & Water, Pretoria

.

Social Impact Assessment

Aucamp, I.C., Woodbourne, S., Perold, J.J., Bron, A. and Aucamp, S.-M. (2011). Looking beyond social impact assessment to social sustainability. In Vanclay, F. and Esteves, A.-M. *New Directions for Social Impact Assessments*, Cheltenham, UK: Edward Elgar.

Census 2011 Community Profiles Database. Statistics South Africa.

CSIE, DME and Eskom. 2001. South African Renewable Energy Resource Database. Available from: www.csir.co.za/environmentek/sarerd/contact.html

Franke, V. & Guidero, A. (2012). Engaging local stakeholder: A Conceptual Model for Effective Donor- Community Collaboration. *Institute for Homeland Security Solutions*.

Gert Sibande District Municipality Integrated Development Plan (2015/2016)

Gert Sibande District Municipality Spatial Development Framework (2009)

IFC. (2007). *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets*. International Finance Corporation: Washington.

Interorganizational Committee on Principles and Guidelines for Social Impact Assessment. *US Principles and Guidelines – Principals and guidelines for social*

impact assessment in the USA. *Impact Assessment and Project Appraisal*, 21(3): 231-250.

Mpumalanga Economic Growth and Development Path (2011)

Mpumalanga Provincial Growth and Development Strategy (PGDS) (2004-2014)

National Climate Change Response Green Paper (DEA, 2010)

National Development Agency (NDA). (2014). Beyond 10 years of unlocking potential. Available from: http://www.nda.org.za/?option=3&id=1&com_id=198&parent_id=186&com_task=1

National Energy Act (2008)

National Environmental Management Act 107 of 1998 (NEMA)

National Development Plan (2030)

National Integrated Resource Plan South Africa (2010-2030)

South Africa Venues. (2015). About Amersfoort. Available from: <http://www.sa-venues.com/attractionsmpl/amersfoort.php>

Solar Energy Technology Roadmap (2013)

South African LED Network (SA LED Network). (2010). Networking Practitioners Developing Local Economies. Available from: <http://led.co.za/>

State of the Environment Report (SOER). 2005. Northern Cape Province. Department of Tourism, Environment and Conservation. CSIR Environmental.

Statistics South Africa. (2014). Education: A Roadmap out of poverty? Available from: <http://beta2.statssa.gov.za/?p=2566>

Strategic Infrastructure Projects (SIPs)

The Constitution Act 108 of 1996

UNEP, 2002. EIA Training Resource Manual. 2nd Ed. UNEP.

United Nations Economic and Social Commission for Asia and the Pacific (UN). (2001). Guidelines for Stakeholders: Participation in Strategic Environmental Management. New York, NY: United Nations.

Vanclay, F. 2003. Conceptual and methodological advances in Social Impact Assessment. In Vanclay, F. & Becker, H.A. 2003. The International Handbook for Social Impact Assessment. Cheltenham: Edward Elgar Publishing Limited.

White Paper on Energy Policy of the Republic of South Africa (1998)

White Paper on Renewable Energy of the Republic of South Africa (2003)

Wetland Impact Assessment

DEPARTMENT OF WATER AFFAIRS AND FORESTRY (1999). Resource Directed Measures for Protection of Water Resources. Volume 4: Wetland Ecosystems Version 1.0, Pretoria.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY (2005): Environmental Best Practice Specifications: Construction for Construction Sites, Infrastructure Upgrades and Maintenance Works. Version 3

DEPARTMENT OF WATER AFFAIRS (2008): Updated Manual for the Identification and Delineation of Wetlands and Riparian areas.

DEPARTMENT OF WATER AFFAIRS (2010). National Water Act, 1998 (Act No 36 of 1998) S21(c) & (i) Water Uses. Version: February 2010. Training Manual.

GAUTENG DEPARTMENT OF AGRICULTURE CONSERVATION & ENVIRONMENT (2002). Gauteng Agricultural Potential Atlas. Johannesburg

GAUTENG DEPARTMENT OF AGRICULTURE, CONSERVATION & ENVIRONMENT (2012) GDARD Minimum Requirements for Biodiversity Assessments Version 3. Directorate Nature Conservation, Johannesburg.

GAUTENG DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT, (2011): Gauteng Conservation Plan Version 3 ArcGIS Spatial data

JONES, A., BREUNING-MADSEN, H., BROSSARD, M., DAMPHA, A., DECKERS, J., DEWITTE, O., GALLALI, T., HALLETT, S., JONES, R., KILASARA, M., LE ROUX, P., MICHELI, E., MONTANARELLA, L., SPAARGAREN, O., THIOMBIANO, L., VAN

- RANST, E., YEMEFACK, M., and ZOUGMORÉ R. (eds.) (2013). Soil Atlas of Africa. European Commission, Publications Office of the European Union, Luxembourg.
- KLEYNHANS, C.J. (1999). A procedure for the determination of the for the determination of the ecological reserve for the purpose of the national water balance model for South African Rivers. Institute for Water Quality Studies Department of Water Affairs and Forestry, Pretoria.
- KLEYNHANS C.J., MACKENZIE J. AND LOUW M.D. (2007). Module F: Riparian Vegetation Response Assessment Index in River Classification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 333/08
- MACFARLANE D.M., KOTZE D.C., ELLERY W.N., WALTERS D, KOOPMAN V, GOODMAN P AND GOGÉ C. (2008). WET-Health: A technique for rapidly assessing wetland health. Water Research Commission, Pretoria. WRC Report TT340/08 February 2008
- MACFARLANE D.M., TEIXEIRA-LEITE A., GOODMAN P., BATE G AND COLVIN C. (2010) Draft Report on the Development of a Method and Model for Buffer Zone Determination. Water Research Commission project K5/1789. The Institute of Natural Resources and its Associates
- MUCINA L., & RUTHERFORD M. C. (2006). Vegetation Map of South Africa, Lesotho and Swaziland, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute., Pretoria.
- NEL, J.L., MURRAY, K.M., MAHERRY, A.M., PETERSEN, C.CP, ROUX, D.J., DRIVER, A., HILL, L., VAN DEVENTER, H., FUNKE, N., SWARTZ, E.R., SMITH-ADAO, L.B., MBONA, N., DOWNSBOROUGH, L., and NIENABER, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. 1801/2/11, Water Research Commission, Pretoria.
- SCHULTZE R.E. (1997). South African Atlas of Agrohydrology and Climatology. Water Research Commission, Pretoria, Report TT82/96