ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED TUTUKA PV SOLAR ENERGY FACILITY NEAR STANDERTON, MPUMALANGA PROVINCE

DEA REF NO.: 14/12/16/3/3/2/754

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR PUBLIC REVIEW

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/754
Title	:	Environmental Impact Assessment Process Draft Environmental Impact Assessment Report for the Proposed Tutuka PV Solar Energy Facility near Standerton, Mpumalanga Province
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Client	:	Eskom Holding SOC (state owned company) Ltd
Report Status	:	Draft Environmental Impact Assessment Report for Public Review
Review Period	:	24 March 2016 – 26 April 2016

When used as a reference this report should be cited as: Savannah Environmental (2016) Draft Environmental Impact Assessment Report: Proposed Tutuka PV Solar Energy Facility near Sasolburg, Mpumalanga Province.

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 65.9 MW and associated infrastructure on a site within the Tutuka Coal Fired Power station boundary, approximately 28 km north-east of Standerton in Mpumalanga Province. This project is to be known as the Tutuka 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 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 currently proposed layout for the Tutuka 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 will provide 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 will incorporate all issues raised during the public review period of the draft report and responses provided.

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

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	**Mpumalanga Province**
District Municipality	Gert Sibande District Municipality
Local Municipality	Lekwa Local Municipality
Ward number(s)	12
Nearest town(s)	Standerton
Farm name(s) and number(s)	Pretorius Vley 374 IS
Portion number(s)	Portions 4, 10, 11 and 12
SG 21 Digit Code (s)	T0IS00000000037400004 T0IS00000000037400010 T0IS00000000037400011 T0IS00000000037400012

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

Component	Description/ Dimensions
Electricity Generating capacity	65.9MW
Extent of the proposed development footprint	Alternative site 1 - approximately 99ha, located south of the power station Alternative site 2 - approximately 36ha, located south-east of the power station
Centre Point proposed site	Alternative site 1: Longitude: 29° 21’ 11.60”E Latitude: 26° 47’ 02.18”S Alternative site 2: Longitude: 26°46'51.81"S Latitude: 29°21'58.87"E
Extent of broader site	Alternative site 1- approximately 99ha, located south of the power station Alternative site 2 - approximately 36ha, located south-east of the power station
Site access	Access to the site is provided from the R38 that runs east of the boundary of the proposed site and that connects the town of Standerton and Bethal. Internal access roads of up to 5m 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	Alternative site 1:

Component	Description/ Dimensions
	» 263360 (considering 250 Wp capacity per Polycrystalline PV module) » 627,620 PV modules (considering 105 Wp capacity per thin film PV module) Alternative site 2: » 96,000 (considering 250 Wp capacity per Polycrystalline PV module) » 228,570 PV modules (considering 105 Wp capacity per thin film PV module)
Panel Dimensions	1.638 × 0.982 × 0.04 m (considering standard crystalline 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	North facing
Number of inverters	Dependant on inverter to be used. This will be confirmed before construction. Typically it would be: » Alternative site 1: Approximately 130 inverters and height of each inverter up to 2.6 m (Assumption: 500 kW inverter per capacity) » Alternative site 2: Approximately 72 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 Alternative site– same as above
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: approximately 200 - 400 m Height of towers: maximum height of 13 m
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 be affected by the proposed activity	Chapter 5
(e)	Details of the Public Participation Process (PPP) conducted: (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
(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	Chapters 6, 7 and 8

	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	
(l)	Assessment of each identified potentially significant impact, including— (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
(m)	Assumptions, uncertainties and gaps in knowledge	Appendix D-K, Chapter 4
(n)	Reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Chapter 6;7 and 8
(o)	Environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives	Chapter 6-8
(p)	Draft environmental management programme	Appendix M
(q)	Specialist reports	Appendix D-K
(r)	Specific information required by CA	Appendix B, Table 4
(s)	Other matters required in terms of sections 24(4)(a) and (b) of the Act, i.e. NEMA section 24 (4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment- (a) must ensure, with respect to every application for an environmental authorisation- (i) coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state;	Chapter 4

	(ii) that the findings and recommendations flowing from an investigation, the general objectives of integrated environmental management laid down in this Act and the principles of environmental management set out in section 2 are taken into account in any decision made by an organ of state in relation to any proposed policy, programme, process, plan or project;	Chapter 6-8
	(iii) that a description of the environment likely to be significantly affected by the proposed activity is contained in such application;	Chapter 5
	(iv) investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts; and	Chapter 6-7
	(v) public information and participation procedures which provide all interested and 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	Chapters 4
	(b) must include, with respect to every application for an environmental authorisation and where applicable-	
	(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;	Chapter 6
	(ii) investigation of mitigation measures to keep adverse consequences or impacts to a minimum;	Chapter 6
	(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;	Chapter 6 Appendix F
	(iv) reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required	

	information; (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; (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.	Appendix M Appendix L

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: • 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.	The EIAr must include the following: GN R544 Item 18: With	Chapter 6-8

	regards to infilling and excavation of the watercourses for the construction of the PV Solar Energy Facility. The applicant must provide an indication of the preferred and alternate locations from which the material used for infilling will be source and where excavated material will be stored and or disposed off. In addition the impacts associated with this activity must be adequately assessed in the EIAr.	
iv.	The relevant authorities are continuously involved through the EIAr process	Appendix C Chapter 4
v.	The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	Chapter 6-7
vi.	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
vii.	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. 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 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: • 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 Appendix L
ix.	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.	Chapter K
x.	The EIAr must provide motivation for the applicability of Item 10 of GNR 546 and assess the impacts in the EIAr	Chapter 6
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	Chapter 2

	decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies	
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 6-8
xviii.	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Chapter 6
xix.	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Chapter 6
xx.	A shape file of the preferred development layout/footprint must be submitted to this Department.	Appendix L
	The Environmental Management Programme (EMPr) to be submitted as part of the EIAr	Appendix M

INVITATION TO COMMENT ON THE DRAFT SCOPING REPORT

This **Draft EIA Report** has been made available for public review at the following places, which lie in the vicinity of the proposed project area from **24 March 2016 – 26 April 2016**

» Thuthukani Library
» Standerton Public Library

The report is also available for download on:

» www.savannahsa.com

Please submit your comments to
Gabriele of **Savannah Environmental** PO Box 148, Sunninghill, 2157 Tel: 011 656 3237 Fax: 086 684 0547 Email: gabriele@savannahsa.com
The due date for comments on the Draft EIA Report is **26 April 2016**

Comments can be made as written submission via fax, post or e-mail.

EXECUTIVE SUMMARY

Background

Eskom Holding SOC (state owned company) Ltd is proposing to establish a 65.9MW photovoltaic solar energy facility and associated infrastructure on a site within the Tutuka coal fired power station boundary, approximately 28 km north-east of Standerton in Mpumalanga Province.

Based on a pre-feasibility analysis and site identification process undertaken by Eskom Holding, 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 Lekwa Local Municipality within the Mpumalanga Province
.

The **Tutuka 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 final Scoping Report.

Project Location

The project is portions 4, 10, 11 and 12 of the farm Pretorius Vley 374 IS located approximately 28km north-east of Standerton in Mpumalanga Province within the Tutuka Power Station.

Project Components

The facility is proposed to include several arrays of photovoltaic (PV) solar panels with a net generating capacity of up to 65.9MW. The broader site is proposed to accommodate the following infrastructure:

- Solar panels (fixed/tracking technology) with an export capacity of up to 65.9MW.
- 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 invertor/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 Tutuka power station or nearest grid connection within the Tutuka 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 will be 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 Tutuka 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 draft Environmental **Management Programme (EMPr)** included within **Appendix M**.

The most significant impacts associated with the construction, operation and decommissioning phases of the development of The Tutuka PV Solar Energy Facility (without the use of mitigation measure) are impacts on terrestrial and wetland ecology.

The sensitive areas/environmental features/issues that have been identified are presented n Figure 1 and include:

Impacts on Surface water resources:-Two wetlands were delineated on the study site both being unchannelled valley-bottom wetlands. The two wetlands in the study site are very similar in their function, type and ecology. They

merge shortly downstream of the study area and as such they were assessed as one wetland for the purpose of these assessments.

The wetlands encroach onto the western section of Alternative Site 1 and the southern section of Alternative Site 2. From a wetland function point of view, development should ideally be confined to the central portion of Alternative Site 1, or the northern portion of Alternative Site 2. Alternative Site 1 is considered the most favourable for development of the PV facility since less wetland habitat will be lost. Overall the wetlands on site are largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred. The ecological importance and sensitivity suggests that wetlands in this category are considered to be ecologically important and sensitive on a provincial or local scale.

The overall impact on wetlands is likely to be of a medium significance prior to mitigation. This could be reduced to low negative significance following the implementation of mitigation measures, i.e. avoidance of the wetlands and associated 30 m buffer set to protect wetland functionality. With the proposed buffer, the proposed site is considered acceptable for development.

Impacts on Ecology:-

The Tutuka PV Solar Energy facility development will not have significant impacts on the above-ground ecology of the site if all mitigation measures are followed, especially if listed alien invasives can be reduced. If 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. Potentially significant negative impacts on the ecological environment will occur if remaining portions of high diversity natural vegetation will be further disturbed – these sections should be avoided. 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, 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.

The overall impact on the ecology (including flora and fauna) is likely to be of a medium significance prior to mitigation. This impact could be reduced to low-medium significance following the implementation of mitigation measures. 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.

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. Considering that displacement through habitat destruction is potentially the most significant impact associated with the construction of solar energy facilities, a significant proportion of Alternative Site 1 is comprised of areas that represent systems with high connectivity and possibly important bird flight paths with high bird diversity. However sufficient similar habitat is available within the broader study area, so it is highly unlikely that the displacement impact will be of regional or national significance. Both sites are considered acceptable for development with the implementation of the proposed mitigation measures. However, it is recommended that the proposed Tutuka PV Energy Solar Facility be developed at Alternative Site 2.

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 Tutuka 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 most important potential social benefits associated with the construction and operations of the project refer to the job opportunities and possible socio-economic spin-offs created. New economic activities such as this project having the potential to assist with the developmental challenges that much of province is faced with, providing employment and skills development to local community and contributing to the social, economic and institutional development of the local area. The benefit of employment opportunities and disposable income in the local project area has the opportunity to improve levels of health, education and service delivery with the exposure to such opportunities. Additional employment and associated indirect economic benefits will maintain and improve the quality of life of these communities. The main negative impacts are associated with the influx of in-migrants and intrusion impacts associated with the construction phase.

Visual / Social Receptors: Both alternative sites will be visible to a small number of farmsteads / farm workers houses, the R38 and a small section of the local road that is located to the west of the power station. It is also possible that alternatives may be visible to a short section of the R38, however, this view is likely to be of short duration and it is unlikely that the partial view of either development would be recognisable. Alternative 2 will also be developed alongside the R38 and therefore will take industrial development almost up to the road edge. It will therefore have a greater impact than Alternative 1 on this regional route. Both alternatives will have minor impacts on the local route to the west of the power station and the flight path approaches to the adjacent landing strip. The overall visual impact is likely to be of a low-medium significance.

Cumulative effects:

There are no renewable project development sites within a 30km radius of the proposed Tutuka PV Solar Energy Facility. In general, Cumulative impacts of the proposed Tutuka 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 impacts on wetlands, ecology and avifauna, are likely to be of a medium significance prior to mitigation. This could be reduced to low-medium negative significance with the implementation of the proposed mitigation measures.

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.

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

In order to connect the Tutuka PV Solar Energy Facility to the power grid, the Eskom intends on building on-site substation and power line 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, potential impacts on heritage sites and visual impacts. There are no fatal flaws associated with the associated infrastructure of the Tutuka PV Solar Energy Facility site.

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 the areas identified as being of high sensitivity and no-go areas. As recommended in the Wetland assessment the PV facility has been confined to the central portion of Alternative Site 1, in order to maintain optimal wetland functionality. This refinement of the layout has resulted in the repositioning of the PV facility outside of identified sensitive and a decrease in the net generating capacity, from 65.9 MW to 23 MW. This refined layout will still be able to meet the main objective of supplementing Eskom's self consumption at the Tutuka Power station. The required mitigation measures are illustrated in 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 Tutuka 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. Alternative Site 1 is anticipated to have the least significant impact on ecological resources and generate greater positive impacts from a Social perspective (in terms of economic impact and jobs). In terms of this conclusion, the EIA project team support the decision for environmental authorisation on Alternative site 1 on condition that the facility layout is optimised to include 30 m buffer zones around the wetland sensitivities identified as presented in Figure 2.

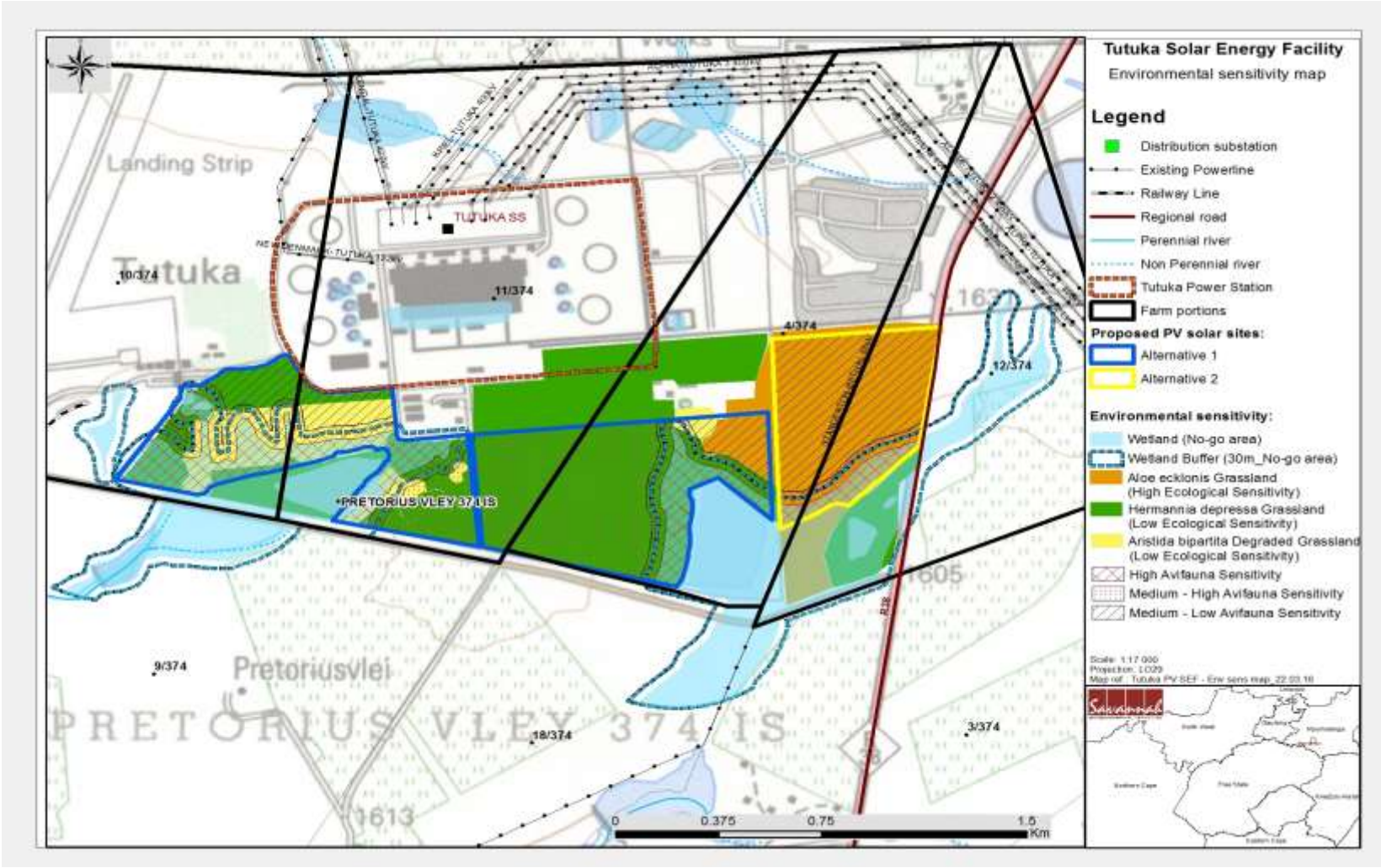

Figure 1: Environmental sensitivity map of the proposed Tutuka PV Solar Energy Facility

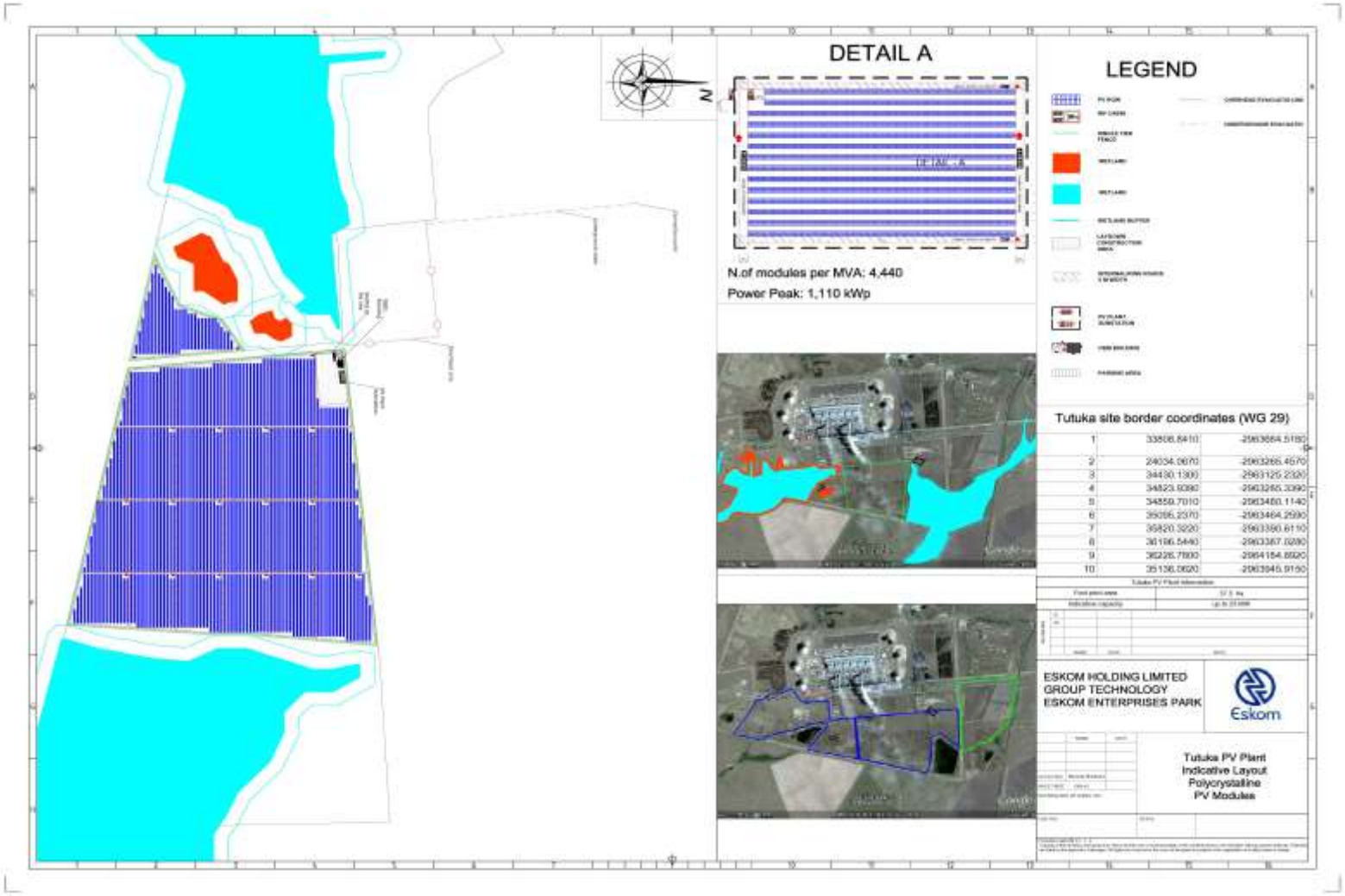

Figure 2: Optimised Layout of the Tutuka PV Solar Energy Facility

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APPENDIX LIST

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 though 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 65.9 MW and associated infrastructure on a site within the Tutuka Coal Fired Power station boundary, approximately 28 km north-east of Standerton in Mpumalanga Province (Refer to Figure 1.1). This project is to be known as the Tutuka 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 within 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 Draft Environmental Impact Assessment Report.

1.1. Background to the project

The Tutuka Solar Energy Facility is proposed on portions 4, 10, 11 and 12 of the Farm Pretorius Vley 374 IS, located in the jurisdiction of Gert Sibande District Municipality and Lekwa Local Municipality within the Mpumalanga Province. A study area of approximately 99 ha just south of the Tutuka Power Station (alternative site 1), with an additional 36 ha south-east of the power station (alternative site 2) is being investigated (Refer to Figure 1.1) through this EIA process. 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). Access to the site is provided from the

R38 that runs east to the boundary of the proposed site and that connects the town of Standerton and Bethal.

The facility is proposed to include several arrays of PV solar panels with a net generating capacity of up to 65.9 MW. The broader site is proposed to accommodate the following infrastructure:

» 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 invertor/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 Tutuka Power Station substation or nearest grid within the power station footprint.
» 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 Tutuka 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.

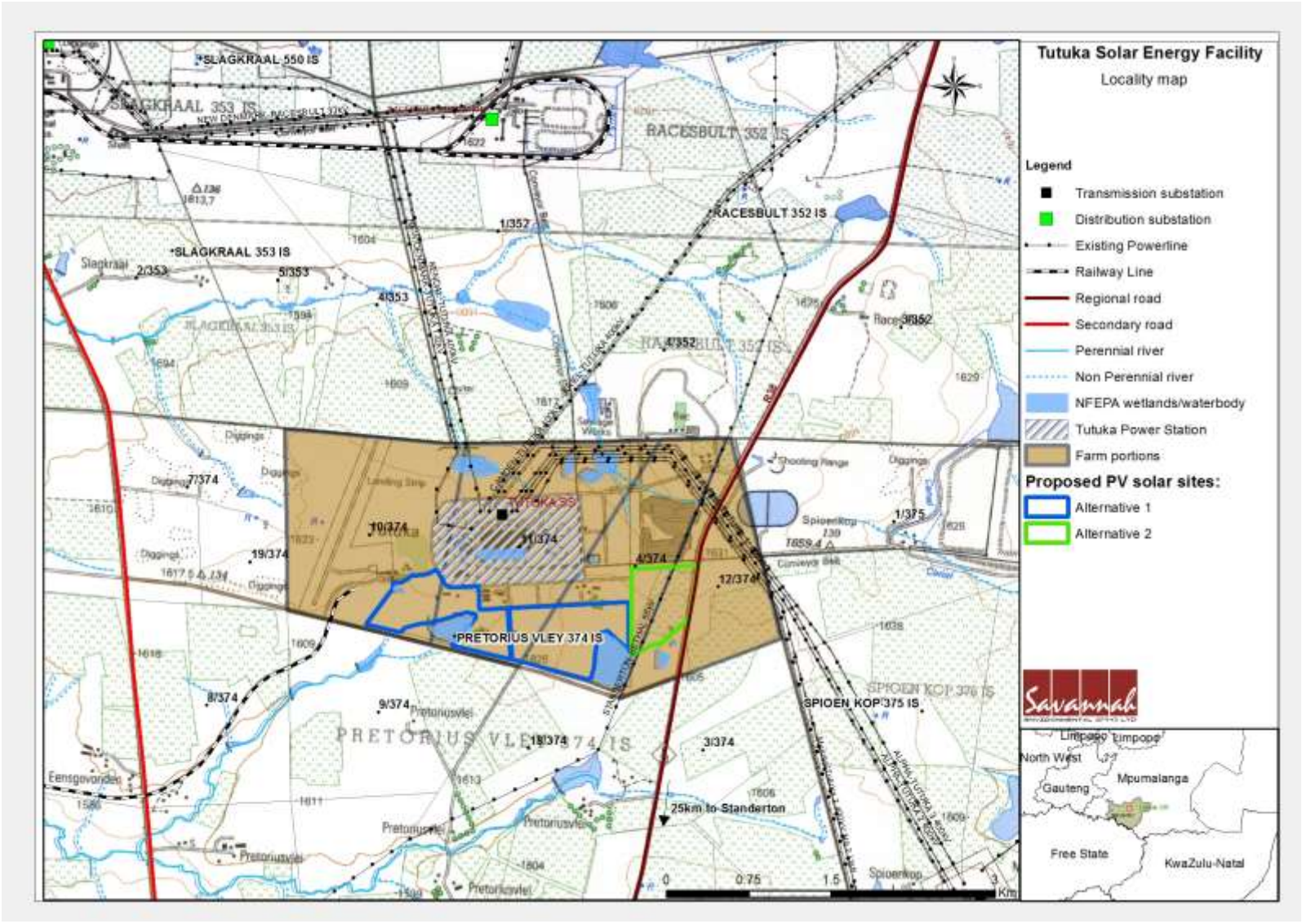

Figure 1.1: Locality Map for the Tutuka PV Solar Energy Facility

Table 1.1: Detailed description of the project site

Province	**Mpumalanga Province**
District Municipality	Gert Sibande District Municipality
Local Municipality	Lekwa Local Municipality
Ward number(s)	12
Nearest town(s)	Standerton
Farm name(s) and number(s)	Pretorius Vley 374 IS
Portion number(s)	Portions 4, 10, 11 and 12
SG 21 Digit Code (s)	T0IS00000000037400004 T0IS00000000037400010 T0IS00000000037400011 T0IS00000000037400012

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 Tutuka 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 Tutuka Solar PV Facility can be constructed at either alternative PV 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, additional on-site substations and operations building.

Ecologically sensitive areas on the site – The Mpumalanga Biodiversity Conservation Plan classifies the western half of the study area as of Least Concern, whilst the roughly the eastern half of the study area is considered Important and Necessary for meeting biodiversity targets. 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, on especially the eastern part regarded as Important and Necessary to meet Mpumalanga Biodiversity Targets, needs to be assessed in detail to correctly identify its conservation status/irreplaceability rating.
- Depending on the state of the vegetation in the eastern portion of the study area, all or parts thereof may not be regarded suitable for the proposed development.
- All indigenous and alien invasives, weeds and potential invasives 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 invasives.
- Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed.
- Soils are prone to capping and erosion and need to be stabilised by a permanent grass or suitable indigenous vegetation layer.

Many of the naturally occurring grass species become moribund and die off if not grazed or burnt regularly. It is thus recommended to implement a regular mowing program (to replace the effect of grazing and burning) to reduce dead biomass accumulation on grass tufts. This will also greatly reduce the risk of fire, which is a natural component of grassland dynamics.

Heritage and palaeontology –
This scoping study revealed that very few known heritage sites occur in the larger region but this can be attributed to a lack of research in the area. Every site is relevant to the Heritage Landscape, but it is anticipated that no site in the study area could have conservation value.

The palaeontology desktop study did not identify any paleontological reason to prejudice the progression of the Tutuka PV Solar Energy Facility within either the alternative locations, subject to the recommended damage mitigation procedures being enacted. The geological strata underlying the project area will be restricted to the Early Permian Vryheid Formation; this geological unit is known to be fossiliferous. The probability of the project resulting in a negative impact on the palaeontological heritage of the Vryheid Formation has been assessed as moderate.

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 occur in the study area however this assumption will have 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 with in a development. These sites can how ever be relocated if conservation 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 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 possibility of moderate potential agricultural soils in the vicinity of the site, this impact would in all probability have a degree of significance, although local in extent.

» Social impacts**:** The most important potential social benefits associated with the construction and operations of the project refer to the job opportunities and possible socio-economic spin-offs created. New economic activities such as this project having the potential to assist with the developmental challenges that much of province is faced with, providing employment and skills development to local community and contributing to the social, economic and institutional development of the local area. The benefit of employment opportunities and disposable income in the local project area has the opportunity to improve levels of health, education and service delivery with the exposure to such opportunities. Additional employment and associated indirect economic benefits will maintain and improve the quality of life of these communities. Continued investment in the project area will also support development. The main negative impacts are associated with the influx of in-migrants and intrusion impacts associated with the construction phase and the visual impact of the facility and associated infrastructure while in operation, with possible subsequent negative social consequences and/or impacts.

» Visual / Social Receptors - The brief assessment undertaken for the scoping stage indicates that because the project is proposed against the backdrop of the Tutuka 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 and associated infrastructure are generally unlikely to be significant.

In terms of possible landscape degradation, the landscape does not appear to have any specific protection or importance 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.

In terms of visual intrusion or obstruction impacting on visual receptors, the initial investigation indicates that generally these impacts are not likely to be significant. However, there are a number of homesteads in close proximity to the proposed development and impacts on these needs to be investigated in detail in the field.

Whilst visual impacts are indicated as likely to be low, due to the nature of the proposed development and the fact that there is potential to impact on a reasonably cohesive rural landscape, a detailed assessment is recommended.

» Cumulative effects - There are no other solar developments in the study area but the presence of the existing Tutuka 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 depressions, seepage areas and wetlands such as dams and vleis, as well as possibly intact natural vegetation as shown in **Figure 1.2**. It was recommended that infrastructure should be placed so as to consider the identified sensitive areas to minimise impacts. Subsequently, the sensitive environmental features that were identified during the Scoping phase have been taken into consideration through the layout design of the solar energy facility by the developer. The proposed layout of infrastructure is discussed further in Chapter 2.

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.

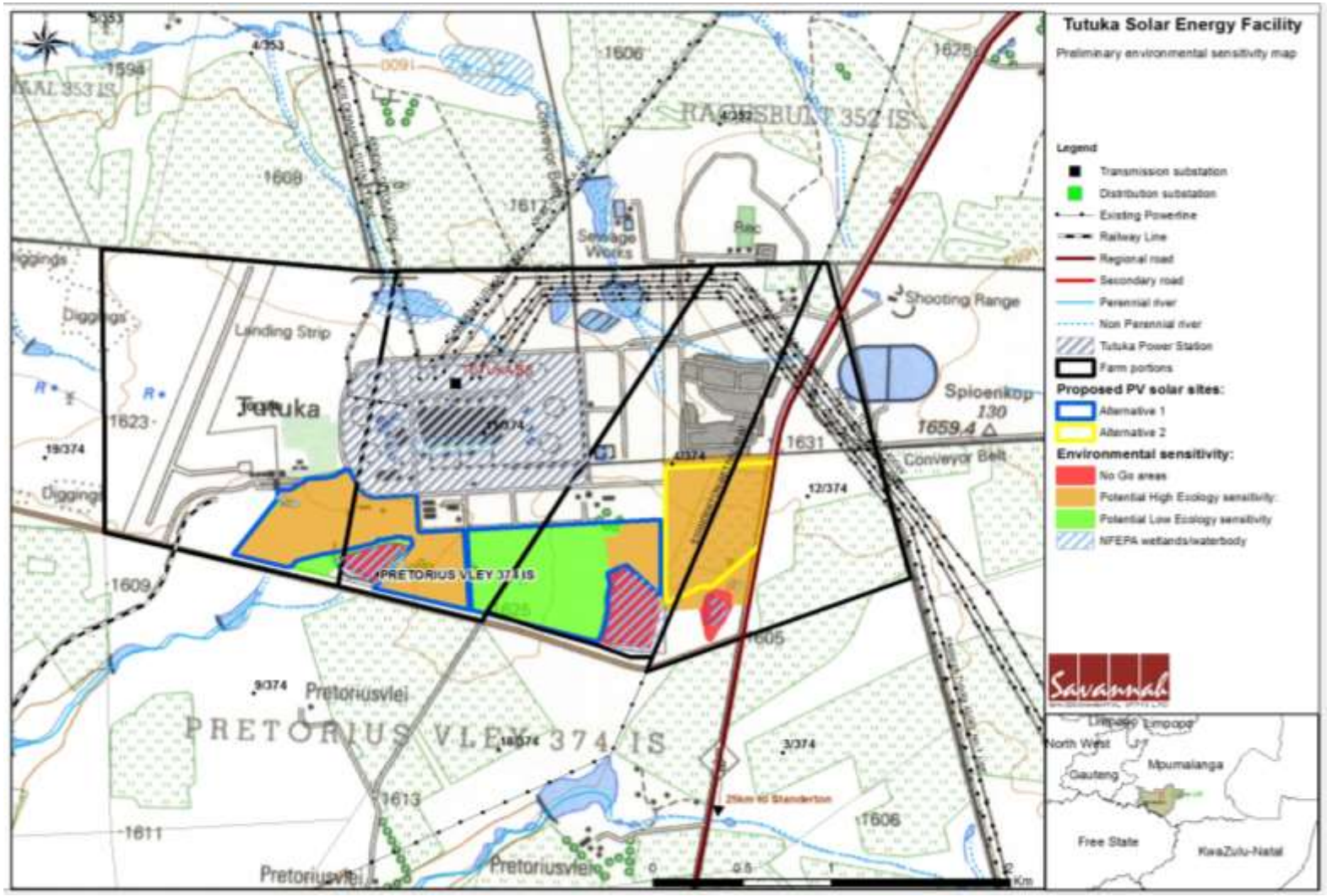

Figure 1.2: Scoping Environmental Sensitivity Map for the proposed Tutuka Solar Energy alternatives sites showing sensitive ecological areas and potential wetlands.

1.3. Requirement for an Environmental Impact Assessment Process

The construction and operation of the proposed Tutuka 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.

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 (DEA[1]) is the competent authority for this project. An application for authorisation for Tutuka PV Solar Energy Facility has been accepted by the DEA (under Application Reference number: 14/12/16/3/3/2/754). 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 consultant to undertake the required EIA process for Tutuka 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

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

included both government authorities and interested and affected parties (I&APs) was included in the evaluation of impacts.

The EIA Phase of the process aimed to assess those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of 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 currently proposed layout for the Tutuka 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 will provide 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 will incorporate 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 Tutuka 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 over 7 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.
- *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)
- 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 – Barry Millstead (BM Geological Services)

» 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 Tutuka 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 Tutuka 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 65.9 MW presented in this report represents the maximum estimated PV capacity at Tutuka Power Station.

As can be seen in the above paragraph, 65.9 MW for Tutuka is way above the capacity allocated for self-consumption (8 – 12 MW) at Tutuka. The Program is also exploring to construct maximum available capacity if Eskom would be permitted to develop a project and connect into the national grid. Currently, Eskom is not permitted to feed into the national grid.

Receptiveness of the site to development of a PV Facility

The Tutuka PV Solar Energy Facility is proposed on portions 4, 10, 11 and 12 of the Farm Pretorius Vley 374 IS in the jurisdiction of Gert Sibande District

Municipality and Lekwa 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 Tutuka PV Solar Energy Facility, 98.8 ha ha of land is available for the development footprint of Alternative 1 and 2 within the Eskom-owned property.
» Power transmission considerations: A power line to facilitate the connection of the solar energy facility from the onsite substation to a substation/power line located within the Tutuka power station. The length of transmission line connecting to the Tutuka power station is estimated to be between 500 – 1000 m. The connection point will be either at HV yard within power station or at station board. However, the project is going to apply for grid connection through grid access unit, which identifies the alternative grid connection point. The project will determine the exact connection point for alternative options, at a later stage.
» Site access: Access to the site is provided from the R38 that runs to the east of the boundary of the proposed site and that connects the town of Standerton and Bethal. 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 Tutuka PV site is characterised by three distinctive land uses**:**
    * **Heavy industrial development** includes the adjacent Tutuka Power Station with its associated conveyors and stockpiles and the adjacent New Denmark Coal Mine.
    * **Urban development** including the small settlement of Thuthukani which lies approximately 5km to the west of the proposed alternative development sites. This settlement largely houses workers from the power station and adjacent mine facilities.
    * **Agricultural development** is the main development type surrounding the proposed site. There is a mixture of arable agriculture and grazing land. Within the agricultural landscape there are several groups of buildings including homesteads and groups of farm workers' cottages.
» Topographic conditions: The site is relatively flat to slightly undulating. Within close proximity of the site are several valley floor wetlands (vleis), of which one has been expanded to form a dam for farming purposes. The soils are expected to be mainly dark cracking clay soils with a high swell-shrink potential, being plastic and sticky when wet. Fertility is high, but due to

occasional seasonal inundations, soils may not always be suitable for crop-based agriculture.

» Proximity to towns with a need for socio-economic up-liftment: The Mpumalanga Province, like most of South Africa, is marred by unemployment, inequalities and poverty. To this extent the Tutuka PV Solar Energy Facility is situated in close proximity to Standerton which serves as the urban node, of the Lekwa Local Municipality. Standerton is a large commercial and agricultural town lying on the banks of the Vaal River. Most of the semi-urban areas within the municipality may be defined as hubs which are fundamentally distribution centres for the rural areas providing a moderate range of services and economic activities. There are only two hubs in the municipal area, namely Thuthukani Village and Morgenzon. The proposed development is situated near the Thuthukani Village. Thuthukani is located some 18km North-East of Standerton and it began essentially as a workers village for the Tutuka Power Station which is situated about 3km east of the Village. It is divided into two main sections namely, the eastern section belonging to Eskom and the western section owned by New Denmark Mining Company (part of Amcoal Group). 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 up-liftment. 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, reduces 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 Tutuka 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. Lekwa Integrated Development Plan (IDP) (2013-2014)

The municipality identified a number of challenges and constraints which impact on the way the municipality functions and fulfils its mandate as per section 152 of the South African constitution. Challenges confronting the municipality include a declining revenue base and poor management of resources, inefficiencies that limit the manner in which the municipality interface with the communities, aging infrastructure due to truck haulage and deferred maintenance, structural inefficiencies that result in poor service delivery standards, low economic growth and high unemployment rate, vulnerable environmental assets and natural resources. To address the identified challenges the municipality has identified the **following long- term** strategic objectives these are as follows: ;

- » Build local economies to create more employment, decent work & sustainable livelihoods
- » Improve service and broaden access to them
- » Promote more active community participation in local government
- » Ensure more effective, accountable and clean local government that works with
- » Build more united, non-racial, integrated and safer communities

Over the next five year term (short-term) the municipality will concentrate on the nine strategic focal areas outlined below:

1. *Equitable provision of services* (In the next five years the municipality will ensure that residents have equal access to services they are entitled to).
2. *Creation of integrated and sustainable human settlement* (The focus over the past has been on delivering basic needs and housing)
3. *Creation of a linked ecological open space*
4. *Delineation of an urban edge*
5. *Establishment of an efficient access and integrated mobility*
6. *Creation of a functional hierarchy* (development needs to be concentrated and directed to specific nodes and that higher densities should be encouraged)

7. *Financial and environmental sustainability*
8. *Effective and good governance*
9. *Boosting the local economy and job creation:* The municipality acknowledges that low economic growth and high unemployment rate are still prevalent and present a major challenge. These further translate to relatively high levels of poverty which is widespread within the LLM. High dependency ratio (11700 households living below poverty lines), Low literacy and education levels, a relatively high Gini coefficients or high levels of income inequality, labour dependency ratio, which indicates the number of persons that each economically active person has to support, is 3.88 prove some serious treats to the future development of the local economy. The main focus of the municipality is placed mainly on the following:
    - Promote and support sustainability of existing businesses.
    - Promote small and micro sized rural enterprises.
    - Tourism growth and promotion
    - Creation of job opportunities.
    - Industries to support SMME activities.
    - Improve skills development.
    - Increase the revenue potential of the Municipality.
    - Develop the business potential of the area.
    - Establish the municipality as one of preference for national and international visitors.

The municipality has a number of challenges; one of the main challenges includes low economic growth, high unemployment rate and poverty. The municipality has developed a number of long-term and short-term goals to address these challenges. In terms of the municipality's long-term objectives, the proposed development will contribute to LLM 1 through building the local economy by introducing a relatively new industry that will create employment opportunities, decent work and sustainable livelihoods. In terms of the short term objectives the project will be in line with the ninth strategic focal area through employment opportunities and contributing towards improving skills development.

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 Tutuka 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 Tutuka PV Solar Energy Facility 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, and education and employment opportunities in this area, as identified in these planning documents. The Tutuka 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 Tutuka 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 Tutuka Solar Energy Facility proposed on portions 4, 10, 11 and 12 of the Farm Pretorius Vley 374 IS 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 and technical perspective (refer to Section 2.1) 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.

The findings of the review of the relevant policies and documents pertaining to the energy sector, as detailed in this chapter, indicate that solar energy and the establishment of the Proposed Tutuka 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.

2.5. 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.

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 describe the alternatives considered for this project.

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, Tutuka, Tutuka, Matimba, Tutuka, Camden, Komati and Ingula. The sites within the Arnot, Duvha, Tutuka, Tutuka 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.

From the outcome of this screening study it was concluded by Eskom that the Tutuka Power Station has land available for a large PV facility. The land is flat with little vegetation but with some wild dominant animals present at the proposed alternatives. This could have some environmental impact but may also be beneficial in keeping the animals in the area so as to control the growth of the grassland. There was support offered from the power station personnel in accepting to install PV at the power station as well as providing the required information. Although there are only two sites identified there is great potential at the power station and the personnel are very supportive of the PV project being developed.

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

2.6.2. Layout and Design Alternatives

Two alternative PV layouts have been identified through the scoping process. These have been assessed further in this EIA report, and are discussed below as follows:

» **Alternative PV site 1 –** This layout is located in the southern section of the study area. There are a number of wetland areas on and adjacent to the southern and western portion of the study area.
» **Alternative PV site 2** – This layout is located in the south-eastern section of the study area. The ecological state of the vegetation is regarded as important and necessary to meet Mpumalanga Biodiversity Targets. This has been confirmed during the field study with a high abundance of some

protected plant species. This area is therefore not preferred for a PV development.

In the initial design, the Alternative 1 PV facility was proposed to include several arrays of PV solar panels with a net generating capacity of up to 65.9 MW. However, the detailed EIA studies undertaken informed the planning process to avoid environmentally sensitive areas as far as possible. Due to site sensitivities and presence of the wetlands and sensitive areas highlighted in the scoping phase, the layout of the PV solar panels and associated infrastructure has been re-designed to include PV solar panels with a net generating capacity of up to only 65.9 MW, to be installed outside the 30 m buffer from the wetlands (**Figure 2.1**). This is considered to be the preferred design layout as it allows for the avoidance of identified sensitive areas, and it is this layout which is assessed within this EIA Report.

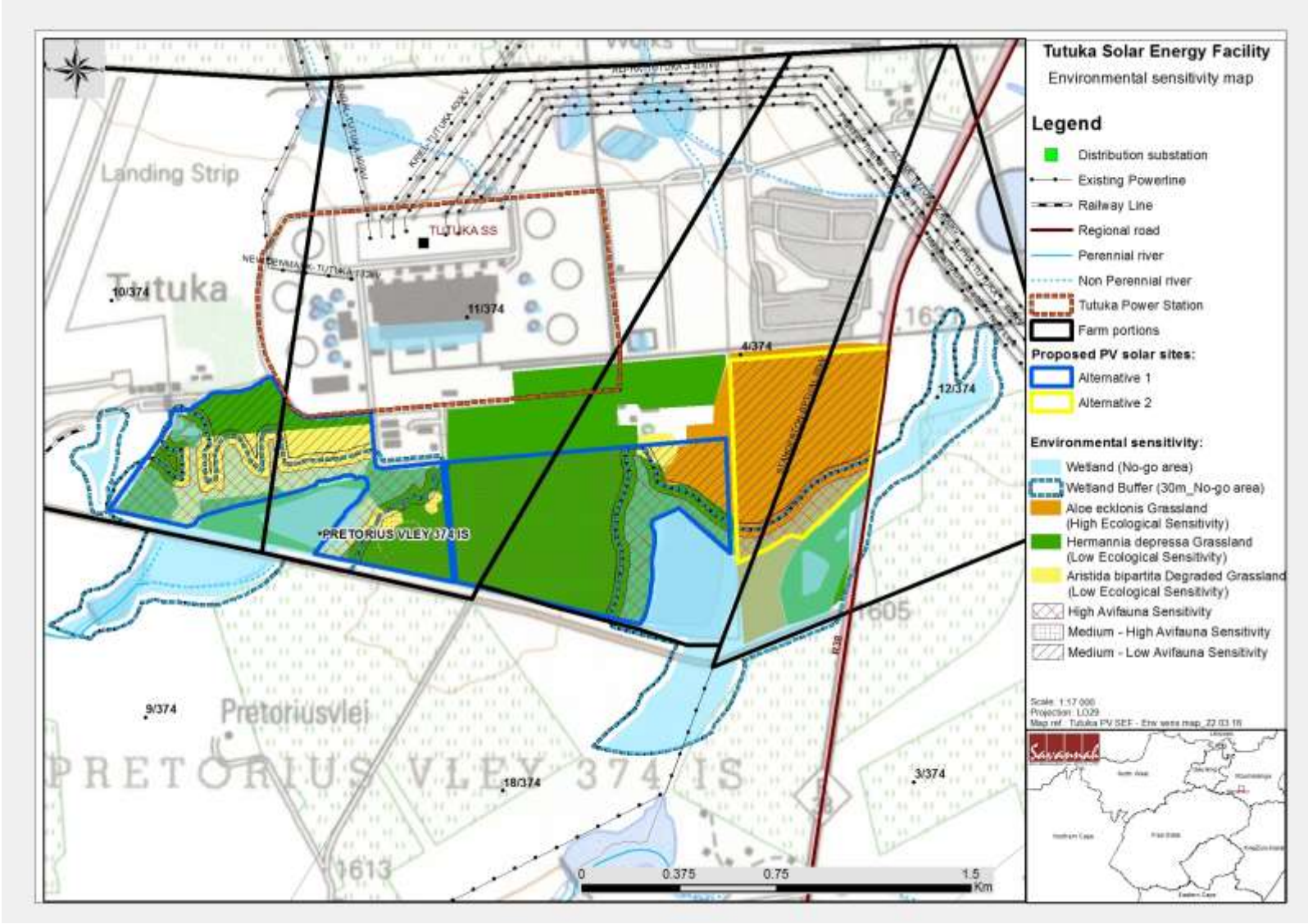

Figure 2.1: Tutuka PV Solar Energy Facility Layout in relation to Ecological Sensitivity

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 Tutuka PV Solar 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 a net generating capacity of 65.9 MW. An area of up to 99 ha in extent will be occupied by the PV panels and associated infrastructure. A layout of the proposed Tutuka PV Solar Energy Project and associated infrastructure has been provided by Eskom, 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 Tutuka 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 65.9 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 Tutuka 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.

[2]**Table 2.1:** The position of the planned infrastructure

65.9 MW facility project site	Latitude	Longitude
Corner (as indicated on Figure 2.2)	**Y(m)**	**X (m)**
1	33808.8410	-2963664.5160
2	24034.0670	-2963265.4570
3	34430.1300	-2963125.2320
4	34823.9390	-2963285.3390
5	34859.7010	-2963480.1140
6	35095.2370	-2963464.2590
7	35820.3220	-2963390.6110
8	36196.5440	-2963387.0280
9	36226.7800	-2964184.8920
10	35136.0620	-2963945.9150

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

Component	Description/ Dimensions
Location of the site	Portions 4, 10, 11 and 12 of the Farm Pretorius Vley 374 IS, in the jurisdiction of Gert Sibande District Municipality and Lekwa Local Municipality within the Mpumalanga Province
SG Code	T0IS00000000037400004 T0IS00000000037400010 T0IS00000000037400011 T0IS00000000037400012
Project development footprint	Alternative site 1: 99 ha Alternative site 2: 36 ha
Proposed technology	Static or tracking photovoltaic

[2] Table 2.1 only shows the position of the preferred layout plan, i.e. Alternative 1

Component	Description/ Dimensions
Export capacity	Alternative site 1: 65.9 MW Alternative site 2: 24 MW
Height of installed panels from ground level	Static - up to 3.5 m Tracking – single/double axis up to 6 m
Access road	Access to the site is provided from the R38 that runs to the east of the boundary of the proposed site and that connects the town of Standerton and Bethal. Internal access roads of up to 5-8 m wide will also be required.
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
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 2.3). 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.

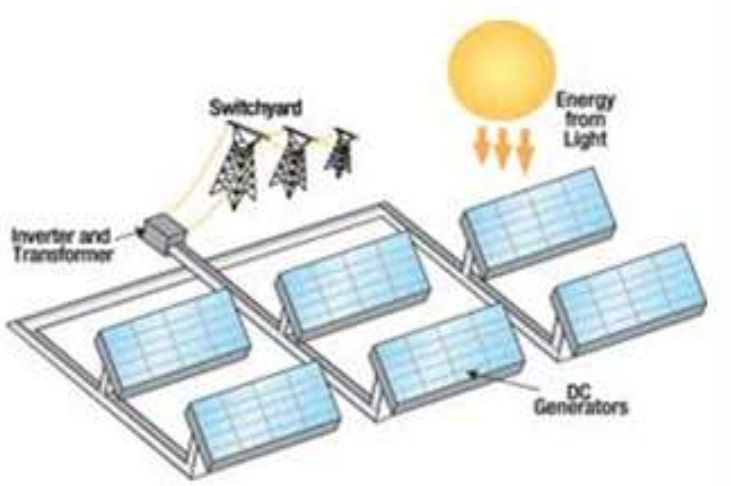

Figure 2.3: Schematic diagram of a PV plant (Sourced from: http://www.solar-green-wind.com/archives/tag/solar-cells)

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 2.4** and **Figure 2.5**. The PV panels are designed to operate continuously for more than 25 years with minimal maintenance required.

Figure 2.4: Picture of a PV Modules (75 MW plant in Kalkbutt South-Africa Source: SMA)

Figure 2.5: 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 2.6**) 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 2.7)**. 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 2.6: Image of a typical inverter

Figure 2.7: 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 2.8**).

Figure 2.8: 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 Tutuka PV Solar Energy Facility will require the use of water during its construction and operation phases. The water requirement for the project is anticipated to be approximately 100 m^3 per day over the construction period. Approximately 6 500 m^3 per annum for a 20-year operational lifespan of the solar energy facility is required for maintenance (cleaning panels) during the operational phase. This will be acquired from the Tutuka Power Station adjacent to the proposed project.

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 Tutuka 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 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 these are as follows:

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)[3] 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.

Establishment of Access Roads to the Site

The site can be accessed from the R38 that runs east to the boundary of the proposed site and that connects the town of Standerton and Bethal. Within the site itself, access is already established and is used for the power station. Where possible, these existing roads will be utilised for construction purposes (and later limited access for maintenance). Internal access roads between the project components will 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.

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 2.9**). 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] A permit will be required for the transportation of these abnormal loads on public roads.

3.5 m for fixed mounted structures. In case of single/dual axis structures, the height of Panel Structure, can reach up to 6 m.

Figure 2.9: Frame, structural details (Lased 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 ~3-8 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 6 500 m^3 per annum would be required during the operational phase. This will be acquired from the Tutuka 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 dissembled 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

At the end of the PV plant operational life time, will start a dismantling phase of all structures to re-establish the original condition of the site before the PV plant installation.

The following elements/materials will be removed from the site:

» Steel/aluminium mounting structure elements and concrete foundation (if any)
» PV modules, Inverter, transformers and all electrical equipment which were needed for the PV plant operation;
» Metal fence including:
    - fence mounting structure
    - concrete foundation (if any)
    - Gates
» Inverters and O&M buildings including the concrete foundation
» Electrical wire

All equipment such as electrical equipment like PV modules, inverters, transformers and other electrical tools will be recycled. All elements which cannot be recycled like concrete mounting structures foundation (if any) and inverter cabin foundation will be dumped into authorized dump. Then, the restoration of the site to the original condition will be completed by removing all residual materials like concrete fragments etc. as well as removing all transporting means form the site. All these activities need to be carried out according to the local/national prescription related to the waste disposal regulation.

REGULATORY AND LEGAL CONTEXT CHAPTER 3

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.

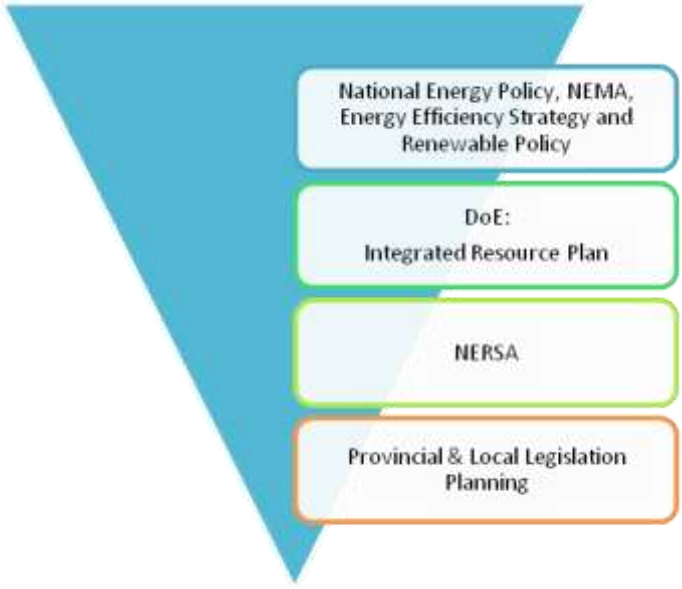

Figure 3.1: Hierarchy of electricity policy and planning documents

3.1.1The Kyoto Protocol, 1997

South Africa's electricity is mainly generated from coal-based technologies. South Africa accounts for ~38 % of Africa's CO_2 (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.

3.1.2 White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)

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.

3.1.3 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.

3.1.4 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.

3.1.5 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.

3.1.6 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.

3.1.7 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.

3.1.8 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 authority 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 Lekwa 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).
» Lekwa 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.

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

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	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. 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. 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.	National Department of Environmental Affairs – lead authority. Mpumalanga Department of Economic Development, Environment and Tourism	The final EIA report is to be submitted to the DEA and Provincial Environmental Department in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	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. 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.	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 Department of Economic Development, Environment and Tourism 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)	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). Consumptive water uses may include the taking of water from a water resource and storage - Sections 21a and b. 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.	Department of Water & Sanitation (DWS)	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 flood line whichever is greatest).
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	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. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.	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
	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.		
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as "priority areas" in terms of air quality. Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 32 makes provision for measures in respect of dust control. Section 34 makes provision for: (1) the Minister to prescribe essential national noise standards - (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise	National Department of Environmental Affairs – air quality Local Municipality - Noise	No permitting or licensing requirements applicable for air quality aspects. 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. 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. The Act provides that an air quality officer may require any person to

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	(ii) the maximum levels of noise (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.		submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » 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. 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 m^2; or the re-zoning of a site exceeding 10 000 m^2 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. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38.	» 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	An HIA has been undertaken for the project (Appendix F) Based on the results of the study there are no significant archaeological risks associated with the proposed solar facility. A chance finds procedure will be implemented should graves be discovered.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	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)	» 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). » The Department of Environmental Affairs (DEA)	National Department of Environmental Affairs	A specialist flora and fauna assessment has been undertaken for the proposed project (Appendix E). All 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

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	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		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» 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: » 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 flood line 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.	Department of Agriculture	» 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.
National Forests Act	» Protected trees: According to this Act, the Minister	Department of Environmental	A permit or license is required for

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
(Act No. 84 of 1998)	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.	Affairs	the destruction of protected tree species and/or indigenous tree species within a natural forest. 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.
National Veld and Forest Fire Act (Act 101 of 1998)	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. In terms of S17, the landowner must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Environmental 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 importation, manufacture, sale, use, operation,	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 Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	modification, disposal or dumping of such substances and products. » 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. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	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. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 921), a Basic Assessment or Environmental	Hazardous Waste – National DEA General Waste – Mpumalanga Department of Economic Development, Environment and Tourism	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).

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers, in which any waste is stored, are intact and not corroded or in any other way rendered unlit 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.		
National Road Traffic Act (Act No 93 of 1996)	» 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. » The general conditions, limitations, and escort	Provincial Department of Transport (provincial roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » 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 configuration and height when

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	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.		loaded, some of the power station components may not meet specified dimensional limitations (height and width).
Provincial			
Mpumalanga Biodiversity Conservation Plan.	» The Mpumalanga Biodiversity Conservation Plan contains various classes of environmental features of conservation value, such as protected areas; irreplaceable areas etc.	Mpumalanga Department of Economic Development, Environment and Tourism	Environmental features of conservation value and mapping of critical biodiversity areas is provided in this document.

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:

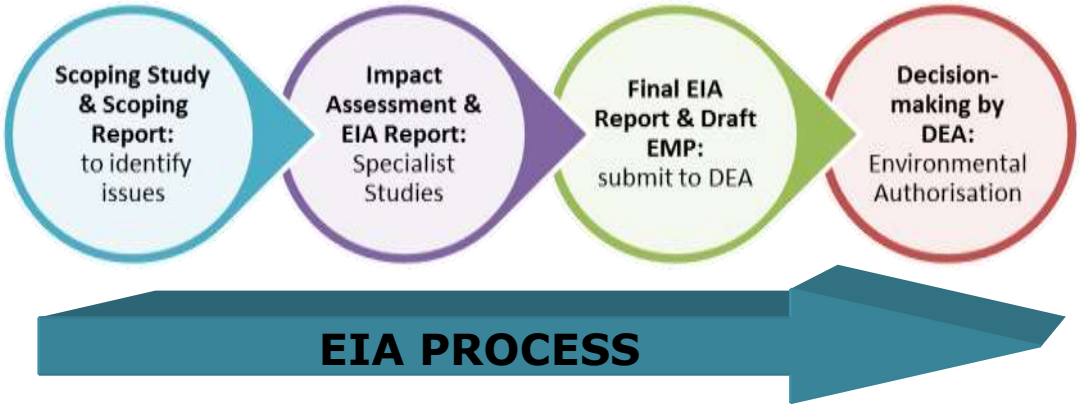

Figure 4.1: The Phases of an EIA Process

The EIA process for the proposed Tutuka PV Solar Energy Facility is being undertaken in accordance with the Section 24 (5) of the National Environmental Management Act (No 107 of 1998). In terms of the EIA Regulations of June 2010 (GNR 543 - 546), 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 4.1.**

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

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
GN 544, activity 10 The construction 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 275kV;	GN983, activity 11 (i) 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	An overheard power line and on-site substation will be constructed to connect the PV facility to the Eskom grid
GN 544, activity 11 The construction of: **(xi)** infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse.	GN983, activity 12 The development of (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse, or c) within 32m of a watercourse	The PV facility will include the construction of buildings (workshop area and site office) and infrastructures (underground cabling, panels) within 32 metres of a watercourse.
GN 544, activity 18 The infilling or depositing of any material of more than 5 cubic metres into, or the	GN983, activity 19 The infilling or depositing of any material of more than 5 cubic metres into, or the	Construction of the PV facility may require the infilling or excavation and removal of soil of more than 5 cubic metres from a

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from **(i)** a water course	dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse	watercourse.
GN 544, activity 22 The construction of a road, outside urban areas, Where no road reserve exists where the road is wider than 8 metres **(i)** Where no road reserve exists where the road is wider than 8 m;	GN983, 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	The facility will require construction of new access roads. These will exceed 8 metres in width in some instances.
GN 544, activity 47 The widening of a road by more than 6 metres, **(ii)** Where no reserve exists, where the existing road is wider than 8 metres –	GN983, 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	The facility will require the widening/lengthening of existing access roads within the site.
GN 545, activity 1 The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.	GN984, 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	The proposed facility will consists of arrays of photovoltaic (PV) panels with an electricity output of 65.9 MW.
GN 545, activity 15 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	GN983, activity 28 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	The development footprint of the solar energy facility would be in excess of 20 ha.

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
	urban area, where the total land to be developed is bigger than 1 hectare	
GN 546, activity 4 The construction of a road wider than 4 metres with a reserve less than 13.5 metres a) In Mpumalanga ii. Outside Urban areas, in: **(ee)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	GN 985, activity 4 The construction of a road wider than 4 m with a reserve less than 13,5m. a) In Mpumalanga **ii. Outside Urban areas,** **(ee)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Access roads will be constructed during the development of the proposed facility. The site falls within a CBA as identified by the Mpumalanga Biodiversity Conservation Plan.
GN 546, activity 10 The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres a) In Mpumalanga ii. Outside Urban areas, in: **(ee)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	GN 985, activity 10 The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres a) In Mpumalanga ii. Outside Urban areas, in: **(ee)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	The solar energy facility will require facilities for the temporary storage of fuels / oils during construction to be situated on site of a combined capacity of up to 80 m³. The site falls within a CBA as identified by the Mpumalanga Biodiversity Conservation Plan.
GN 546, activity 13 The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, **(a)** Critical biodiversity areas	GN 984, activity 15 The clearance of an area of 20 hectares or more of indigenous vegetation GN 985, activity 12 The clearance of an area of	The solar facility will result in the clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. The site falls within a CBA as identified by the

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority.	300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (c) In Mpumalanga (ii) Critical biodiversity areas as identified in systematic biodiversity plans	Mpumalanga Biodiversity Conservation Plan.
GN546 Item 14: 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	GN 985, activity 12 The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (c) In Mpumalanga (ii) Critical biodiversity areas as identified in systematic biodiversity plans	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.
GN 546, Item 16 The construction of (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, b) In Mpumalanga ii. Outside Urban areas, in: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	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- (a) within a watercourse, or (c) within 32m of a watercourse	*The PV facility will include the construction of buildings (workshop area and site office) and infrastructures (underground cabling, panels) within 32 metres of a watercourse within CBA as identified by the Mpumalanga Biodiversity Conservation Plan*
GN 546, activity 19 The widening of a road by more than 4 meters or the lengthening of a road by more than 1 kilometres a) In Mpumalanga	GN 985, activity 18 The widening of a road by more than 4 meters or the lengthening of a road by more than 1 kilometres a) In Mpumalanga	Access roads will be widened or lengthened during the development of the proposed facility. The site falls within a CBA as identified by the Mpumalanga Biodiversity

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
ii. Outside Urban areas, in: (cc). sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority	ii. Outside Urban areas, in: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Conservation Plan.

4.2 Scoping Phase

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**. 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 Tutuka 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).

4.2. Environmental Impact Assessment Phase

The EIA Phase for the proposed Tutuka 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 cumulative[4] 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.

4.2.1. Tasks completed during the EIA Phase

The EIA Phase for the proposed Tutuka 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.
» Preparation of a Draft 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.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

These tasks are discussed below.

4.2.2 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

[4] "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).

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))
  * Lekwa Local Municipality and Gert Sibande District Municipality.

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

4.2.3 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 will be captured within a Comments and Response Report, which will be 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 (in English and isiZulu) were placed at visible points on the entrance of the Tutuka power station on 11 December 2014, in accordance with the requirements of the EIA Regulations. Further notices were placed at the Standerton Public Library and at the Lekwa Local Municipality. In addition to the advertisements and site notices, key stakeholders and registered I&APs were notified in writing of the commencement of the EIA process. Copies of all the advertisements, site notices and written notifications are included within **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 as presented in **Table 4.2**.

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
Lekwa 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 (Afrikaans & isiZulu: 14 January 2015)
» Ibis Newspaper (English: 12 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)
» Ibis Newspaper (17 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
» Recorder Newspaper

» **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 below:

Consultations in Scoping phase:	**Date**
Public meeting	8 April 2015
Focus Group Meeting with Lekwa Local Municipality	19 February 2015
Focus Group Meeting with impacted and adjacent landowners	19 February 2015
Consultations in EIA phase:	**Date**
Public meeting	6 April 2016

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

4.2.4 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**.

4.2.5 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 4.3**.

Table 4.3: Specialist consultants appointed to evaluate the potential impacts associated with the Tutuka PV Solar Energy Facility

Specialist	Area of Expertise	Appendix
Megan Diamond (Feathers Environmental Services)	Avifauna	Appendix D
Marianne Strohbach (Savannah Environmental)	Ecology	Appendix E
Jaco van der Walt (Heritage Contracts and Archaeological Consulting CC (HCAC))	Heritage and Archaeology	Appendix F
Barry Millstead (BM Geological Services)	Palaeontology	Appendix G
John Marshall (Afzelia Environmental Consultants and Environmental Planning and Design)	Visual	Appendix H
Candice Hunter (Savannah Environmental) and 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 Tutuka PV Solar Energy 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 EMPr is included as **Appendix M**.

4.2.6 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 Tutuka 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 Draft 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 Tutuka 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 Tutuka Solar Energy Facility is proposed on Portions 4, 10, 11 and 12 of the Farm Pretorius Vley 374 IS, within the jurisdiction of Gert Sibande District Municipality and Lekwa Local Municipality within the Mpumalanga Province. A study area of approximately 99 ha just south of the Tutuka Power Station (alternative site 1), with an additional 36 ha south-east of the power station (alternative site 2) is being investigated **(Figure 5.1).** The proposed development site is traversed by a number of power lines connecting into the Tutuka Power Station. Access to the site is provided from the R38 that runs east to the boundary of the technically preferred site and that connects the town of Standerton and Bethal.

5.2 Biophysical Characteristics of the Study Area

5.2.1 Climatic Conditions

The climate for the Tutuka site has been derived from climatic data summarised for Standerton, located about 22 km south-west of Tutuka. 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 26°C, with an average of 17°C for June. During July, night temperatures are on average -1°C, with frosts during winter being common.

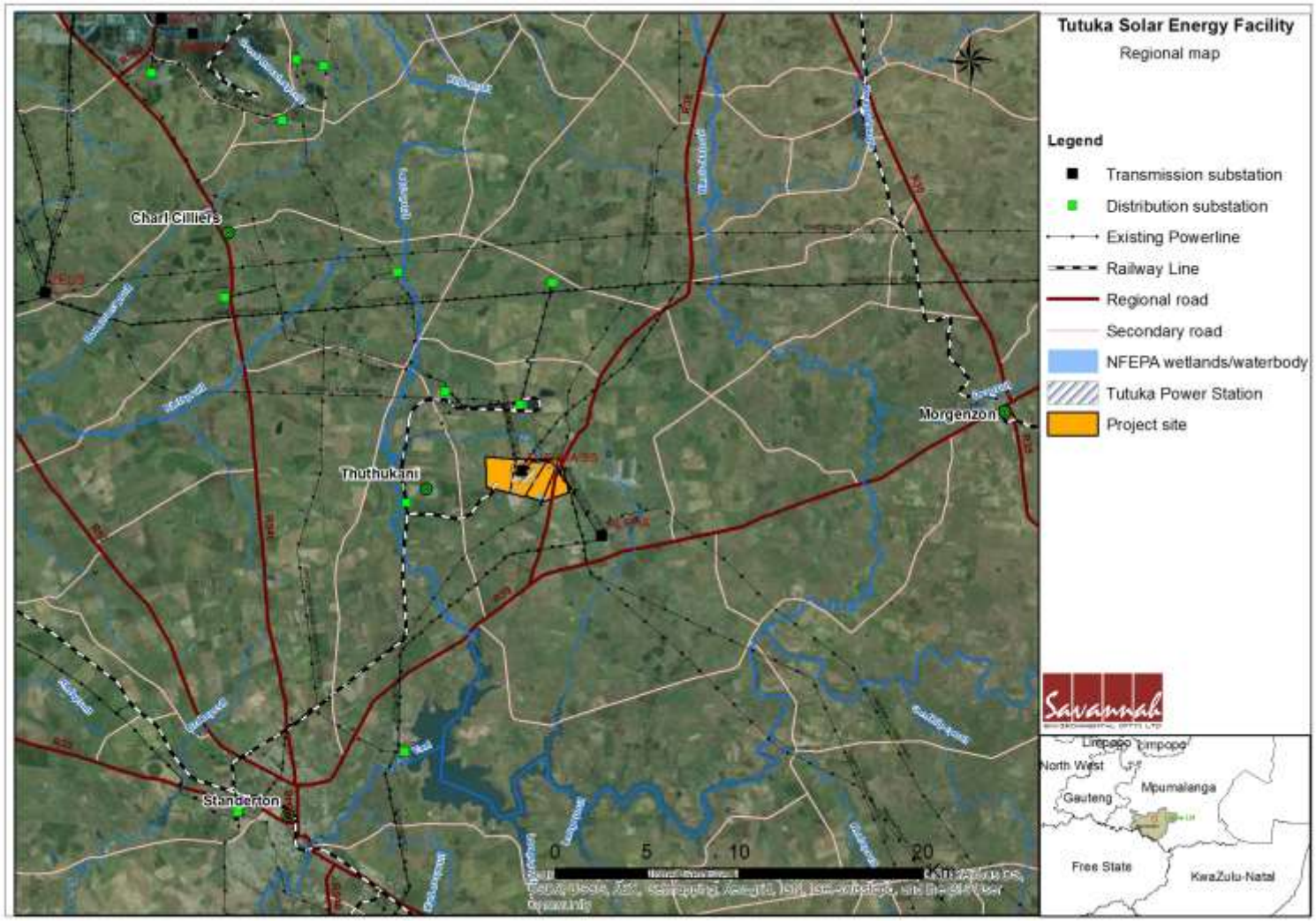

Figure 5.1: Regional context of the Tutuka PV Solar Energy Facility project site showing the site location

5.2.2 Topography and Geology

The site is relatively flat to slightly undulating. Within close proximity of the site are several valley floor wetlands (vleis), of which one has been expanded to form a dam for farming purposes. The geology of the study area consists of extensive dolerite intrusions into the sandstone and shale of the Vryheid Formation, of the Karoo Sequence (Geological Survey, 1984). The dolerite occurs mainly in the east, with the sandstone and shale occurring in the west and north. The identified alternative areas are completely underlain by rocks of the Early Permian Vryheid Formation.

5.2.3 Soils and Agricultural Potential

Soils

The soils occurring in the study area are mostly structured, black clay soils (Arcadia form, map unit **Ar**) with shrink-swell properties. Two zones of shallow, dark brown soils on rock (Mispah soil form, map unit **Ms**) also occur, as well as some wetter clay soils in the lower parts (Sepane form, map unit **Se**). A summary of the dominant soil characteristics is given in **Table 5.1.**

The soil analysis results showed that there is clay-rich nature of the soils, with high base status, relatively high pH values, moderate organic carbon levels and low P values due to the lack of any recent cultivation.

Agricultural Potential

The area consists of a mixture of soils ranging from moderately deep to deep, black, shrink-swell clay soils to shallow soils on rock. The broad agricultural potential summarized in **Table 5.2** indicates that most of the area (67%) has low to moderate agricultural potential with the remainder being low to very low.

Table 5.1: Soil Characteristics of the Tutuka PV Solar Energy Facility Site.

Map Unit	Dominant soils	Sub-dominant soils	Depth (mm)	Characteristics	Area (ha)
Ar	Arcadia	Rensburg	500-1200+	Dark brown to black, moderately to strongly structured, shrink-swell clay soils on weathering rock. In the lower landscape positions, the subsoil is grey and mottled, showing signs of wetness (Rensburg form).	**114.32**
Ms	Mispah	Glenrosa	0-200	Brown, weakly structured, sandy clay loam topsoil over hard (occasionally weathering) rock.	**35.09**
Se	Sepane	Tukulu, Katspruit	300-1200+	Brown to grey-brown, weakly structured, sandy clay loam topsoil on brown, moderately structured clay subsoil on grey, mottled gleyed clay. In the lowest parts, the gleyed subsoil occurs closer to the surface, with signs of wetness (Katspruit form).	**21.16**
Bu	Buildings			Built up area with structures	**5.59**
				Totals	**176.16**

Table 5.2: Agricultural potential of the proposed Tutuka PV Solar Facility

Agricultural Potential Class	Map Unit(s)	Limitations	Area (ha)
Low to moderate	Ar	Moderately deep to deep vertic soils can be waterlogged (especially in lower parts) but if well managed they can be productive soils.	**114.32**
Low	Se	B horizons with clay cutans and mottles which have a potential for water logging during rainy seasons.	**21.16**
Very Low	Ms	General shallow depth to underlying hard rock or weathering rock.	**35.09**

Totals	**170.57**

5.2.4 Surface Water

Regional Hydrology

This relatively flat (~0.6% south facing slope) study area contains a cluster of NFEPA wetlands. Wetlands appear to form within the study sites draining into earthen dams located within the 500 m buffer zone of the study site.

Wetlands on site

The study sites have been largely modified by dams, large drains, scattered building rubble and alien plant infestations. Two wetlands were delineated on the study site, both being unchannelled valley-bottom wetlands. **Figure 5.2** shows the delineated wetlands together with the 30 m wetland buffers. 25.5 ha of wetland is located on the Alternative site 1 and 4.12 ha of wetland on the Alternative site 2.

Quaternary Catchments

The study site falls within the quaternary catchment C11K. In this catchment the mean annual precipitation is lower than the potential evaporation 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.

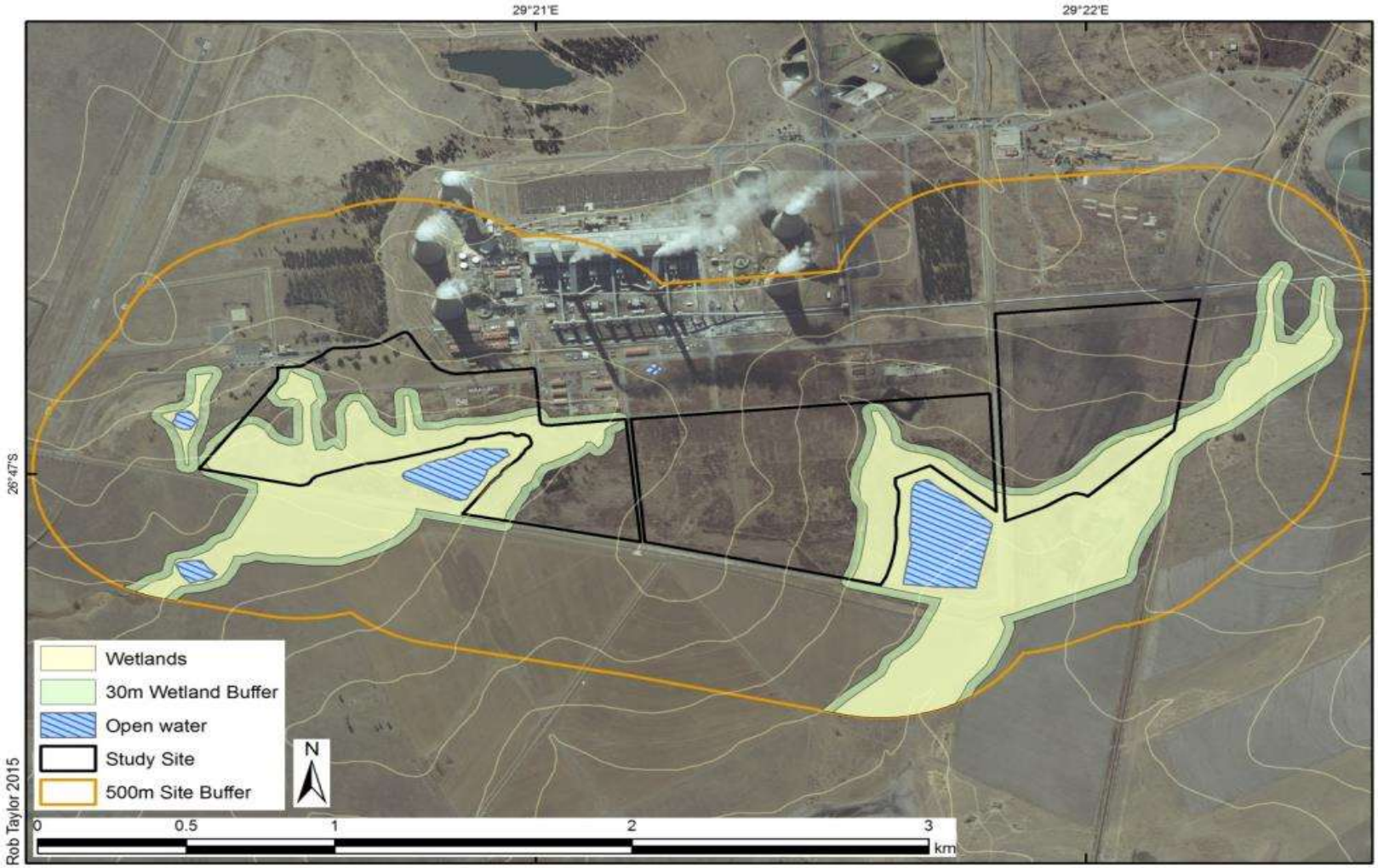

Figure 5.2: The wetlands and wetland buffers on the study site.

5.3 Ecological Profile

5.3.1 Flora

Vegetation overview

The site falls within the original extent of the Soweto Highveld Clay Grassland as defined by Mucina and Rutherford (2006) (**Figure 5.3)**. The short to medium high dense tussock grassland is dominated almost entirely by *Themeda triandra*, with other prominent grasses such as *Andropogon appendiculatus*, *Brachiaria serrata*, *Cymbopogon pospischilii*, *Elionurus muticus*, *Eragrostis* species, *Heteropogon contortus* and *Setaria* species. Overall grass diversity is relatively high, as is the diversity of herbs and geophytes (Mucina and Rutherford 2006). Many of the herbs resprout every year from below-ground storage tubers, usually early in the growing season before the grasses reach their full cover. Some of the more common low shrubs scattered in the grassland include *Anthospermum* species, *Felicia muricata* and *Ziziphus zeyheriana*.

Mucina and Rutherford (2006) already classified this grassland as endangered, with only about 0.2% of its original extent protected, and a mere 52% remaining in a natural state. It is listed under the National List of threatened ecosystems as Vulnerable.

A total of 973 indigenous plant species have been recorded in the Tutuka Area according to the SANBI database. 120 indigenous species could be confirmed present on site. A large portion of the study site is disturbed or has been transformed in the past, allowing many alien invasives to become established, with 25 alien invasive species 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. Most of the grasslands are still in a state of rehabilitation, thus gradual future changes in species composition can still be expected. The western portion of site alternative 1 has numerous small wetlands. *Typha capensis* (Bulrush) and *Phragmites australis* were found in ponding water. Some common obligate and facultative wetland species noted were, *Paspalum dilatatum, Agrostis lachnantha*, *Sorghum bicolor, Imperata cylindrica, Andropogon eucomus* (Snowflake grass), *Cyperus denudatus, Cyperus congestus, Juncus effuses* and *Verbena bonariensis.*

None of the grasslands are considered to be in a pristine condition, with only a small section considered to be primary (natural) grassland. 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. The remaining extent of primary grassland is classified as important and necessary, whilst the better condition rehabilitated and more diverse grassland is

classified by the Mpumalanga Biodiversity Conservation Plan (MBCP) as least concern. The remainder of the area has been recognised as rangelands with no Natural Habitat Remaining. It must be noted here that the mapping for the MBCP was done at a high scale, and hence delineations currently available for the different habitats do not entire match the actual state of the vegetation on the ground, which is especially applicable to the eastern section of Site Alternative 1, where the grasslands have been severely degraded and transformed in the past.

Fine-Scale Vegetation Patterns

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

- Association 1: *Andropogon chinensis - Aloe ecklonis* Grassland
  - Sensitivity: High
  - MBCP Rating: Important and necessary
- Association 2: *Pennisetum clandestinum - Aristida bipartita* Grassland
  - Sensitivity: Low
  - MBCP Rating: No Natural Habitat Remaining
- Association 3: *Eragrostis chloromelas - Hermannia depressa* Grassland
  - Sensitivity: Low
  - MBCP Rating: Least Concern

The distribution on site and sensitivity of the above associations is shown in **Figure 5.3.**

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. 25 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;*
- *Cuscuta campestris;*
- *Datura stramonium;*
- *Gleditsia triacanthos;*
- *Solanum pseudocapsicum;*
- *Verbena bonariensis; and*
- *Verbena brasiliensis*

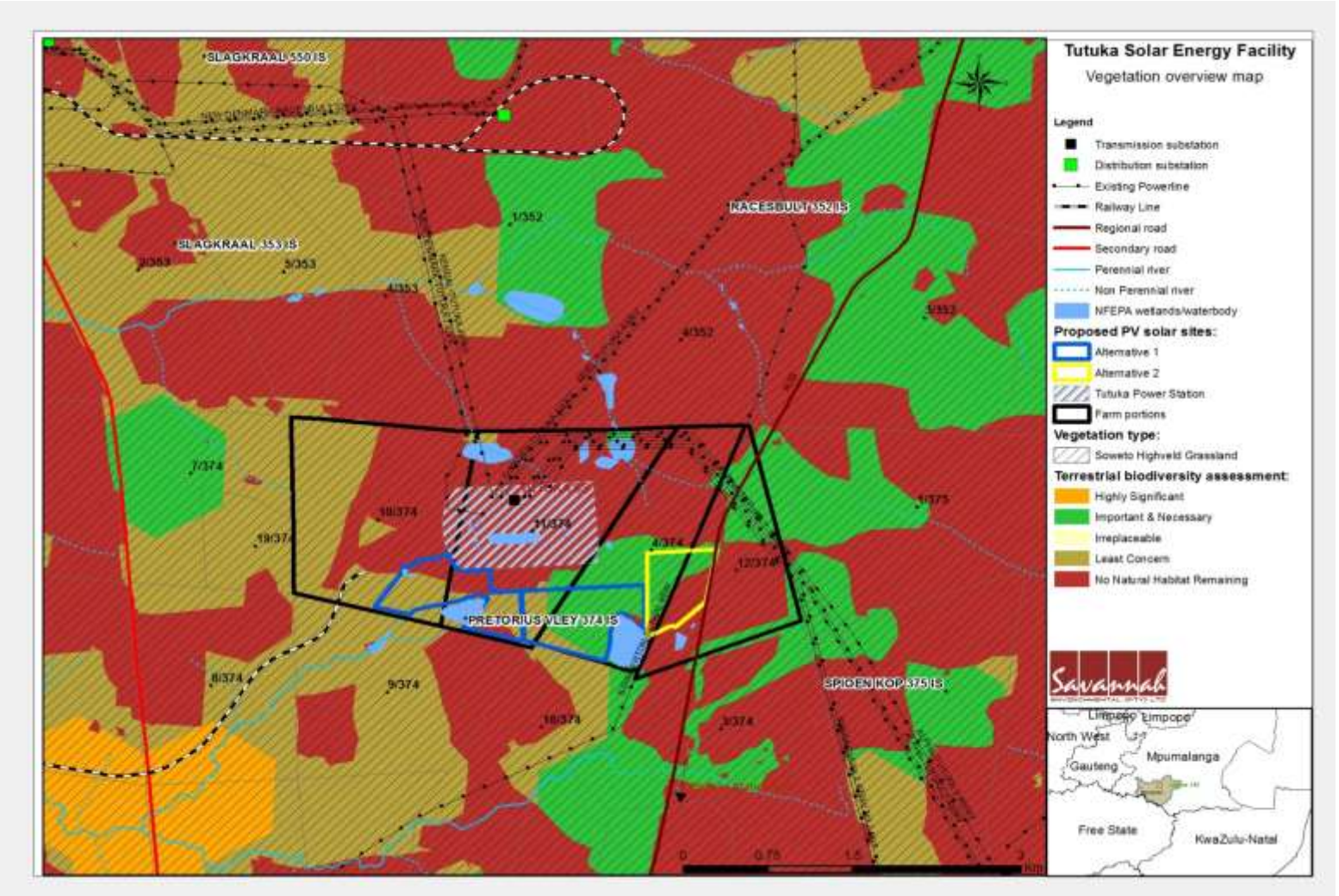

Figure 5.3: The original extent of the vegetation types on the proposed development site (after Mucina and Rutherford, 2006)

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.

Plant species of Conservation Concern

The following red data species have been recorded from the area (2827) according to the red data species list of SANBI and the ADU database. These are presented in **Table 5.3**.

Table 5.3: Red data species recorded in the study area

Species	RD Status	Suitable Habitat	Possibility of being present	Threat
Aloe cooperi subsp. *cooperi*	Declining	Grasslands	Slight	Habitat destruction
Aspidoglossum xanthosphaerum	VU	Grasslands	Slight	Medicinal trade
Frithia humilis	EN	Rocky outcrops	Unlikely	Habitat destruction
Khadia carolinensis	VU	Rocky outcrops	Unlikely	Habitat destruction
Miraglossum davyi	VU	High altitude grasslands	Unlikely	Habitat destruction
Pachycarpus suaveolens	VU	High altitude grasslands	Unlikely	Habitat destruction
Acalypha caperonioides var. *caperonioides*	DDT	Grasslands	Slight	Habitat destruction
Asparagus fractiflexus	EN	High altitude grasslands	Unlikely	Medicinal trade
Cineraria austrotransvaalensis	NT	High altitude grasslands	Unlikely	Habitat destruction
Rapanea melanophloeos	Declining	Riparian areas	Unlikely	Habitat destruction
Alepidea peduncularis	DDT	High altitude grasslands	Unlikely	Habitat destruction
Argyrolobium campicola	NT	High altitude grasslands	Unlikely	Habitat destruction
Gunnera perpensa	Declining	Wetlands	Unlikely	Habitat destruction
Kniphofia typhoides	NT	Wetlands	Unlikely	Habitat

Species	RD Status	Suitable Habitat	Possibility of being present	Threat
				destruction
Boophone disticha	Declining	Variable habitats	Observed	Medicinal Trade
Crinum bulbispermum	Declining	Grasslands and wetlands	Slight	Habitat destruction
Drimia elata	DDT	Variable habitats	Slight	Medicinal Trade
Eucomis montana	Declining	High altitude grasslands	Unlikely	Habitat destruction
Gladiolus robertsoniae	NT	Dolerite outcrops	Unlikely	Habitat destruction
Habenaria barbertoni	NT	Rocky hillsides	Not expected	Habitat destruction
Hesperantha rupestris	DDD	Rocky areas or wetlands	Unlikely	Habitat destruction
Hypoxis hemerocallidea	Declining	Variable	Slight	Medicinal Trade
Merwilla plumbea	NT	Rocky hillsides	Not expected	Medicinal Trade
Nerine gracilis	VU	Grassland	Slight	Habitat destruction
Stenostelma umbelluliferum	NT	Riparian areas	Not expected	Habitat destruction
Trachyandra erythrorrhiza	NT	Black turf marshes	Not expected	Habitat destruction

The following plants recorded on the project site are protected by the Mpumalanga Nature Conservation Act (Act 10 of 1998) **(Figure 5.4).**

» *Aloe ecklonis*
» *Boophane disticha;*
» *Corycium nigrescens;*
» *Eulophia hians;*
» *Eulophia leontoglossa;*
» *Eulophia ovalis;*
» *Gladiolus crassifolius; and*
» *Gladiolus permeabilis*

Figure 5.4 (From left): *Eulophia ovalis, Boophane disticha, Gladiolus crassifolius and Aloe ecklonis*

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 small herd of Hartebeest and Eland are being kept within the Tutuka Power Station fenced portion, and were recorded roaming on the study area. No other terrestrial fauna was recorded during the field study.

Species of conservation concern

The red data species presented in **Table 5.4** have been recorded from the area (2827) according to the red data species list of SANBI and the ADU database:

Table 5.4: Red data faunal species list of SANBI and the ADU database (2827)

Species	RD Status	Suitable Habitat	Possibility of being present	Threat
Giant Girdled Lizard	VU	Grassland	Slight	Habitat destruction
Giant Bull Frog	NT	Wetlands	Slight	Habitat destruction
Coppery Grass Lizard	NT	Grasslands	Slight	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 two alternative development sites revealed the presence of grassland habitat (degraded and disturbed to some extant) interspersed with small stands of trees at Alternative Site 1 **(Figure 5.5).** In addition, commercial dryland cultivation, several river systems, dams, wetlands, eucalyptus plantations as well as mines, quarries and industrial areas feature prominently within the immediate surrounds of the two proposed development sites.

Figure 5.5: Examples of the microhabitat observed, at each of the two proposed sites, during the site visit investigation.

Relevant Bird Populations

» Southern African Bird Atlas Project (SABAP) 1 and 2: A combined total of at least 190 bird species has been recorded within the relevant SABAP quarter degree squares and pentads. The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur at the two alternative sites. Of the 190 species, ten are Red List species, six near-endemics and four regional endemics. Although Red List endemics (Blue Korhaan and Agulhas Long-billed Lark) have been recorded in the broader study, the report rate for the Agulhas Long-billed Lark is relatively low which suggests that this species may not in fact occur frequently within the quarter degree squares or pentads and are therefore unlikely to occur at either of the two identified sites. 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 5.5.** While most of the grassland dependent Red List species (recorded in this area) could possibly occur at either of the two site locations, the small size of the proposed properties, the degraded nature of the vegetation and the proximity to the existing sources of disturbance will preclude species of conservation concern from occupying these areas. The proposed development sites do however support a diversity of more common small terrestrial species and significant number of water birds at each of the two dams located on Alternative Site 1. Development in these areas will undoubtedly displace these species either temporarily or perhaps more permanently. However sufficient similar habitat is available within the broader study area, so it is highly unlikely that the displacement impact will be of regional or national significance.

» Coordinated Avifaunal Roadcount (CAR) Data: 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 the all the individuals in a population, they do provide a measure of relative abundance in a particular area. A relatively new CAR has been established 2 km to the west of the proposed development sites; however data emanating from surveys along this route have not been consolidated and are not readily available. Secretary bird, Grey Heron, Black-headed Heron and Helmeted Guinea fowl were the only large terrestrial species observed at the proposed development sites and their immediate surrounds during the data collection period.

» *Coordinated Water bird 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 water birds, 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). The presence of a CWAC site within the study area is an indication of the occurrence of a large number of bird species and the overall sensitivity of the area. New Denmark Dam CWAC site is situated within the broader study area and is a private dam in a coal mining area. CWAC data here records large numbers of Red-knobbed Coot, Egyptian Goose, Yellow-billed Duck, Blacksmith Lapwing, Little Stint and African Darter. Greater Flamingo has been recorded here on numerous occasions between 2005 and 2009, while Caspian Tern has also been recorded at the New Denmark Dam site. Of the species mentioned, Red-knobbed Coot, Egyptian Goose, Yellow-billed Duck and Blacksmith Lapwing (among others) were recorded at the DB Thermal and Stein Muller dams located at Alternative Site 1 and the smaller dam located to the south of Alternative 2 during the data collection period.

TABLE 5.5: Annotated list of bird species likely to occur within the development area and immediate surrounds of the proposed Tutuka PV Facility

COMMON NAME	SCIENTIFIC NAME	REGIONAL STATUS	GLOBAL STATUS	ENDEMISM	SABAP 1	SABAP 2	GRASSLAND	CULTIVATION	WETLANDS	HABITAT LOSS & DISTURBANCE	COLLISION PV PANELS	COLLISION POWER LINES	ELECTROCUTION
Buzzard, Jackal	*Buteo rufofuscus*			Near Endemic	x		x					x	x
Cisticola, Cloud	*Cisticola textrix*			Near Endemic	x	x	x			x	x		
Crane, Blue	*Anthropoides paradiseus*	NT	VU		x		x					x	
Falcon, Lanner	*Falco biarmicus*	VU	LC		x		x			x	x	x	x
Flamingo, Greater	*Phoenicopterus ruber*	NT	LC		x	x			x		x	x	
Flamingo, Lesser	*Phoenicopterus minor*	NT	NT		x				x		x	x	
Ibis, Southern Bald	*Geronticus calvus*	VU	VU		x		x	x		x		x	
Korhaan, Blue	*Eupodotis caerulescens*	-	NT	Regional Endemic	x	x	x			x		x	
Lark, Agulhas Long-billed	*Certhilauda*	NT	NR	Near Endemic	x		x	x		x	x		

	brevirostris												
Lark, Cape Clapper	*Mirafra apiata*			Near Endemic	x		x			x	x		
Lark, Eastern Long-billed	*Certhilauda semitorquata*			Near Endemic	x		x			x	x		
Roller, European	*Coracias garrulus*	NT	NT		x		x				x		
Secretary bird	*Sagittarius serpentarius*	VU	VU		x		x			x		x	
Starling, Pied	*Spreo bicolor*			Regional Endemic	x		x			x	x		
Stork, White	*Ciconia ciconia*	BONN			x		x	x	x			x	
Stork, Yellow-billed	*Mycteria ibis*	EN	LC		x				x			x	
Sunbird, Greater Double-collared	*Cinnyris afer*			Regional Endemic	x		x		x	x	x		
Tern, Caspian	*Sterna caspia*	VU	LC		x				x		x		
Thrush, Karoo	*Turdus smithi*			Near Endemic	x		x		x	x	x		
White-eye, Cape	*Zosterops virens*			Near Endemic	x		x			x	x		

Important Bird Areas (IBAs): The proposed development sites are not within an established IBA, however Amersfoort-Bethal-Carolina District (SA018) IBA lies approximately 27 km to the east of Tutuka Power Station, and it is not unlikely that some bird species found in this IBA may occur in the study area. 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, which is not present on the development site. 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 Alternative Site 1 or Alternative Site 2 during the data collection period.

5.4 Land-Uses

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

» Heavy industrial development including the Tutuka Power Station and associated conveyors and stockpiles. The main coal stockpile site is approximately 7 km to the north and north east that is linked to the power station with an extensive conveyor system. There is also an above ground conveyor running approximately 3.5 km east of the power station linking the facility to an existing pulverised fuel ash dump. This dump appears to be largely rehabilitated.
» Urban development including the small settlement of Thuthukani which lies approximately 5km to the west of the proposed alternative development sites. This settlement largely houses workers from the power station and associated facilities.
» Agricultural development is the main development type surrounding the proposed site. There is a mixture of arable agriculture and grazing land.

5.5 Access and Transport Routes in the Region

Access to the site is provided from the R38 that runs along the east boundary of the proposed site and that connects the town of Standerton and Bethal. 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 Tutuka PV Solar facility is shown in **Figure 5.6** and explained below:

The **Industrial Landscape Character Area**, in which the proposed development is located, is a functional area. 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 generally inward looking. Once inside settlement areas, existing buildings and street / garden trees tend to block the majority of views of surrounding areas. Where views are possible this character area could be sensitive to the proposed development. The only urban area that could be impacted is the settlement of Thuthukani which largely accommodates local power station and mine workers. It was confirmed during the site visit that the proposed development will not be visible from this area.

The **Rural Landscape Character Areas** includes larger scale agricultural units and a diverse agricultural mix including both arable and livestock grazing. Other than roads, conveyors and electrical infrastructure, the area surrounding the plant is not heavily impacted by infrastructure. Whilst this is a productive area it does appear largely undeveloped. The existing power station and associated features have already impacted on this landscape and have changed the character particularly as seen from immediately adjacent areas from which detail of the industrial elements are apparent. From a distance however, whilst the main elements of the power station are visible, they are seen in the broader more natural context of a largely undeveloped Highveld rural landscape. Even though the main industrial elements are obvious, because there is a clear division, the natural elements can be appreciated in their own right. From a pure landscape appreciation perspective, for most people, the outlook might be improved if the power station were not part of the scene; however, as long as the proposed development does not obviously expand or make the division less obvious then it is unlikely to have any significant impact on distance views.

URBAN LANDSCAPE CHARACTER AREA

RURAL LANDSCAPE CHARACTER AREA

INDUSTRIAL LANDSCAPE CHARACTER AREA

Figure 5.6: 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 Lekwa Local Municipality (LLM), 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 2013-2014, 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 495km^2; 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 LLM. The population of the GSDM in 2011 was approximately 1 043 194 people, of which 115 662 people reside in the LLM. The average annual population growth rate in the study area is estimated by comparing data from 2001 to 2011. The LLM is a sparsely populated area of about 25 people per square km in comparison with the DM (33 km²).and the rest of Mpumalanga (53 km²).

5.7.2 Employment profile

The LLM is largely populated by the potentially economically active population. In the LLM the unemployment rate is 25.9% and there are approximately 11 637 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 LLM has a high number of households that fall within a low income category (60.9%) 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 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 5.6** demonstrates the level of education/skills availability in the study area.

Table 5.6: 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%
Lekwa LM	11.2%	14.6%	4.6%	34%	25.1%	10.3%

The education levels in the area are generally low. Majority of the population aged 20 years and older in the municipality have only some secondary education or less (in the LLM this being 34% of the population). More than half of the local population are semi- skilled or unskilled (no schooling to some secondary). This reflects the rural nature of the region and relatively poor education levels. Only 25.1% of the LM have a Matric and 10.3% 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. Especially in the rural/farm areas where there's a need to expand basic services such as water, electricity and sanitation. LLM forms part of the areas that were spatially designated and distorted, the main challenge is on ensuring that rural communities also have the same rights and benefits as urban communities in terms of basic services.

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 LLM include agriculture, mining and power generation. Standerton is the major urban node and is a large commercial and industrial town which specialises in cattle, dairy, maize and poultry farming. The main contributors to the local economy include Agriculture, forestry and fishing (30%), community, social and personal services (13%), and private households (12%).

5.8 Heritage features of the region

5.8.1 Heritage and archaeology

Very few previous heritage studies were conducted in the immediate vicinity of Site alternative 1 and 2 (SAHRA report mapping project V 1.0 and SAHRIS). Studies consulted for this study include Van Schalkwyk (2002 and 2012) and van der Walt (2013) in the greater study area. The studies did not record any sites of heritage significance. Additionally, 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 grassland and was extensively ploughed in the past. Infrastructure such as 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 occur in the areas visited although several structures occur in the broader site which was not covered during the survey. These structures are associated with the operation of the power station and assumed not to be older than 60 years. No burial grounds or graves were recorded and no significant cultural landscapes or viewscapes were noted.

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 proposed sites are both underlain by potentially fossiliferous sedimentary rocks of the Early Permian Vryheid Formation. This formation is one of 16 recognised stratigraphic units that constitute the Permian Ecca Group. The most conspicuous and common components of the palaeontological record of the Ecca Group in general are the plant macrofossils of the *Glossopteris* flora. Two large leaf form taxa dominate the *Glossopteris* flora; these being Glossopteris and *Gangamopteris*. The *Gangamopteris* has ceased to exist with only the *Glossopteris* present.

The Vryheid Formation can be expected to contain the plant macrofossils *Buthelezia, Sphenophyllum, Rangia, Phyllotheca, Schizoneura, Sphenopteris, Noeggerathiopsis, Taeniopteris, Pagiophyllum* and *Benlightfootia* and the wood taxa *Australoxylon, Vertebrari* and *Prototaxoxylon (Bamford, 2004).*

The presence of fragmentary fish fossils, *Coelacanthus dendrites*, within the Ecca sequence of southern Africa were noted by Jubb and Gardiner (1975). While fish faunas are rare and none have been reported from the Vryhied Formation the possibility remains that they may be present. Faunal fossils are rare within the

Ecca Group and no reptile fossils have been identified within the Vryheid formation. Hobday and Tavener-Smith (1975) reviewed trace fossil assemblages identified within the Vryheid Formation. Within that fossil assemblage they identified two forms, *Helminthiopsis* and *Taphrelminthopsis* within horizontally

laminated siltstones and mudstones that represent part of the deep water *Nerites* community.

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 Tutuka PV Solar Energy Facility and associated infrastructure. This assessment has considered the construction of a 65.9 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 Tutuka 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 Tutuka PV Solar Energy Facility will have a development footprint of approximately ~99 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 Tutuka PV Solar Energy Facility is expected to take approximately 15-18 months.
» *Operation* – will include operation of the facility and the generation of electricity for Eskom's own consumption at the Tutuka Coal Fired Power station which will be fed via the on-site substation and an overhead power line. The operational phase of the Tutuka 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

Alternative PV site:

» **Alternative PV site 1 –** This layout is located in the southern section of the study area. There are a number of wetland areas on and adjacent to the southern and western portion of the study area.
» **Alternative PV site 2** – This layout is located in the south-eastern section of the study area. The ecological state of the vegetation is regarded as Important and Necessary to meet Mpumalanga Biodiversity Targets. This has been confirmed during the field study with a high abundance of protected plant species.

Potential impacts pertaining to the alternative PV sites assessed in the sections below, and a comparative assessment of these alternatives is provided.

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 Tutuka PV Solar Energy Facility and associated infrastructure requires ~99 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

The selected study area falls within the original extent of the Soweto Highveld Grassland (Unit Gm8). The short to medium high dense tussock grassland is dominated almost entirely by *Themeda triandra*, with a relatively high diversity of grasses, herbs and geophytes (Mucina and Rutherford 2006). None of the grasslands are considered to be in a pristine condition, with only a small section considered to be primary (natural) grassland. The remaining extent of primary grassland is classified as Important and Necessary, whilst the better condition rehabilitated and more diverse grassland is classified by the Mpumalanga Biodiversity Conservation Plan (MBCP) as of Least Concern. The remainder of the area has been recognised as rangelands with no Natural Habitat Remaining. It must be noted here that the mapping for the MBCP was done at a high scale, and

hence delineations currently available for the different habitats do not entire match the actual state of the vegetation on the ground, which is especially applicable to the eastern section of Site Alternative 1, where the grasslands have been severely degraded and transformed in the past.

A total of 973 indigenous plant species have been recorded in the study area according to the SANBI database. Only 120 indigenous species could be confirmed present on site. A large portion of the study site is disturbed or has been transformed in the past, allowing many alien invasives to become established, with 25 alien invasive species recorded.

These grasslands are utilised by Hartebeest and Eland that are being kept within the Tutuka Power Station enclosure. Animals that may be permanently present can be relocated, 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. The impact on fauna is expected to be small to negligent. The ecological sensitivity of the site is mapped in **Figure 6.1**.

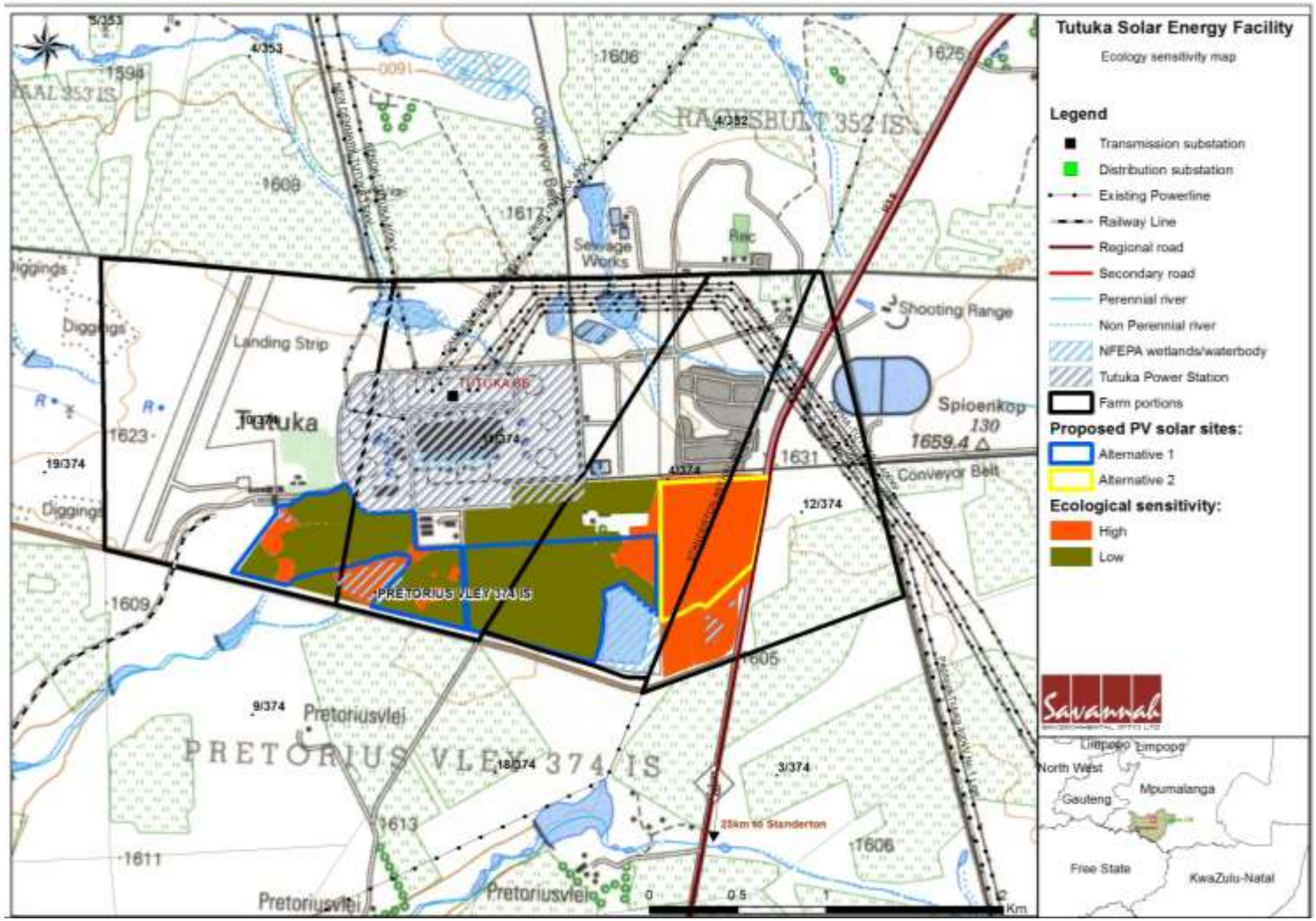

Figure 6.1: Sensitivity map indicating sensitive ecological areas within the proposed Tutuka PV Solar Energy Facility

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	*Positive* where aliens invasive species will be cleared *Neutral* 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*:**

» The footprint of the development should not encroach onto wetland areas or their associated buffer zones.
» Avoid high biodiversity grassland areas (Refer to Figure 6.1).
» 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 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.
» 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.

***Cumulative impacts*:**

» 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.

***Residual impacts*:**

» Altered vegetation composition and structure.
» Altered topsoil conditions.
» Potential barren areas.
» Potential for erosion and invasion by weed or alien species.

***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.

Activity**:** Fencing area – may also serve as maintenance track to PV panels
Environmental Aspect: Removal of vegetation, compaction of soils, creation of runoff zone, impact on protected species, impact on terrestrial vertebrates

Note: Secure fencing already exists around the larger power station property

Relevant Listed activities:
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	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (15)**

Status	Negative	*Positive* where alien invasive species will be cleared *Neutral* where on transformed or highly degraded areas *Minimal new negative impacts expected*
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

» The footprint of the development should not encroach onto wetland areas or their associated buffer zones.
» Avoid wetland and high biodiversity grassland areas.
» 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:
  - 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.
» 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.
» 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 *before* regenerative material can be formed.

Cumulative impacts:

» 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.

Residual impacts:

» 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/ 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 (55)**	**Medium (35)**
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Highly Probable	Slight Probability
Can impacts be mitigated?	Yes	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 and surroundings (2)	Site specific (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**High (65)**
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 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.
» 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.

Cumulative impacts:

» If mitigation measures are not strictly adhered to the following could occur:
  - Loss of and further fragmentation of remaining portions of natural grassland and associated ecosystem services such as pollination.
  - Alteration of occupancy by terrestrial fauna, possible reduction of available habitat and food availability to terrestrial fauna.
  - Spread and establishment of invasive species, and further associated degradation of remaining endangered vegetation.

Residual impacts:

» altered topsoil characteristics.
» altered vegetation composition.
» fragmentation and loss of diversity of endangered vegetation.

***Nature of impact*:** Loss of vegetation, increase in runoff and erosion, disturbance of burrowing animals

Activity: Construction of a short power line as part of the grid connection

Environmental Aspect: Limited removal of vegetation, compaction of soils, temporary or permanent damage to animal burrows

Relevant Listed activities:

GN 544, activity 10 (i),11(ii), 18(i)
GN 545 activity 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	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:

» 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.
» The footprint of the development should not encroach onto wetland areas or their associated buffer zones.
» 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 where affected by pylons, maintenance tracks or construction, 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 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:

» Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)

Residual impacts:

» 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 *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna

Activity: Construction of substation and other associated buildings, workshops, offices, etc. on *transformed areas*
Environmental Aspect: 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 *(Negative on high diversity grassland areas.*
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» During the design phase, ensure that none of these development components are situated outside transformed areas.
» Treat higher diversity grasslands as No-Go zones for these development components.
» The footprint of the development should not encroach onto wetland areas or their associated buffer zones.
» 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.
» Weeds and alien invasive species must be eradicated or significantly reduced:
  - 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

Cumulative impacts:
» If mitigation measures are not strictly followed the following could occur:
  - 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;
  - 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:
  - 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 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:
  - erosion of the development area with associated siltation and/or erosion of lower-lying wetlands;
  - contamination of drainage lines, lower-lying rivers, wetlands and ground water;
  - 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: Borrow-pits and/or topsoil stockpiles that might be required during construction
Environmental Aspect: Removal of vegetation, compaction of soils, creation of runoff zone, displacement of terrestrial vertebrates

Note: remaining sealed surfaces on the Alternatives Site *2 could be crushed and used as filling material, as this will also greatly benefit the ongoing rehabilitation efforts on that area*

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	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» Exclude high diversity grasslands and wetlands from this development area (Refer to Figure 6.1).
» 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.
» 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 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.
» 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.

Cumulative impacts:

» If mitigation measures are not strictly followed the following could occur:
  - 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.

Residual impacts:
» 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:
» 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:
  - Correct salvage, disposal and preferably also recycling methods (or possibilities) for any broken materials.

Cumulative impacts:
» 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:
» None expected if mitigation measures are implemented.

6.2.3 Comparative Assessment of the PV site alternatives

There are numerous wetland areas on and adjacent to the southern and western portion of the study area. The ecological state of the vegetation on Alternative Site 2 is

regarded as Important and Necessary to meet Mpumalanga Biodiversity Targets. This has been confirmed during the field study with a high abundance of some protected plant species, namely *Eulophia ovalis, Boophane disticha, Gladiolus crassifolius and Aloe ecklonis*. From an ecological perspective, it is recommended that Alternative Site 2 be entirely excluded from the proposed development.

Aspect	Site Alternative 1	Site Alternative 2
Ecology	Acceptable: **Preferred alternative** » The eastern section of Site Alternative 1 are severely degraded and transformed due to past activities.	Acceptable » The ecological state of the vegetation on Site Alternative 2 is regarded as Important and Necessary to meet Mpumalanga Biodiversity Targets: » A high abundance of protected plant species » It is recommended that site alternative 2 be entirely excluded from the proposed development

6.2.4 Implications for Project Implementation

» The Tutuka PV Solar Energy facility development will not have significant impacts on the above-ground ecology of the site if all mitigation measures are followed, especially if listed alien invasives can be reduced. If 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.
» Potentially significant negative impacts on the ecological environment will occur if remaining portions of high diversity natural vegetation will be further disturbed – these sections should be avoided.
» 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.

6.3 Potential Impacts on Avifauna

6.3.1 Results of the avifauna assessment

While renewable energy sources, such as solar energy, hold great potential to alleviate dependence on fossil fuels they are not without their environmental risks and negative impacts. Poorly sited or designed solar energy facilities can have negative impacts on not only vulnerable species and habitats but also entire ecological processes. These impacts are extremely variable and are dependent on a number of contributing factors which include the design and specifications of the development, topography, habitats capable of supporting various bird species as well as the number and diversity of birds present at the development site. 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 vegetation present at both alternative sites is degraded to a fairly large extent and 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 activities in the immediate 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 flights 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. 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

The avifaunal sensitivity of the two sites is considered to be moderate to high, given the presence of the dams, the associated wetland areas and the species utilizing these areas. The wetlands have been buffered by a conservative 80 m and together with the dams have been assigned a high sensitivity rating. These areas represent systems with high connectivity and possibly important bird flight paths with high bird diversity and construction in these areas must be avoided. As discussed, the area between the DB Thermal and Stein Muller dams is an area that may be subject to high bird utilization and an important flight path. This portion of land has been assigned a medium sensitivity based on the fact that it is a slightly modified area with disturbances of low-medium intensity, some degree of connectivity between the dams and wetlands and a moderate level of species diversity (refer to Figure 6.2). The remainder of Alternative Site 1 and Alternative Site 2 is fairly uniform, highly disturbed and transformed and poor in species diversity. These areas have been assigned a low sensitivity rating.

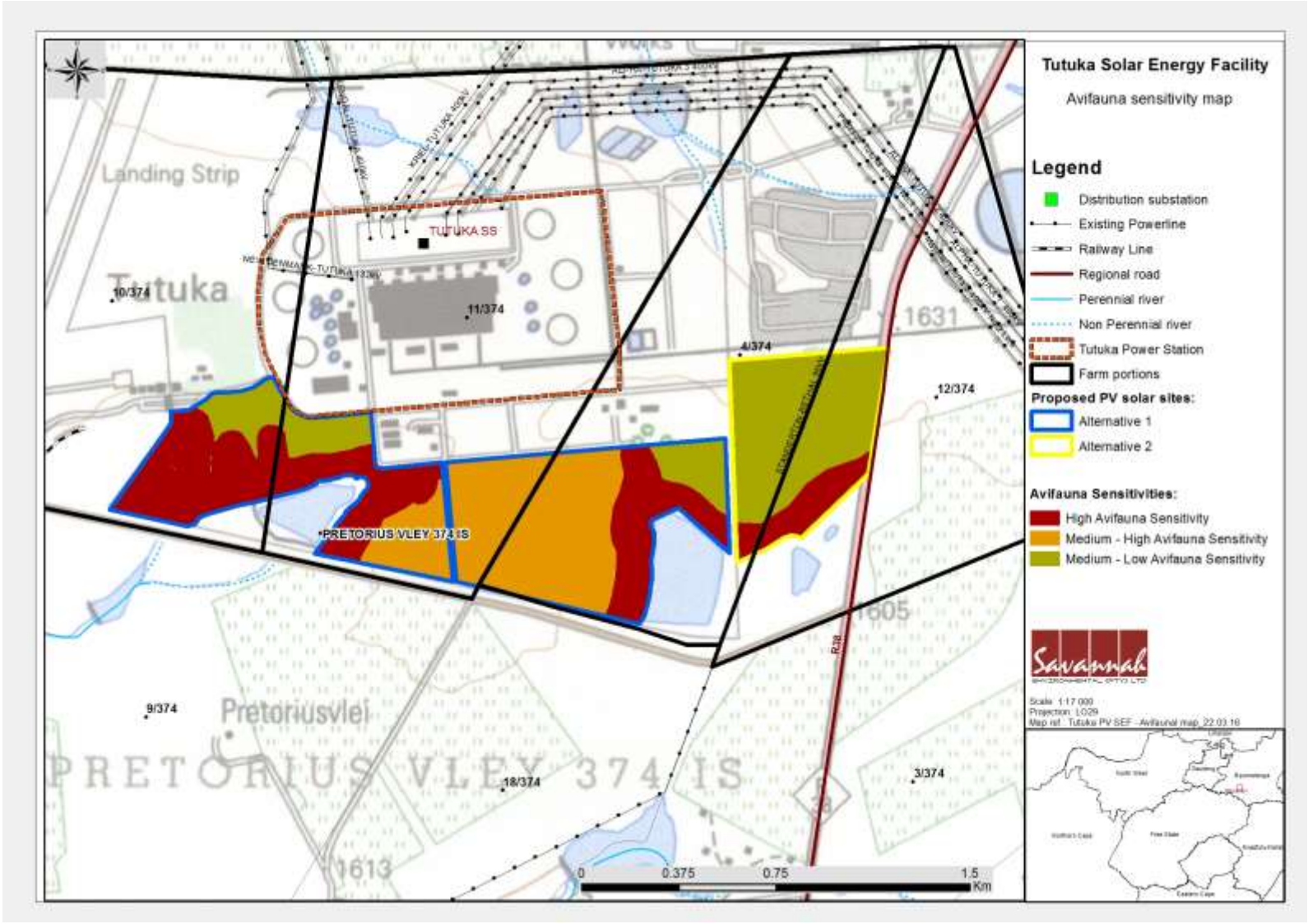

Figure 6.2: Avifaunal sensitivity map.

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

***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 Secretary bird, water birds 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	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 Tutuka 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 sites, 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 particular 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 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	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. Secretary bird, Grey Heron, Egyptian Goose, Black-headed Heron and various 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 low 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 bound (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 both on the proposed sites 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 in the broader study area and therefore electrocutions on the towers of the proposed grid connections will have a medium to high 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 a shorter grid connection 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 and the 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 bound(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 electricity network features prominently 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 to low 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 Bound (1)	Site Bound (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 substations, 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 EMPr.

Cumulative impacts:

None

Residual impacts:

None

6.3.4 Comparative Assessment of the PV site alternatives

Considering that displacement through habitat destruction is potentially the most significant impact associated with the construction of solar energy facilities, a significant proportion of Alternative Site 1 is comprised of areas that represent systems with high connectivity and possibly important bird flight paths with high bird diversity. However sufficient similar habitat is available within the broader study area, so it is highly unlikely that the displacement impact will be of regional or national significance. Both sites are considered acceptable for development with the implementation of the proposed mitigation measures. However, it is recommended that the proposed Tutuka PV Energy Solar Facility be developed at Alternative Site 2.

Aspect	Site Alternative 1	Site Alternative 2
Avifauna	Acceptable – » Areas represent systems with high connectivity » Possible important bird flight paths » High bird diversity	Acceptable – **preferred alternative** » Bird diversity species within the development area is low » The area is of a smaller scale therefore the impacts are considered to be less.

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 EMPr. Of particular concern is the layout of the PV facility and the power line infrastructure. Ideally an avifaunal walk down should be conducted once the final layout and 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), Glenrosa (Othic A / Lithocutanic B), Rensberg (Vertic A / G horizon). Signs of wetness that were used to delineate the wetland boundary included red and yellow mottles and soft and hard plinthic nodules.

Vegetation Indicators

Wetland plants are an important indicator for the delineation process. *Typha capensis* (Bulrush) and *Phragmites australis* were 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: *Paspalum dilatatum, Agrostis lachnantha*, *Sorghum bicolor, Imperata cylindrica, Andropogon eucomus* (Snowflake grass), *Cyperus denudatus, Cyperus congestus, Juncus effuses* and *Verbena bonariensis.*

6.4.2 Sensitivity Assessment

Two wetlands were delineated on the study site both being unchannelled valley-bottom wetlands. Figure 6.3 shows the delineated wetlands together with the 30 m wetland buffers. 25.5ha of wetland is located on the Alternative Site 1 and 4.12 ha of wetland on the Alternative Site 2. The two wetlands in the study site are very similar in their function, type and ecology. They merge shortly downstream of the study area and as such they will be treated as one wetland for the purpose of these assessments.

Present Ecological Status (PES)

A major impact on this wetland has been the construction of earthen dams. These dams have flooded large parts of the wetland and are impeding low flows. Several roads also impede the flow of water. Several large drains drain areas of infrastructure and hardened surfaces from the power station, increasing storm water peak flows. Additional drains drain some of the wetlands extracting water to outside of the study site. 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 combined PES score for all the wetlands on site is a D, largely modified - A large change in ecosystem processes and loss of natural habitat and biota has occurred. The condition of this wetland is expected to remain in a steady state over a five year timeframe (Macfarlane *et al*, 2007). The scores are summarised in **Table 6.1 & Table 6.2.**

Table 1.1: Summary of hydrology, geomorphology and vegetation health assessment for the wetlands on the study site (Macfarlane *et al,* 2009).

Wetland Unit	Hydrology		Geomorphology		Vegetation	
	Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
Unchannelled valley-bottom	6.5	0	2	0	3.66	-1

PES Category and Projected Trajectory	**E**	→	**C**	→	**C**	↓

Table 2.2: Combined PES score for the all the wetlands on site (Macfarlane *et al,* 2009).

Overall Health Score for the Entire Wetland	Impact Score	Category	Change score	Change Symbol	Health class
	4.4	D	-0.33	→	D (→)

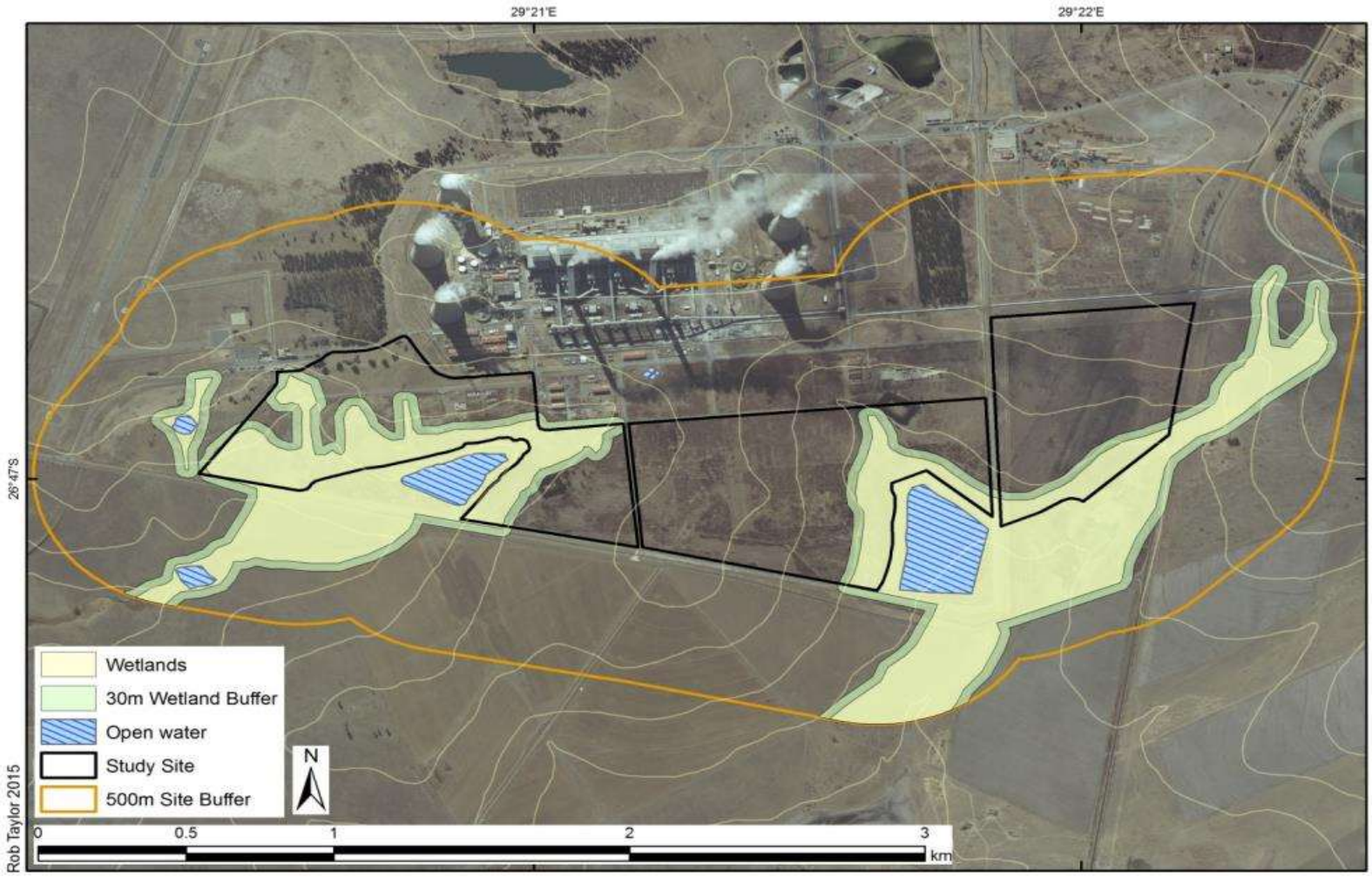

Figure 6.3: Tutuka wetlands and wetland buffers on the study site

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.

These impacts and are assessed as recommended by the guidelines supplied by Savannah Environmental (Pty) Ltd. 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 plans 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	**Moderate (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 30m 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	**Moderate (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 of site or within appropriately controlled areas to avoid hydraulic or diesel spills.
» Control of waste discharges.
» Maintenance of 30m 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 30m 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 Comparative Assessment of the PV site alternatives

Overall the wetlands on site are largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred. The ecological importance and sensitivity suggests that wetlands in this category are considered to be ecologically important and sensitive on a provincial or local scale. It was recommended that a 30 m buffer is set to protect wetland functionality.

The wetlands encroach onto the western section of Alternative Site 1 and the southern section of Alternative Site 2. From a wetland function point of view, development should ideally be confined to the central portion of Alternative Site 1, or the northern portion of Alternative Site 2. Alternative Site 1 is considered the most favourable for development of the PV facility since less wetland habitat will be lost.

Aspect	Site Alternative 1	Site Alternative 2
Wetlands	Acceptable – **preferred alternative** » The wetlands encroach onto the western section of Alternative Site. » Development should be confined to the central portion of Alternative Site 1. » Less wetland habitat will be lost.	Acceptable – » The ecological state of the vegetation on Site Alternative 2 is regarded as Important and Necessary to meet Mpumalanga Biodiversity Targets: » The wetlands encroach substantially on the southern section of Alternative Site 2.

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.
» Should wetlands 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 the 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 Soweto Highveld Grassland and some portions extensively ploughed in the past. Infrastructure such as roads and sand mining have also impacted on the study area. 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 study area. No burial grounds or graves were recorded and no significant cultural landscapes or viewscapes were noted during the fieldwork.

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

6.5.2 Paleontological impacts

The effects of the required construction operations to the geological strata underlying the project area will be restricted to the Early Permian Vryheid 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 Vryheid Formation has been assessed as moderate. Any negative impact on the fossil materials will potentially be significant due to the scientific and cultural importance of many of the fossils that may be expected to be present.

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	Not Probable (1)	Not Probable (1)
Significance	**Low (10)**	**Low (9)**

Status	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation::

Mitigation measures are not considered necessary. In the instance of a chance find, the following procedures and management actions will be required for inclusion in the EMPr, these include the following: :

» 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:

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

Residual Impacts:

Where any archaeological contexts occur the impacts are once-off permanent destructive events.

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 (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium(36)**	**Low (20)**
Status	Negative	Negative
Reversibility	Not reversible	Not 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:

Multiple projects in an area can contribute to a cumulative impact on fossil materials.

Residual Impacts:

Where any paleontological resources occur the impacts are once-off permanent destructive events.

6.5.5 Comparative Assessment of the PV site alternatives

In terms of impacts arising from disturbance and loss as a result of the proposed PV facility, there is no significant difference in the potential impacts on the alternative sites. Therefore, there is no preference between the alternatives from a heritage and paleontological perspective.

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 consist of structured, black clay soils with shrink-swell properties. Two zones of shallow, dark brown soils on rock also occur, as well as some wetter clay soils in the lower parts. The analysis results reflect the clay-rich nature of the soils, with high base status relatively high pH values, moderate organic carbon levels and low P values due to the lack of any recent cultivation. Most of the area (67%) has low to moderate agricultural potential with the remainder being low to very low.

6.6.2 Impacts on Soils

The major impact on the natural resources of the study area would be the loss of arable/grazing 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	Local (2)	Local (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: None		
Cumulative impacts: Little or none		
Residual Risks: Little or none, due to the potential of the soil.		

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:

» 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 Comparative Assessment of the PV site alternatives

If all low-lying areas in the landscape (where wetland soils pose a flooding hazard) are avoided, the most suitable soils for the establishment would be the shallow soils which are most prevalent in the central portion of the study area. Based on the soil survey, it is recommended and preferred that the proposed PV facility be developed on Alternative 1 site.

Aspect	Site Alternative 1	Site Alternative 2
Soils and Agricultural potential	Acceptable – **preferred alternative** » Shallow soils are most prevalent in the central portion of Site Alternative 1.	Acceptable – » The wetlands encroach substantially on the southern section of Alternative Site 2. Wetland soils pose a flooding hazard

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 and the New Denmark Mine. The structures associated with the power station dominate the local landscape. The main obvious structures include;
  - The cooling towers, chimneystacks and main generating facility;
  - The conveyors that transfer coal and waste pulverised fuel ash;
  - The pulverised fuel ash dump; and
  - 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**: There is only one small area (Thuthukani) approximately 5km to the west of the proposed sites. This settlement is likely to mainly house personnel from the power station and the adjacent mine site. Generally settlements tend to be inward looking with views of external areas only obvious from the fringes. This generally means that development within the Industrial or Rural Landscape Character Areas is not obvious from within urban areas. The scoping report indicated that the proposed development would not be visible from

Thuthukani. This was ground truthed during the site visit and this point was confirmed. Whilst Thuthukani is an obvious character zone within the surrounding landscape, it will not be directly affected.

» **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. There are differences within the character area associated with of agricultural practices. However there are also numerous small ridgelines that punctuate the landscape. These ridgelines are likely to be the main influencing factors with regard to the visual absorption capacity of the landscape as small undulations are likely to be all that is necessary to screen the proposed array.

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 Thuthukani. Should there be a significant impact on this area, it is possible that there could be significant objection from residents. However, should the development be visible it is also likely that residents would perhaps not be as sensitive to views of the development as people who are not associated with local industry would be.
  - Areas that are likely to be important for recreational use such as the Grootdraai Dam and surrounding areas approximately 8 km to the south of the proposed development alternatives.

» Linear Receptors which include main routes through the area. It is likely that these routes will be mainly used by local people although the R38 and R39 are regional routes and are likely to carry a proportion of tourism / recreational related 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 alternative 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 west of the power station that is aligned in an approximate north / south direction.
  b) The R38 that runs to the east of the power station.
  c) A local road to the New Denmark Colliery that runs to the west of the power station.
  d) Eskom offices on the south side of the power station.

Possible visual receptors that may be sensitive to landscape change are indicated on **Figures 6.5 and 6.6** (Zones of Theoretical Visibility). These figures indicate that:

i. Alternatives 1 and 2 will be visible over a similar area.
ii. The proposed development could be visible intermittently from as far as the visual horizon from the north.
iii. Neither alternative will be visible from the residential area of Thuthukani or the recreational area around Grootdraai Dam.
iv. Alternative 1 is likely to be visible over a slightly wider area to the south east of the site when compared with alternative 2.
v. Alternative 2 is likely to be visible over a slightly greater area to the north of the site when compared with alternative 1.
vi. Both alternatives are likely to be visible from a small number of homesteads to the south and east of the proposed development sites.
vii. Neither alternative will be visible from the R39.
viii. Both alternatives will be visible from the R38 for a distance of approximately 5km in the vicinity of the Power Station

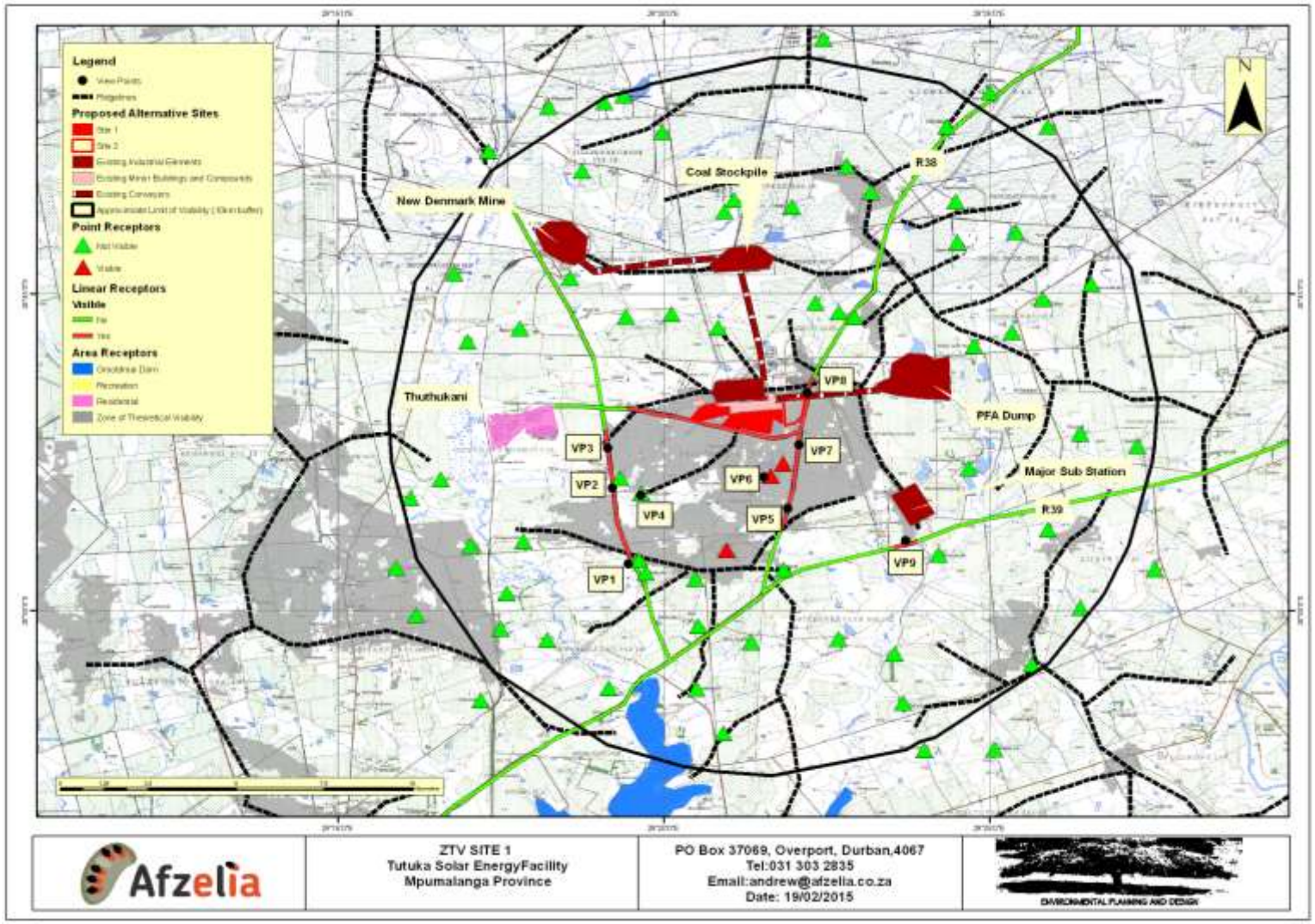

Figure 6.5: Zones of Theoretical Visibility – PV Alternative Site 1

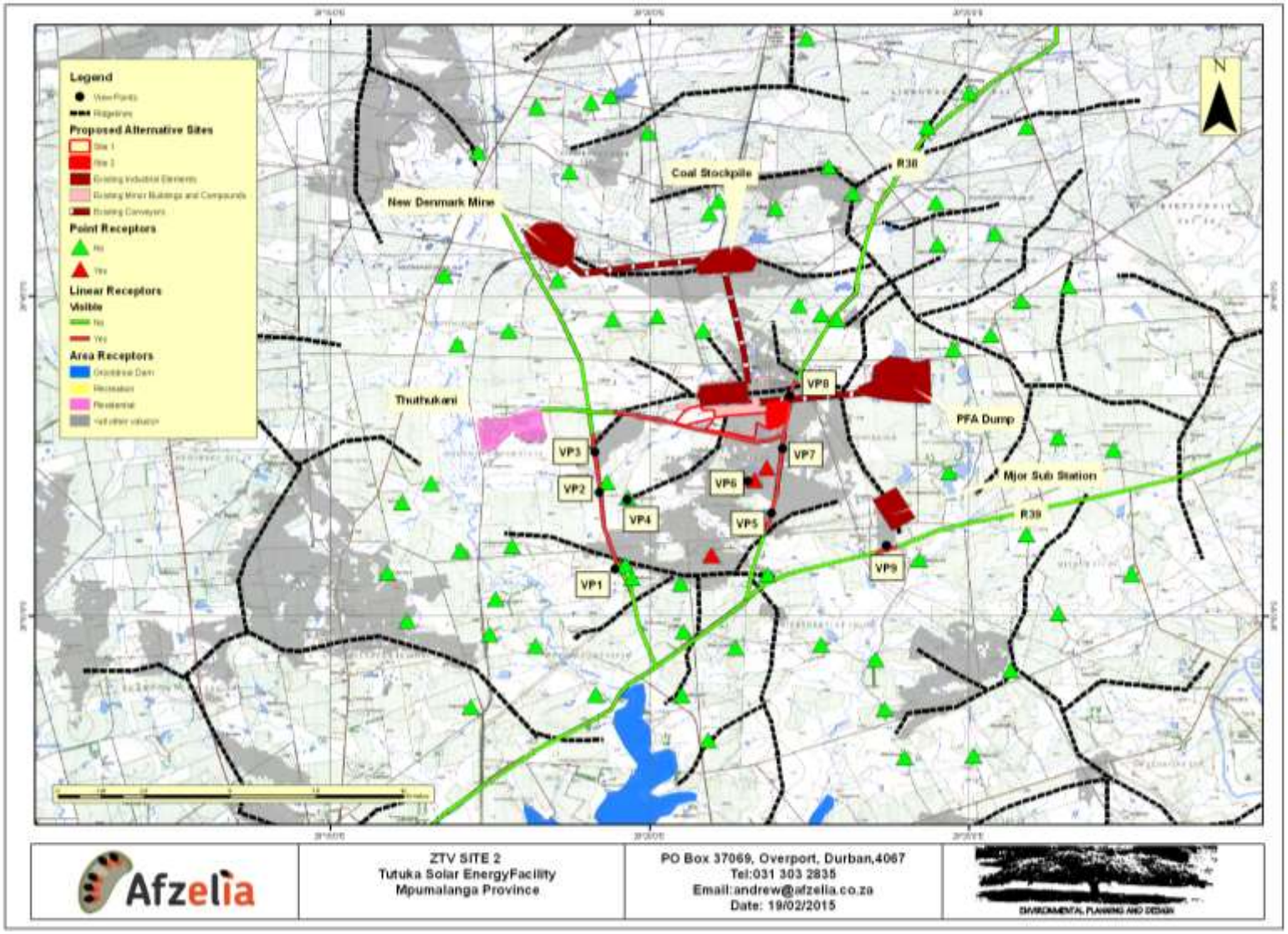

Figure 6.6: Zones of Theoretical Visibility – PV Alternative Site 2.

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	**Alternatives 1 and 2** Site and immediate surroundings **(2)**	n/a
Duration	**Alternatives 1 and 2** Long term **(4)**	n/a
Magnitude	**Alternatives 1** The proposed development will be viewed in the context of the existing power station from most viewpoints **(0)** **Alternatives 2** The proposed development will appear to extend industrial elements to the east. **(2)**	
Probability	**Alternatives 1** Significant impact is very improbable **(1)** **Alternatives 2** Distinctly Possible **(3)**	
Significance	**Alternatives 1** Very low **(6)** **Alternatives 2** Low **(24)**	
Status	**Alternatives 1 and 2** Negative.	n/a
Irreplaceable loss	The project can be dismantled. Therefore there will be no irreplaceable loss.	n/a
Can impacts be mitigated?	Yes	
Mitigation / Management: *No mitigation possible*		

Explanatory note: a) Alternative 1 is located directly in front of the main built elements of the power station and so from most viewpoints will be seen as part of the existing development area. b) Alternative 2 will be seen to extend an industrial element to the east and outside the current development footprint. It will therefore be seen to extend the influence of industry into the rural area***.***
Cumulative impacts Because Alternative 2 will be seen to extend the footprint of industrial development into the Rural Landscape Character Area, this impact is largely cumulative. Alternative 1 will only be seen to extend the influence of industrial development into the Rural Landscape Character Area from limited areas but from these areas the impact will be cumulative.
Residual impacts The project can be dismantled after decommissioning, thereby removing the impact

Change of view for visual receptors

The assessment indicates that the following Visual Receptors could be impacted;

1. Residential areas particularly Thuthukani.
2. Main routes (linear receptors) through the area particularly the R38 and the R39.
3. Adjacent Farmsteads particularly the closest properties to the south and east of the alternative development sites.

Nature of impact: Further Industrialisation and reduction in rural character of the view from Thuthukani		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**Alternatives 1 and 2** Local **(1)**	No mitigation is possible
Duration	**Alternatives 1 and 2** Short term **(1)**	No mitigation is possible
Magnitude	**Alternatives 1 and 2** The proposed development is unlikely to be highly obvious. **(0)**	No mitigation is possible
Probability	**Alternatives 1 and 2** This impact is improbable **(1)**	No mitigation is possible
Significance	**Alternatives 1 and 2** No impact likely **(2)**	No mitigation is possible
Status	**Alternatives 1 and 2** Neutral.	n/a
Irreplaceable loss	The project can be dismantled after decommissioning. Therefore there will	n/a

	be no irreplaceable loss.	
Can impacts be mitigated?	Mitigation is not really possible due to relative levels nor is it necessary.	
Mitigation / Management: No mitigation measures are necessary as the development is unlikely to be visible from any area within Thuthukani.		
Cumulative impacts: Because Alternative 2 will be seen to extend the footprint of industrial development into the Rural Landscape Character Area, this impact is largely cumulative. Alternative 1 will only be seen to extend the influence of industrial development into the Rural Landscape Character Area from limited areas but from these areas the impact will be cumulative.		
Residual impacts The project can be dismantled after decommissioning, thereby removing the impact.		

Nature of impact: Impacts on main routes (linear receptors) through the area particularly the R54, R716 and R82.		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**<u>Alternatives 1 and 2</u>** Site and immediate surroundings **(2)**	n/a
Duration	**<u>Alternatives 1 and 2</u>** Long term **(4)**	n/a
Magnitude	**<u>Alternative 1</u>** The proposed development will be visible at a distance to small sections of the local road to the west and the R38. An exceptionally short view may be possible from the R39. The development will also be seen as part of the power station **(2)** **<u>Alternative 2</u>** Will be visible to the same degree as Alternative 1 from the R39 and to a lesser degree from the local road to the west. It will however be developed immediately adjacent to the R38. It will be highly obvious for more than 4 km and will dominate the view from the road for approximately 2 km **(6)**	n/a
Probability	**<u>Alternative 1</u>** Significant impact is improbable **(2)** **<u>Alternative 2</u>**	n/a

	The impact on the R38 is definite **(5)**	
Significance	**Alternatives 1** Low **(16)** **Alternatives 2** High**(60)**	n/a
Status	**Alternatives 1 and 2** 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: No meaningful mitigation measures possible that will reduce the change in character. However undertaking adequate site management will help to ensure that the nature of the view particularly across Site 2 from the adjacent R38 is not more negative than it needs to be. Management should include minimising litter, maximising vegetation cover beneath the PV units, maintaining storage areas away from and out of sight of the road.		
Cumulative impacts: Because Alternative 2 will be seen to extend the footprint of industrial development into the Rural Landscape Character Area, this impact is largely cumulative. Alternative 1 will only be seen to extend the influence of industrial development into the Rural Landscape Character Area from extremely short sections of road but from these areas the impact will be cumulative.		
Residual impacts The project can be dismantled after decommissioning, thereby removing the impact		

Nature of impact: Impacts on farmsteads south of the proposed development		
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**Alternatives 1 and 2** Site and immediate surroundings **(2)**	n/a
Duration	**Alternatives 1 and 2** Long term **(4)**	n/a
Magnitude	**Alternative 1** Alternative 1 will be seen as part of the power station development. **(2)** **Alternative 2** Alternative 2 will extend the influence of industrial elements in these views. **(4)**	n/a
Probability	**Alternative 1** Significant impact is very improbable.	n/a

	(1) **<u>Alternative 2</u>** Alternative 2 will extend the view over industry. **(4)**	
Significance	**<u>Alternative 1</u>** Low **(8)** **<u>Alternative 2</u>** Medium **(40)**	n/a
Status	**<u>Alternative 1</u>** Neutral. **<u>Alternative 2</u>** 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?	Yes	
Mitigation / Management: Because views will be over the Alternative 2 array, there is no opportunity for screening. ***Explanatory note:*** Both alternatives will be seen from the same farmsteads and houses. However, Alternative 2 will extend the industrial character whereas Alternative 1 will be seen to be part of the existing industrial area.		
Cumulative impacts: Because Alternative 2 will be seen to extend the footprint of industrial development into the Rural Landscape Character Area, this impact will be cumulative. Alternative 1 will not be seen to extend the influence of industrial development into the Rural Landscape Character Area this impact therefore will not be cumulative.		
Residual impacts The project can be dismantled after decommissioning, thereby removing the impact		

***Nature of impact*:** Glare impacting on adjacent roads, Eskom offices and the airstrip flight path		
Relevant Listed activities: GN 545, activity 1		
	Without mitigation	**With mitigation**
Extent	**<u>Alternatives 1 and 2</u>** Site and immediate surroundings **(2)**	n/a
Duration	**<u>Alternatives 1 and 2</u>** Long term **(4)**	n/a
Magnitude	**<u>Alternative 1</u>** Glare from the proposed development will have a minor impact on the airstrip	**<u>Alternative 1</u>** **(2)**

	flight path and Eskom offices. It could however create a dangerous situation on the adjacent R38. **(8)** **<u>Alternative 2</u>** Glare from the proposed development will have a minor impact on the airstrip flight path and the Eskom offices. It could however create a dangerous situation on the adjacent R38. **(8)**	**<u>Alternative 2</u>** **(4)**
Probability	**<u>Alternative 1</u>** Significant impact is improbable **(2)** **<u>Alternative 2</u>** Significant impact is probable **(3)**	**<u>Alternative 2</u>** Significant impact is possible **(3)**
Significance	**<u>Alternative 1</u>** Medium **(42)** **<u>Alternative 2</u>** Medium **(42)**	**<u>Alternative 1</u>** Low **(24)** **<u>Alternative 2</u>** Low to Medium **(30)**
Status	**<u>Alternatives 1 and 2</u>** 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?	Yes	
Mitigation / Management: 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 for either alternative. The use of a screen fence along the R38 roadside for the length of the array would probably largely mitigate the alternative 2 impact on the adjacent road. The use of a combination of screen fence and planting on the eastern side of alternative 1 is likely to be more successful in mitigating impacts on the R38 than alternative 2 due to the amount of space available.		
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 Comparative Assessment of the PV site alternatives

Alternative Site 1 will be viewed in the context of and appear to be developed within the existing industrial area at the base of the power station whereas Alternative Site 2 will appear to extend the industrial area towards the R38, Alternative Site 1 should be favoured.

However, the extent of the impact is limited and the quality of the rural landscape is such that development of Alternative Site 2 would not create unacceptable impacts.

When the potential impact of glare that could affect drivers on the R38 is also considered however, this reinforces the argument that Alternative Site 1 should be the favoured alternative on visual grounds.

Aspect	Site Alternative 1	Site Alternative 2
Visual	Acceptable – **preferred alternative** » Will appear within the existing industrial area » Glare would not affect drivers form this site	Acceptable – » Extend the industrial area towards the R38 » Glare would affect drivers on the R38

6.7.5 Implications for Project Implementation

Both alternative sites will be visible to a small number of farmsteads / farm workers houses, the R38 and a small section of the local road that is located to the west of the power station. It is also possible that alternatives may be visible to a short section of the R38, however, this view is likely to be of short duration and it is unlikely that the partial view of either development would be recognisable. Alternative 2 will also be developed alongside the R38 and therefore will take industrial development almost up to the road edge. It will therefore have a greater impact than Alternative 1 on this regional route. Both alternatives will have minor impacts on the local route to the west of the power station and the flight path approaches to the adjacent landing strip. Alternative 1 will also have an on offices within the power station complex; however this will occur outside normal office impact hours.

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 farm 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 **operational 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 **operational 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 alternative site 1, 65.9MW component, is expected to extend over a period of 18-24 months. The construction period for the alternative site 2 for the 24MW solar energy facility will be approximately 15-18 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 approximately the 65.9MW solar energy facility on the alternative site 1 is likely to create approximately 250-300 employment opportunities, for approximately

18-24 months. The alternative site 2 with a generating capacity of 24MW solar energy facility will generate approximately 100-150 employment opportunities, for approximately 8-12months. 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 65.9MW facility on the alternative site 1 is estimated to be in the region of R12 million. The wage bill for the alternative site 2 will be less, in the region of R6 million for the 24MW facility. 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.

The nearest town to the proposed sites is Standerton. The population of Standerton is approximately 43 966 people. According to the Ward Councillor from Ward 12 "unemployment and job creation is the biggest struggle. Creating economic opportunities for the local area is a challenge with the limited prospects available." The Lekwa Local Municipality has an unemployment rate of 25.9%. There will be significant job opportunities available for low skilled (construction and security workers) and semi-skilled workers, which can be sourced from the local area. The proponent will need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members of the local community. It is likely that an Engineering, Procurement and Construction (EPC) contractor will be appointed by the developer who will hire the necessary employees. The applicant has indicated that training will also be provided to employees with the proposed development. More positive economic opportunities will come from the alternative site 1, as it is a 65.9MW development which means more employment opportunities will be available for a longer period of time in comparison to the alternative site 2. Employment opportunities for the proposed development will peak during construction phase and significantly decline during the operation phase.

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				
	Alternative site 1 (65.9 MW)		**Alternative site 2 (24 MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- Regional (2)	Local- Regional (2)	Local- Regional (2)	Local- Regional (2)

Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Moderate (6)	Minor(2)	Low (4)
Probability	Probable (3)	Highly probable (4)	Probable (3)	Highly probable (4)
Significance	**Low (24)**	**Medium (40)**	**Low (15)**	**Low (28)**
Status	Positive	Positive	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, Ward 12, if this is not possible, then the broader focus areas should be considered for sourcing employees such as the Lekwa Local Municipality. » Employ local contractors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. » 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 ~25km north east of Standerton. 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 65.9MW Solar Energy Facility (alternative site 1) is estimated to be in the region of R1.6 billion for the Solar Energy Facility. The alternative site 2 is estimated to cost approximately R1 billion for the 24MW 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. About 44% of the capital expenditure will be spent locally on goods and services required for the development of 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 town and local service providers.

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				
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1				
	Alternative site 1 (65.9 MW)		**Alternative site 2 (24MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- regional (2)	Local- Regional (2)	Local- regional (2)	Local- Regional (2)
Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Moderate (6)	Minor (2)	Low (4)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (30)**	**Low (15)**	**Low (21)**
Status	Positive	Positive	Positive	Positive

Reversibility	N/A
Irreplaceable loss of resources	N/A
Can impacts be enhanced	Yes
Enhancement » It is recommended that a local procurement policy is adopted by the developer to maximise the benefit to the local economy, where feasible. » 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. » Eskom should source as much goods 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. The alternative Site 1 is likely to create approximately 250-300 employment opportunities (approximately 15-18 months). The Alternative Site 2 will generate approximately 100-150 employment opportunities (approximately 8-12 months). An influx of construction workers will be significantly more and for a longer period of time for the alternative site 1, therefore increasing the perceived safety and security risks in comparison to Alternative Site 2.

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

Relevant Listed activities:
GN 544, activity 10(i)
GN 545, activity 1

	Alternative site 1 (23 MW)		**Alternative site 2 (24 MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Low(24)**	**Low (16)**	**Low (15)**	**Low (10)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			

Mitigation

» Working hours should be kept between daylight hours during the construction phase, and/or as any deviation that is approved by the relevant authorities.
» The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site; the fencing of the site should be maintained throughout the construction period
» 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 firefighting equipment on site and provide firefighting 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,

however limited considering the nature of the area (industrialised area)
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 R38, the same access road that is utilized to access the Tutuka Power Station. This secondary road will be the primary access road to the proposed site. The primary roads that will be used for transportation of project components and equipment will be the R38 and the secondary road off the R38. There are regular daily movement patterns on the R38 and secondary road off the R38 from employees of Eskom that work at the Tutuka Power Station and adjacent landowners that utilize these roads to access their place of work. 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. The movement of construction related activities crossing over the R38 does have the potential to increase the risk for road users. Also with wear and tear on roads that is not maintained / repaired; the safety risk also increases. The R38 and the access road would mainly be affected and 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 temporary disruptions in daily living, movement patterns and quality of life for local community. 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 Tutuka 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				
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1				
	Alternative site 1 (65.9MW)		**Alternative site 2 (24 MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**

Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short term (2)	Short term (2)	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Moderate (6)	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)	Highly Probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (27)**	**Low (24)**	**Low (18)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			
Mitigation » All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and 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) » Eskom 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.				
Cumulative impacts Possible increased traffic and traffic disruptions impacting local communities movement patterns and increased risks for road users				
Residual impacts Non 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.

Standerton is the closest town to the proposed site and is seen as sensitive social receptor and in-migrants (either bringing in an outside workforce or jobseekers)

coming into the area could put pressure on social infrastructure; create social problems, tensions and conflicts. The impact associated with in-migration of jobseeker and/or an outside workforce includes pressure on local municipal services and infrastructure such as sanitation, electricity, water, waste management, health facilities, transportation and availability of housing. Squatter settlements may develop near towns to accommodate jobseekers. It is very difficult to control the influx of people into an area, especially in a country where there's high levels of unemployment. An influx of jobseekers to an area often results in an increase in prostitution activities and temporary sexual relations with locals; this could result in the spreading of HIV/Aids and STD's and unwanted pregnancies. The proposed PV facility development disrupting societies largely depends on the level of local employment achievable and clearly stipulating a local employment regime to limit outsiders coming into the area. Employment opportunities can be sourced from the surrounding local area first, Ward 12, and if availability of labour is limited then the search can be extended to the local municipality. The local municipality's population could fulfil the majority of the lower and semi-skilled employment opportunities that emerge.

The degree to which society is disrupted largely depends on the level of local employment achievable and in the case of this project a certain percentage of local labourers are expected to be sourced locally and the overall number of outsiders would not be significant to cause great disruption.

***Nature*:** Added pressure on economic and social infrastructure during construction as a result of in-migration of people				
Relevant Listed activities: GN 544, activity 10(i) GN 545, activity 1				
	Alternative site 1 (65.9 MW)		**Alternative site 2 (24 MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local-regional (2)	Local- regional (2)	Local-regional (2)	Local- regional (2)
Duration	Short-term (2)	Short-term (2)	Very short-term (1)	Very short-term (1)
Magnitude	High Intensity (8)	Low (4)	Low (6)	Minor (4)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (16)**	**Low (27)**	**Low (14)**
Status	Negative	Negative	Negative	Negative
Reversibility	No			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			

Mitigation
» 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, Ward 12, if this is not possible, then the broader focus areas should be considered for sourcing employees such as the Lekwa Local Municipality. » It is recommended that local employment policy is adopted to maximize the opportunities made available to the local labour force. » Recruitment of temporary workers at the gates of the development site should not be allowed. A recruitment office located in town with a Community Liaison officer should be established to deal with jobseekers. » 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.
Cumulative impacts
» Additional pressure on infrastructure due to additional people in the area. » Possible increase in criminal activities and economic losses in area for property owners.
Residual impacts
Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure.

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 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 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 noise, dust and increased use of the local roads are expected to be negative but short term impact. Social impacts for Alternative site 1 and Alternative site 2 will be similar. The only significant differences of the alternative sites is that the construction phase will be longer for Alternative site 1 as the size of the solar energy facility is larger (65.9MW, 15-18 months of construction), therefore the negative construction impacts such as disruption from nuisance impacts (traffic, noise and dust during construction) would be experienced for a longer period of time in comparison to alternative site 2 (24MW, 8-12 months of construction). However, the proposed development is located within the Tutuka coal fired power station boundary and the surrounding

landowners do not have any concerns in terms of nuisance impacts and safety and security impacts, therefore these impacts have low significance.

***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				
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1				
	Alternative site 1 (65.9MW)		**Alternative site 2 (24 MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)	Very short-term (1)	Very short-term (1)
Magnitude	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)	Probable (3)	Improbable (2)
Significance	**Low (15)**	**Low (10)**	**Low (12)**	**Low (8)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			
Mitigation: The potential impacts associated with construction and heavy vehicles can be effectively mitigated. The mitigation measures include: » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are 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.				
Cumulative impacts » 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 (20-25years) 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 65.9MW facility and approximately ~20 jobs created for the 24MW 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				
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1				
	Alternative site 1 (65.9MW)		**Alternative site 2 (24 MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- Regional (3)	Local- Regional (3)	Local- regional (3)	Local- Regional (3)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Probable (3)	Highly Probable (4)	Probable (3)	Highly Probable (4)
Significance	**Low (30)**	**Medium (40)**	**Low (27)**	**Medium (36)**
Status	Positive	Positive	Positive	Positive
Reversibility	N/A			
Irreplaceable loss of resources	N/A			
Can impacts be enhanced	Yes			

Enhancement
» 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, Ward 12, if this is not possible, then the broader focus areas should be considered for sourcing employees such as the Lekwa Local Municipality. » 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 Lekwa 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 PV 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 150MWp at their various power stations, offices and substations, which includes the proposed Tutuka Solar PV Facility. The solar PV facility 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				
	Alternative site 1 (65.9 MW)		**Alternative site 2 (24 MW)**	
	Without enhancement	**With enhancement**	**Without enhancement**	**With enhancement**
Extent	Local- Regional- National (4)	Local- Regional- National (4)	Local- Regional- National (4)	Local- Regional- National (4)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)	Highly probable (4)	Highly probable (4)
Significance	**Medium (48)**	**Medium (48)**	**Medium (40)**	**Medium (40)**
Status	Positive	Positive	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				

Visual impact and sense of place impacts

The sense of place is developed over time as the community embraces the surrounding environment, becomes familiar with its physical properties, and creates its own history. The sense of place is created through the interaction of various characteristics of the environment, including atmosphere, visual resources, aesthetics, climate, lifestyle, culture and heritage. Importantly though it is a subjective matter and is dependent on the demographics of the population that resides in the area and their perceptions regarding trade-offs. An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. The social impacts associated with the impact on sense of place relate to the change in the landscape character and visual impact of the proposed solar energy facility.

The proposed development is located next to an industrial area, within the Tutuka coal fired power station boundary. The adjacent landowners / tenants are

farmers that utilise the adjacent land for farming activities. The key stakeholders who were interviewed indicated that there won't be any anticipated visual issues from their side as is it located next to an industrial area next to the Tutuka Power Station which is already a visual disturbance and affects the areas sense of place. The Tutuka Power Station located next to the site, the power and transmission lines, roads and the substation are infrastructural and disrupting elements that currently affect visual resources in the immediate local area. There are no tourist attractions located adjacent to the property and therefore the anticipated impact on the areas visual quality and sense of place is expected to be of very low significance.

***Nature*:** Visual impacts and sense of place impacts associated with the operation phase of the project				
Relevant Listed activities: GN 544, activity 10(i), 22 (i) & 47 (ii) GN 545, activity 1				
	Alternative site 1 (65.9 MW)		**Alternative site 2 (24 MW)**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (18)**	**Low (14)**	**Low (14)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes			
Irreplaceable loss of resources	No			
Can impacts be mitigated	Yes			
Mitigation Vegetation screening established if required.				
Cumulative impacts None anticipated				
Residual impacts None anticipated if the visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status.				

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, 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. Based on the current situation of the local area the impacts are assessed to be Low with mitigation measures.

***Nature*:** Social impacts associated with retrenchment including loss of jobs and source of income				
	Alternative site 1 (65.9 MW)		**Alternative site 2 (24 MW)**	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Extent	Local- district (2)	Local- district (2)	Local- district (2)	Local- district (2)
Duration	Short term (1)	Short Term (1)	Short term (1)	Short Term (1)
Magnitude	Low (4)	Low (4)	Minor (2)	Minor (2)
Probability	Highly Probable (4)	Probable (3)	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (21)**	**Low (20)**	**Low (15)**
Status	Negative	Negative	Negative	Negative
Reversibility	Yes, assumes retrenchment packages are paid to all affected employees			
Irreplaceable loss of resources?	No			
Can impact be mitigated?	Yes			
Mitigation » 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.				
Re*sidual impacts*				

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

6.8.4 Comparative Assessment of the PV site alternatives

Social impacts for Alternative site 1 and Alternative site 2 will be similar. The only significant differences is that the construction phase will be longer for Alternative site 1 as the size of the solar energy facility is larger (65.9MW), therefore the negative construction impacts such as disruption from nuisance impacts (traffic, noise and dust during construction) and safety and security impacts would be experienced for a longer period of time. However, the proposed development is located within the Tutuka coal fired Power Station boundary and the surrounding landowners that were contacted do not have concerns in terms of nuisance impacts and safety and security risks, therefore these impacts are neutral and have low significance. With the Alternative site 1 having a longer construction phase (15-18 months for a 65.9MW facility) in comparison to the Alternative site 2 (8-12 months for a 24MW facility) more economic benefits will be experienced for a longer period of time such as; more employment opportunities, wages for a longer period, capital expenditure, skills development and economic multiplier benefits. Therefore these impacts are positive and consequently the Alternative site 1 would represent more socio-economic opportunities for the local area.

Aspect	**Site Alternative 1:**	**Site Alternative 2**
Socio-Economic Impacts	Acceptable – **preferred alternative** The negative construction impacts would be experienced for a longer period of time. » Impacts are considered to be neutral and have low significance due to the industrial nature of the environment. » More economic benefits will be experienced for a longer period of time such as; more employment opportunities, wages for a longer period, capital expenditure, skills development and economic multiplier benefits.	» The negative construction impacts would be experienced for a shorter period of time. » Less economic benefits will be experienced for a shorter period of time.

6.8.5 Implications for Project Implementation

» The findings of the SIA undertaken for the proposed Tutuka PV Facility indicates that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The development of renewable energy has also been identified as key growth sector by the local municipality and also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
» A skills development and training programme to be developed for the construction and operational phases.
» Any negative social impacts during construction and operational of the plant can be managed to acceptable levels.
» It is therefore recommended that the Tutuka PV Facility can be developed, subject to the implementation of the recommended enhancement and mitigation measures contained in the EMPr.

6.9 Assessment of the Do Nothing Alternative

The 'Do-Nothing' alternative is the option of not constructing the proposed Tutuka 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 R6 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: About 100-150 employment opportunities, for approximately 8-12months 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 the 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 power supplementation at the Tutuka 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 CO_2 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 Tutuka 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 Tutuka 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 area[5]. Cumulative impacts associated with other generation facilities within 30 km radius of the proposed facility were assessed (refer to Figure 7.1). The proposed Tutuka 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 Tutuka Power Station
» Various power lines
» Transmission Sub-station
» Distribution Sub-station

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.

[5] Definition as provided by DEA in the EIA Regulations.

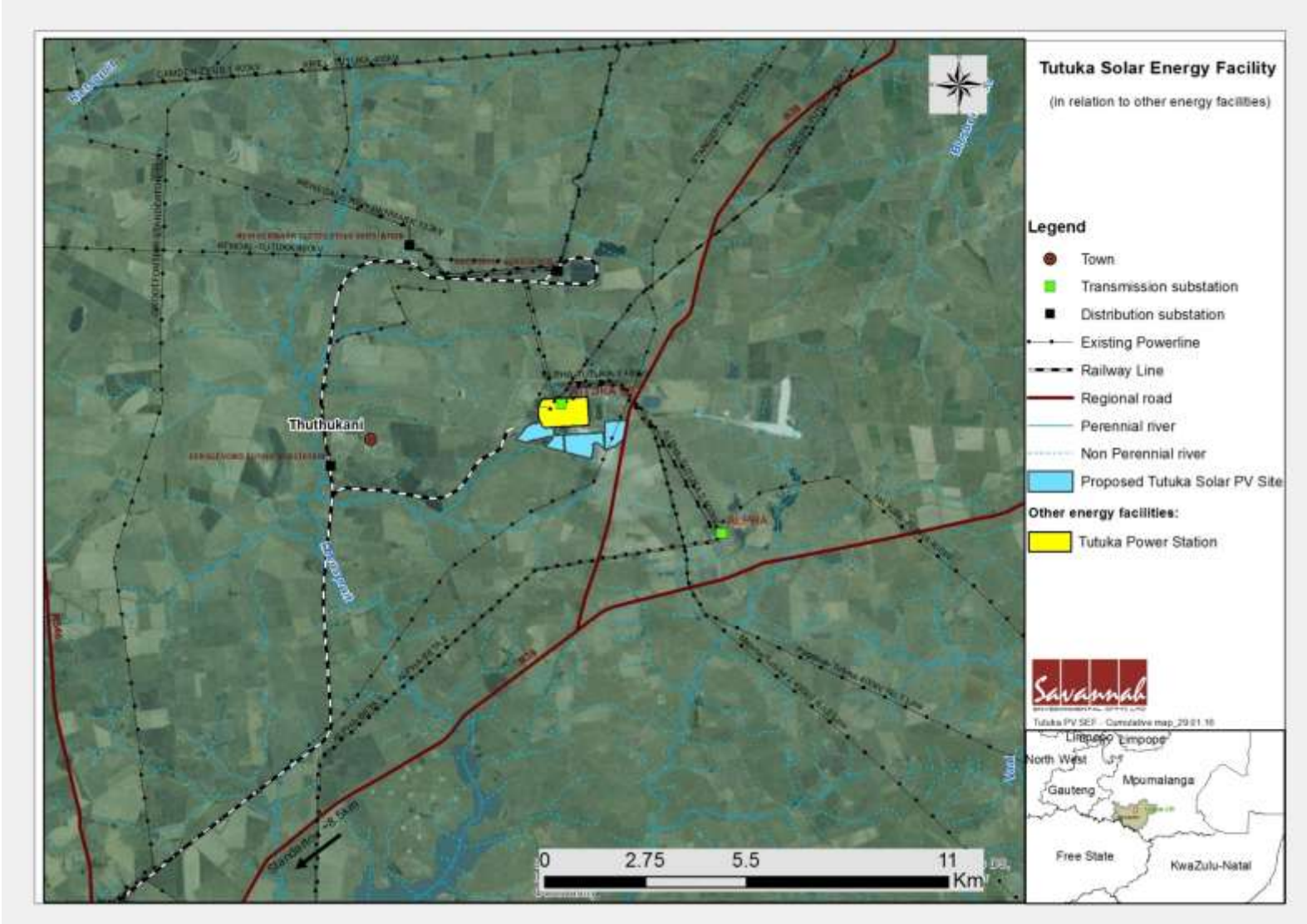

Figure 7.1: The Tutuka PV Solar Energy

7.1.1 Ecological Processes (flora and fauna)

The identified study area falls within the original extent of the Soweto Highveld Grassland (Unit Gm8) as defined by Mucina and Rutherford (2006), consisting of gently to moderately undulating landscapes. The short to medium high dense tussock grassland is dominated almost entirely by *Themeda triandra*, with a relatively high diversity of grasses, herbs and geophytes (Mucina and Rutherford 2006). None of the grasslands identified on site are considered to be in a pristine condition, with only a small section considered to be primary (natural) grassland. 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. The remaining extent of primary grassland, mostly inhabited on Site Alternative 2, is classified as Important and Necessary, whilst the better condition rehabilitated and more diverse grassland is classified by the Mpumalanga Biodiversity Conservation Plan (MBCP) as of Least Concern. The remainder of the area has been recognised as rangelands with no Natural Habitat Remaining. It must be noted here that the mapping for the MBCP was done at a high scale, and hence delineations currently available for the different habitats do not entirely match the actual state of the vegetation on the ground, which is especially applicable to the eastern section of Site Alternative 1, where the grasslands have been severely degraded and transformed in the past.

It is not expected that the development will compromise the survival of any flora or terrestrial vertebrate species on the study area or beyond, but potentially significant negative impacts on the ecological environment will occur if remaining portions of high diversity natural vegetation will be further disturbed – these sections should be avoided. 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.

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 (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

Although there are no large scale commercial solar plants (proposed or established) within 30 km of the study area, several other drivers of habitat transformation i.e. mining, energy generation, agricultural and industrial activities are prevalent in the broader study area. The construction of the Tutuka PV solar plant and associated infrastructure would contribute to cumulative habitat loss and therefore have further impacts on the occurrence of avifauna in the area. An additional barrier would also be created for birds resulting in possible further

displacement and or adjustment of flight paths for species that use the area as a flight corridor. Considering the bird species occurring in the study area, the cumulative impacts are expected to be of moderate to low significance. However a more strategic approach to assessing the cumulative impacts of renewable energy development in South Africa is required than what is currently being applied (Masden *et al.,* 2010 and Jenkins, 2011) but this falls outside of the scope of this assessment. 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	High (8)	moderate(6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (42)**	**Low (22)**
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

Two unchannelled valley-bottom wetlands are located on the study site. The wetlands have been impacted upon by earthen dams and a network of roads which impede low flows. Alien plants are spreading through the wetland and out-competing natural vegetation and reducing flows into the wetlands this has resulted in a large change in ecosystem processes and loss of natural habitat and biota. Overall the wetlands on site are largely modified. The ecological importance and sensitivity suggests that wetlands in this category are considered to be ecologically important and sensitive on a provincial or local scale, however any loss of wetlands will add to the overall loss of wetlands in the region.

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)	Local (2)
Duration	Long term (4)	Short term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Medium (39)**
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 cumulative impact in terms of loss of agricultural land is not significant, as sites are both on Eskom's power station property and not available for agricultural development.
The low potential of the soils on the affected sites it is unlikely that there will be any significant cumulative impacts.

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. There are no significant archaeological risks associated with the proposed solar facility. 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.

7.1.5 Visual impacts

The proposed development will take place within a landscape that is already heavily impacted by large-scale industrial development namely the Tutuka Power Station. Impacts associated with Alternative 2 are generally cumulative in that they extend the apparent influence of industrial development into the Rural Landscape Character Area.
Views of Alternative Site 1 are generally seen within the context and as part of the existing power station. This alternative therefore appears to only influence the existing Industrial Landscape Character Area. These impacts therefore are generally not cumulative. 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 Tutuka Solar Energy Facility has the potential to result in significant positive cumulative impacts; specifically with the establishment of a number of Solar Energy Facilities in the vicinity of Lekwa Local Municipality will create a number of socio-economic opportunities for the area, 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 other 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 and industrial developments 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 Tutuka 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 area located next to the project site and the general low sensitivity of the proposed development area. The overall cumulative impacts on wetlands, ecology and avifauna, are likely to be of a medium significance prior to mitigation. This could be reduced to low-medium negative significance with the implementation of the proposed mitigation measures.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 8

The Tutuka Solar Energy Facility is proposed on portions 4, 10, 11 and 12 of the Farm Pretorius Vley 374 IS, located in the jurisdiction of Gert Sibande District Municipality and Lekwa Local Municipality within the Mpumalanga Province.

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.

The proposed facility will require a development footprint area of approximately ~99 ha, and will be comprised of the following primary elements:

» Solar panels (fixed/tracking technology) with an export capacity of up to 65.9 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 invertor/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 Tutuka 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.

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 Tutuka 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 impacts[6] 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 a draft Environmental Management Programme (EMPr) (refer to **Appendix L**).

The Conclusions and Recommendations of this EIA for Tutuka 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 Tutuka PV Solar Energy Facility are provided in this Chapter.

8.1. Summary of Tutuka 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 Tutuka 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

[6] Direct, indirect, cumulative that may be either positive or negative.

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 occur as a result of the proposed project are summarised in the sections which follow (Refer to Figure 8.1).

The most significant environmental impacts identified and assessed to be associated with the proposed Tutuka PV Solar Energy Facility project include:

» Impacts on wetlands
» Impacts on ecology occurring on the site

Other issues identified which could have an impact on the environment include:

» Impacts on avifauna;
» Impacts on the local soils, land capability and agricultural potential of the site;
» Visual impacts mainly due to the solar panels and partly due to other associated infrastructure (power line, access road etc.);
» Impacts on heritage and paleontological resources; and
» Social and economic impacts.

In summary, the environmental impacts associated with the proposed project, as identified through the EIA, can be summarised as follows:

8.1.1 Impacts on Surface water resources

Two wetlands were delineated on the study site both being unchannelled valley-bottom wetlands. The two wetlands in the study site are very similar in their function, type and ecology. They merge shortly downstream of the study area and as such they were assessed as one wetland for the purpose of these assessments.

The wetlands encroach onto the western section of Alternative Site 1 and the southern section of Alternative Site 2. From a wetland function point of view, development should ideally be confined to the central portion of Alternative Site 1, or the northern portion of Alternative Site 2. Alternative Site 1 is considered the most favourable for development of the PV facility since less wetland habitat will be lost. Overall the wetlands on site are largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred. The ecological importance and sensitivity suggests that wetlands in this category are

considered to be ecologically important and sensitive on a provincial or local scale.

The overall impact on wetlands is likely to be of a medium significance prior to mitigation. This could be reduced to low negative significance following the implementation of mitigation measures, i.e. avoidance of the wetlands and associated 30 m buffer set to protect wetland functionality. With the proposed buffer, the proposed site is considered acceptable for development.

8.1.1 Impacts on Ecology

The Tutuka PV Solar Energy facility development will not have significant impacts on the above-ground ecology of the site if all mitigation measures are followed, especially if listed alien invasives can be reduced. If 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. Potentially significant negative impacts on the ecological environment will occur if remaining portions of high diversity natural vegetation will be further disturbed – these sections should be avoided. 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, 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.

The overall impact on the ecology (including flora and fauna) is likely to be of a medium significance prior to mitigation. This impact could be reduced to low-medium significance following the implementation of mitigation measures. 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.

8.1.2 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. Considering that displacement through habitat destruction is potentially the most significant impact associated with the construction of solar energy facilities, a significant proportion of Alternative Site 1 is comprised of areas that represent systems with high connectivity and possibly important bird flight paths with high bird diversity. However sufficient similar habitat is available within the broader study area, so it is highly unlikely that the displacement impact will be of regional or national significance. Both sites are considered acceptable for development with the implementation of the proposed mitigation measures. However, it is recommended that the proposed Tutuka PV Energy Solar Facility be developed at Alternative Site 2.

8.1.3 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 Tutuka 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.

8.1.4 *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.

8.1.5 *Impacts on Visual quality of the area*

Both alternative sites will be visible to a small number of farmsteads / farm workers houses, the R38 and a small section of the local road that is located to the west of the power station. It is also possible that alternatives may be visible to a short section of the R38, however, this view is likely to be of short duration and it is unlikely that the partial view of either development would be recognisable. Alternative 2 will also be developed alongside the R38 and therefore will take industrial development almost up to the road edge. It will therefore have a greater impact than Alternative 1 on this regional route. Both alternatives will have minor impacts on the local route to the west of the power station and the flight path approaches to the adjacent landing strip. The overall visual impact is likely to be of a low-medium significance.

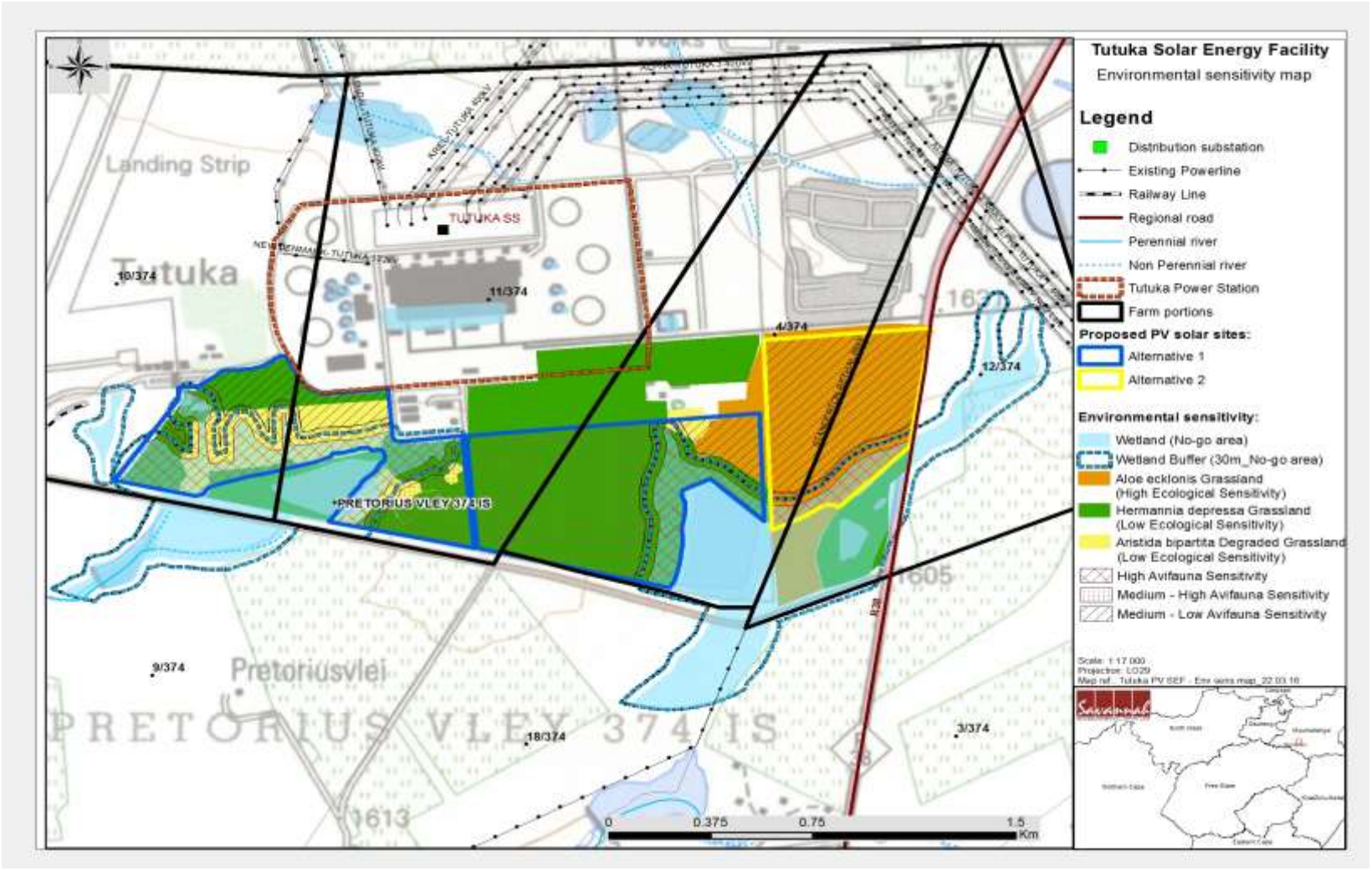

Figure 8.1: Environmental Sensitivity map for the project study area illustrating sensitive areas in relation to the Tutuka PV Solar Energy Facility layout

8.1.6 *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 Tutuka 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.

8.2. 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 the areas identified as being of high sensitivity and no-go areas. As recommended in the Wetland assessment the PV facility has been confined to the central portion of Alternative Site 1, in order to maintain optimal wetland functionality. This refinement of the layout has resulted in the repositioning of the PV facility outside of identified sensitive and a decrease in the net generating capacity, from 65.9 MW to 23 MW. This refined layout will still be able to meet the mainobjective of supplementing Eskom's self consumption at the Tutuka Power station. The required mitigation measures are illustrated in Figure 8.2 and represent a positive outcome in terms of impact reduction and mitigation and the optimal layout for the facility.

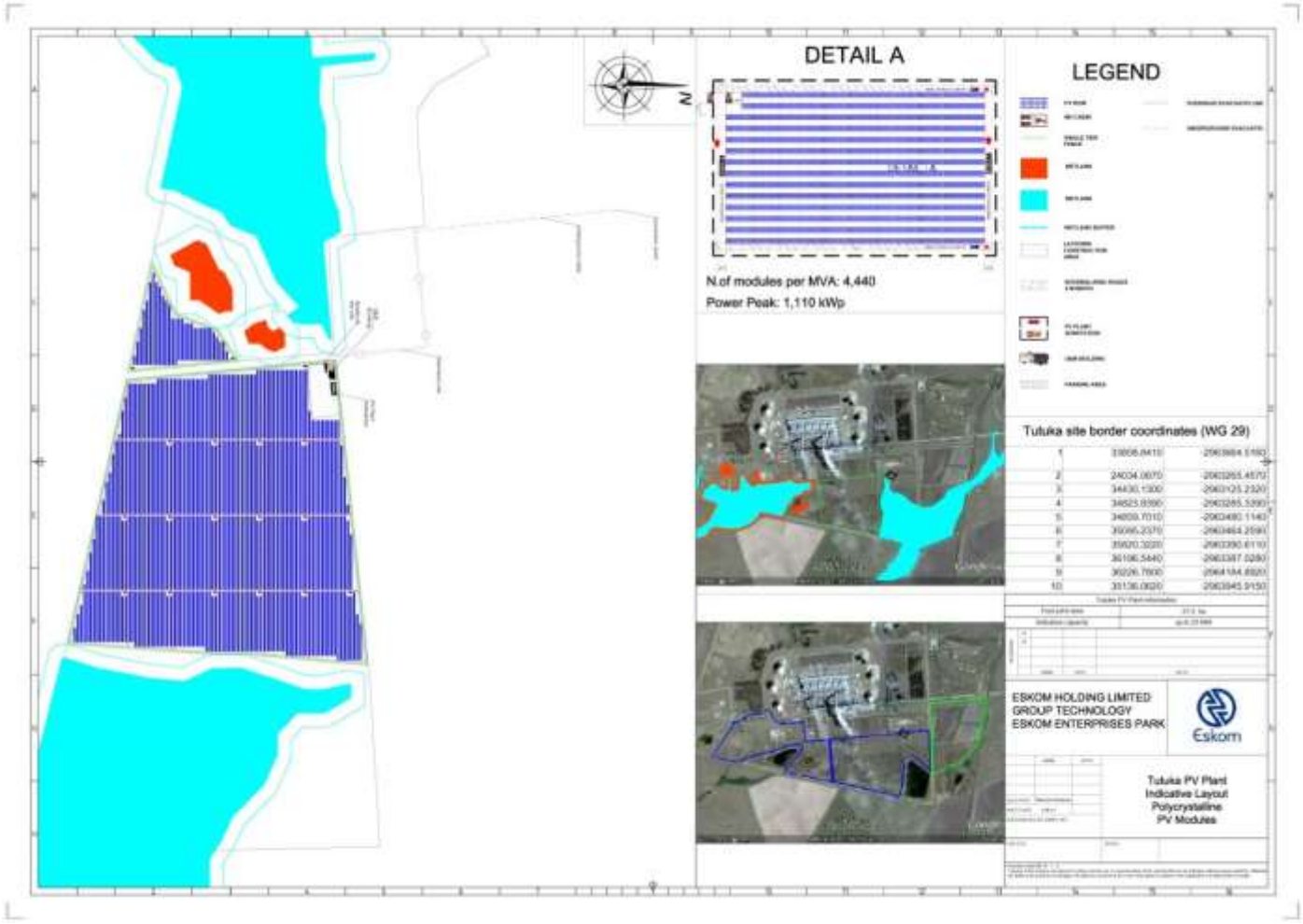

Figure 8.2: Optimised Tutuka PV

Solar Energy Facility Layout

8.3. 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 Tutuka PV Solar Energy Facility. In general, Cumulative impacts of the proposed Tutuka 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 impacts on wetlands, ecology and avifauna, are likely to be of a medium significance prior to mitigation. This could be reduced to low-medium negative significance with the implementation of the proposed mitigation measures. 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.

8.4 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 Tutuka PV Solar Energy site through the careful location of the development to avoid key areas supporting biodiversity of conservation importance, which include the wetlands and the high sensitivity grassland areas.
» 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 Tutuka PV site through the implementation of 30 m buffers around the wetland and careful location of the development to maintain wetland functionality.

» 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 Tutuka Power Station and associated infrastructure.
» 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 Tutuka 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 4, 10, 11 and 12 of the Farm Pretorius Vley 374 IS, located in the jurisdiction of Gert Sibande District Municipality and Lekwa Local Municipality within the Mpumalanga Province has been established by Eskom. The positive implications of establishing the Tutuka 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 Tutuka 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 findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are identified negative impacts that must be reduced by implementing the mitigation measures recommended. This specifically includes optimising the facility layout to exclude the identified high sensitivity ecological areas and the wetland areas and associated 30 m buffer zones in order to avoid impacting on these sensitive habitats. The project must adhere to this constraint to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) for the Tutuka 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 **acceptable** provided all measures are taken to protect and preserve surrounding environment.

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 Tutuka 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. Alternative Site 1 is anticipated to have the least significant impact on ecological resources and generate greater positive impacts from a Social perspective (in terms of economic impact and jobs). In terms of this conclusion, the EIA project team support the decision for environmental authorisation on Alternative site 1 on condition that the facility layout is optimised to include 30 m buffer zones around the wetland sensitivities identified as presented in Figure 8.2.

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

» The identified wetland areas and associated 30m buffers must be excluded from the development footprint.
» The final design of the facility must be submitted to DEA for review and approval prior to commencing with construction.
» 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.
» The draft Environmental Management Programme (EMPr) as contained within Appendix L 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.
» 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 Tutuka 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.

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